

ENTERPRISES CHARACTERISTICS AND LEAN OUTCOME: AN EMPIRICAL EVIDENCE FROM VIETNAM MANUFACTURING ENTERPRISES

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Abstract:

Lean Manufacturing is a popular method to achieve the improvement on productivity, quality, cost, and delivery for organizations. This approach focuses on the systematics to eliminate wastes and non-value added activities from the production. This study mentions the successes and challenges of Vietnam manufacturing enterprises for adapting and transformation for Lean Manufacturing approaching. The aim of this study is to analyze the characteristics of Vietnam enterprises that influencing Lean outcome and present critical factors for overcoming obstacles to successful Lean implementation in Vietnam local enterprises. This paper uses case-based research to collect data through multiple cases that applied Lean to drive the findings. A combination of comprehensive literature review and interview key persons at case study was employed in this study. This study also highlights the strong potential of Lean implementation initiatives in affecting organizational performance improvements.

Key words: *Lean manufacturing, Challenge features, Success factors, Vietnam Manufacturing enterprises*

INTRODUCTION

Globalization and emerging technologies are having enormous impacts on the manufacturing industrial around the world. To effectively compete in the global market, every organizations should focus on improving the effectiveness of internal operational functions with a effectively production and operation management [1]. Lean manufacturing will be the standard manufacturing model in 21st century [2]. The term “Lean Manufacturing” had introduced by Womack and Jones (1990) when published the book named “The machine that changed the world” is one of the improvement initiatives focuses on continuous improvement through waste elimination [3]. The main strength of Lean is its capability to reduce manufacturing cost through elimination all types of wastes. It shall guide a company to become a world-class organization [4]. This approach in eliminating wastes has made a substantial impact on manufacturing companies resulting in higher performance enhancements and significant improvement in delivery, quality, flexibility and manufacturing cost [5]. As a result, many companies have saved millions of dollars in reducing cost via wastes elimination (such as over-production, defect, over-processing, wait, inventory...). Others companies around the world also succeeded in Lean implementation [6].

In Vietnam, Lean was introduced after the 1990s as a new approach for organizations in productivity improvement, cost reduction, and quality assurance. Several Vietnamese enterprises have applied Lean tools and techniques and achieved highly encouraging results. However, Lean in Vietnam is still a new concept for most organizations. As mentioned above, the ratio of successful enterprises in Vietnam is not high, just less than one percent [7]. These results make Lean implementation a complex and central process. Therefore, the critical success factors (CSFs) in the implementation of Lean must be identified. Through the case study, this research aims to present the factors that are perceived as critical for the successful application of Lean based on analyzing the enterprise characteristics affecting Lean implementation outcomes. Thus, the questions research of this paper are:

RQ1. How Lean practices affecting enterprise’s performance in a developing country such as Vietnam?

RQ2. What are the characteristics of Vietnamese enterprises that challenging Lean outcome?

RQ3. What are the critical factors ensuring Lean success for Vietnamese enterprises?

LITERATURE REVIEW

Lean manufacturing

Lean manufacturing (LM) is an integrated set of principles, practices, tools and techniques designed to address the root causes of operational underperformance. It is a systematic approach to eliminate the sources of loss from entire value streams in order to close the gap between actual performance and the requirements of customers and shareholders. Therefore, the objective of Lean is to optimize cost, quality and delivery, while improving safety. Accordingly, Lean tries to eliminate three key types of losses in operation: wastes, variability and inflexibility [8]. Lean as a secret weapon is responsible for wastes elimination and quality improvement, hence cost reduction within organizations [3]. According to Detty and Yingling (2000), Lean is a comprehensive philosophy for structuring, operating, controlling, managing and continuously improving industrial production systems [9]. The goal of Lean is the reduction of wastes in human effort, inventory, time to market and manufacturing space, in order to become highly responsive to customer demand while producing world-class quality products in the most efficient and economical manner. There are seven types of wastes in Lean systems: transportation, inventory, motion, delays, overproduction, over-processing, and defects [1]. Shah and Ward (2003) indicated that Lean is a multi-dimensional approach that encompasses a wide variety of management practices, including Just-In-Time, Jidoka, Standardized work, Kaizen, team work, cellular manufacturing and supplier management [10]. LM is also a broad collection of principles and practices that can improve corporate performance [11]. According to Creese (2000) indicated that the Lean is a manufacturing philosophy that shortens lead time and reduce costs via eliminating wastes (MUDA) yet improves quality, employee skills and job satisfaction [12].

Lean is not a project, but Lean is an approach for continuous improvement to achieve the perfection through the elimination of all sources of loss [13]. Taken to its fullest extent, Lean is as much about operational excellence as a strategy approach. In this context, Lean should be viewed more as a business philosophy than a merely set of tools or techniques just to improve operations. For that, alongside manufacturing, all other subsystems need to change if an organization wants to convert into a Lean, learning enterprise, reaping its full benefits. The right combination for it consists of a long-term philosophy, processes and people with a culture all about competitive excellence. It is important to introduce an alignment in the ways the members of an organization think and behave [14].

Although Lean does yield immediate results, the full benefits come only when it becomes the basis for a process of continuous improvement able to keep the results over time. Such a view implicates a mental shift away from the short-term focus to a long-term perspective. Enterprises need to institutionalize Lean practices and their policies

deployment as part of their capability-building. Sustaining such a long-term management philosophy presents the challenge for the enterprises embarking on a Lean journey [15]. To develop an effective and sustainable Lean transformation change, enterprises need to address each of the following elements, at all levels of the organization: strategy & alignment, leadership, behaviors & engagement, process management and technology, tools & techniques [16]. Lean requires simultaneously the integration of three elements: operating system, management infrastructure and mindsets and behaviors [13].

Success factors for successful Lean implementation

Success factors (SFs) are the limited number of factors in which satisfactory results will ensure successful competitive performance for individuals, departments or organizations. SFs are those areas where “things must go right” for the business to flourish and attain the manager’s goals [17]. SFs are very important in ensuring the successful implementation of Lean and to avoid failure risks such as generation of losses to an organization’s cost, time and employee’s efforts [18]. The SFs approach has been widely adopted and used in different research fields to determine key factors which are essential to the success of any program or technique. For example, Achange et al (2006) classified four SFs of Lean in SMEs, namely leadership and management, skills and expertise, finance, and a culture of continuous improvement [1].

Although, many enterprises have implemented Lean tools and techniques, most of them are faced with challenges. These challenges could be avoided and overcome by identifying the SFs of Lean tools. In other words, there are many SFs if identified and well understood that will support the overcoming of these obstacles and difficulties [19]. Therefore, studying and understanding the SFs of Lean implementation is very essential. There are many papers published regarding the SFs of Lean and productivity improvement initiatives. Table 1 presents factors as indicated by different authors in previous researches.

There have been disagreements among the reviewed articles. Some factors were mentioned in most of the research (e.g.: top management commitment, culture change, training, communication...) while others were found in only one or two of the researches. This gap could be attributed, in the researcher’s opinion, to the sparse theoretical background that underpins the interpretation of how and why these factors guarantee successful implementation of the Lean approach, since they were identified through a revision of the experience of some enterprises that have successfully implemented the Lean approach. Therefore, the necessity of developing a specific study to understand how and why these critical factors guarantee successful Lean approach implementation.

Table 1
Synthesize critical success factors for Lean implementation

No	Critical success factors	References
1	Top management commitment	[1, 3, 6, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29]
2	Clear goals and objectives	[3, 6, 24, 26, 27, 28, 29]
3	Empower decision maker	[3, 20, 26, 29]
4	Financial capability	[1, 3, 27]
5	Time allocation	[30]
6	Infrastructure	[6, 24, 27]
7	Culture change	[13, 26, 27, 29, 30, 31]
8	Behavior change	[3, 26]
9	Effective communication	[3, 6, 20, 21, 23, 27, 30]
10	Team work ability	[3, 23, 29]
11	Understand Lean tools	[1, 3, 6, 26, 29]
12	Continuous improvement	[3, 6, 20]
13	Problem solving capability	[3, 26]
14	Standardization	[3, 29, 32]
15	Employee involvement	[6, 26, 27, 28, 30]
16	Training and education	[6, 20, 23, 27, 28, 29]
17	Reward and punishment	[3, 20]
18	Set up an evaluation system (KPI)	[3, 6, 30, 33]
19	Project prioritization	[3, 6, 23, 27]
20	Flexible in implementing	[26]
21	Linking Lean to suppliers	[3, 27, 32, 24]
22	Linking Lean to customers	[6, 20, 27, 32, 33]

Challenges for Lean implementation

Case studies of enterprises that have tried to adopt the concepts and implement them in their own management systems, have proven that the transition process is an arduous and time-consuming task and can even be somewhat problematic in some cases.

The majority of the researchers acknowledge that the transformation process to a Lean management system across the enterprise requires a lot of effort, participation of all levels in the organization hierarchy, introduction of new principles not only in the shop-floor level but also in the enterprise culture and in the organizational structure. For these reasons, transition can be a slow, incremental, complex and stressful process that might bring along a great degree of uncertainty as there are no clear guidelines for the transition; rather more the process differs substantially from case to case [29]. Transforming an organization to a Lean enterprise is a dynamic process and unique to each organization.

The implementation of Lean, as any other business process change management, is believed to have enormous difficulties. For example, the top 10 most frequent implementation problems as the business tried to implement new strategic decisions – see Table 2.

Furthermore and in general the current level of knowledge possessed by the people leading and participating in a Lean transformation is limited, often missing the intents and nuances of “real Lean” such as: (1) Lean is oriented to be a stakeholder-based system of management and not a management practice that promotes individual shareholders benefits in detriment of all other shareholders; (2) negative cutting, such as layoffs, is not

the intent of Lean. Instead, it should provide a way to create new work, motivate and develop workers full potential, rather than simply destroying jobs in the name of efficiency, in order to create stable and long-term growth; (3) the principles of Lean manufacturing can be applied to every business process; (4) the “continuous improvement” and “respect for people” principles are the key to making the Lean management system work [35].

Table 2
Most problems frequency for Lean implementation

#	Ten most frequency implementation problems	%
1	Implementation took long than planned	76
2	Major unanticipated problems occurred during implementation	74
3	Co-ordination of implementation activities was not effective enough	66
4	Competing activities and crises distracted attention from implementation	64
5	Skills and abilities of implementation team were lacking	63
6	Training and instructions to lower level employees was not enough	62
7	Uncontrollable factors in the external environment adversely affected implementation	60
8	Leadership and direction provided by department managers was not good enough	59
9	Key implementation tasks and activities were not defined in enough detail	56
10	Information systems used to monitor implementation were not adequate	56

Source: The authors conducted from [15, 34].

Because these points are not widely shared and understood among Lean practitioners, it is foreseeable that associates or other key stakeholders, such as suppliers, customers, or investors will experience negative outcomes. Emiliani and Stec (2005), refers to a survey made by the Lean Enterprise Institute, in 2004, reporting the “State of Lean” based on data from 999 participants. According to it only 4% of participants described their progress as “advanced”, while 46% described their Lean implementation efforts as “early” [35]. The report identified several “common obstacles” related to their experience in Lean implementation efforts – see Figure 1.

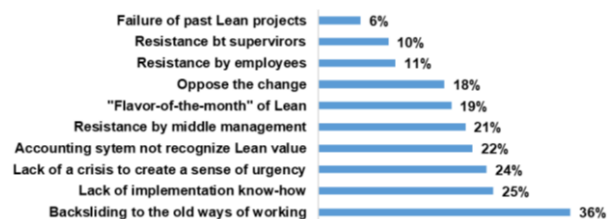


Fig. 1 Common obstacles for Lean implementation

Source: The authors conducted from [35].

RESEARCH METHODOLOGY

Data collection and analysis

A qualitative method has been conducted for this research to provide insights and understanding about the problems and answer “how” and “why” Lean can be successfully applied [36].

The case study method provides the flexibility approach during interviews and gathering of in-house documentary evidence. A combination technique for data collection has been employed in this research. This comprises literature review and interview key persons in Lean implementation. Information from the personal interviews were conducted through prepared questionnaires. They involved a number of key personnel in the cases that included the general workforce of the concerned enterprises and involved in Lean projects [37].

As shown in Figure 2, enterprises were contacted by telephone and e-mail. After the initial contacts were made, a review meeting was arranged between the researcher and the participants. The review meeting enabled the researcher to carry-out direct observation of the activities within a particular case. The observatory exercise has enabled a visual assessment of the general manufacturing issues at stake.

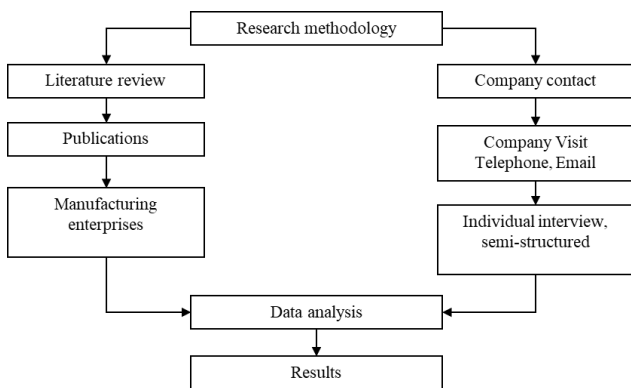


Fig. 2 Scenario for research methodology

Results obtained were noted in a specially improvised document known as the observation data collection sheet. For example, observations were focused on both performance of work force during their daily tasks and the time frame to carry out these activities. The observation exercise was conducted for approximately 30 minutes at each particular point of observation. Eventually, information from the observation data collection sheet was analyzed and used for the preparation of the interviewing process. Personal interviews were conducted through prepared semi-structured questionnaires. They involved a number of key personnel in the company that included the general workforce of the enterprises concerned. This selection criterion was used as a means of acquiring information in a blanket format so as to make the study more representative.

Six manufacturing enterprises in Vietnam implementing Lean in their production processes more than 3 years are chosen to be representatives for case studies, including: (1) Toyota Motor Vietnam – TMV, (2) Vietnam Precision Industrial No.1 Co., Ltd – VPIC1, (3) LeGroup Manufacturing and Trading Company – LeGroup, (4) Ha Yen Join-Stock Company – Ha Yen, (5) Pho Yen Mechanical Joint Stock Company – Fomeco, (6) Diesel Song Cong Limited Company – Disoco.

Case studies are include state companies, private companies and FDI companies possessing typical features and represent for multiple enterprises in the same sector. Data collected by three main sources including: (1) Documents, secondary data collected and analyzed via results of the reports about the manufacturing reality, quality control, cost improvement and activities related to Lean implementation of the enterprise. (2) Individual interview. The targeted participants via the semi-structured interview Table are the ones who has experience in years and directly take part in the Lean implementation plan. The subjects consist of Production Director, Director of factory, Heads and Deputies of workshops, specialization deviations of Lean and members of Lean plans of workshops. (3) Observing the participation at TMV and Ha Yen to get notices on site in one process by applying two Lean projects in each enterprise.

In order to evaluate the critical obstacles hampering successful Lean implementation in Vietnam manufacturing enterprises, and evolving success factors contributing to successful Lean implementation, a detailed interview questionnaire has been designed. The approach has been directed towards justification of Lean implementation for its support to competitive manufacturing in Vietnam industries. The questionnaire technique has been deployed in the present study for seeking information on the issues related to scrutinizing barriers to effective Lean implementation and developing an understanding of success factors and enablers for successful Lean implementation in the Vietnam manufacturing enterprises. The key questions asked in the semi-structured questionnaires were as follow:

Is this enterprise independently managed or it is owner-managed?

- What is your definition of Lean manufacturing?
- What has motivated the enterprise to implement Lean manufacturing?
- Where has Lean been implemented in your organization (piecemeal or whole)?
- What were the criteria for choosing that specific area?
- How many people were involved in the exercise?
- What training if any, did the staff undertake?
- What were the difficulties and challenges and how to overcome these issues?

The profile of the case study and number of participants as shown in Table 3.

Table 3 Case study profile and number of participants

Participants	Case study					
	FDI sector		Private sector		State-owned sector	
	TMV	VPIC1	LeGroup	Ha Yen	Fomeco	Disoco
Senior managers	1	1	2	2	1	1
Middle Managers	3	4	1	1	2	2
Staff	2	1	3	3	3	3

Source: The authors selected number of participant based on research of [37].

RESEARCH RESULTS AND DISCUSSION

Characteristics of Vietnam enterprises and challenges to applying Lean

Six features of manufacturing enterprises in Vietnam affect the choice of tools, techniques of LEAN, including: (1) Business size, (2) Technology level, (3) Management Capacity, (4) Quality of labor, (5) Corporate culture, and (6) Ability of Supply chain Link of the enterprise.

Firstly, the business size, in 2016 Vietnam has 391,777 (97.7%) of 401,000 businesses that are small and medium-sized enterprises – SMEs [38], and in 2020 the number of SMEs up to 593,629 of 610,637 businesses with 97.2% [39]. Most of them belong to the private sector (accounting for 591,499 enterprises (96.9%) of the total number of enterprises in 2020 are private, 16,878 enterprises (2.7%) are FDI enterprises, and 2260 enterprises (0.4%) are state-owned business). SEMs is restricted by financial, time, and human resources and there are less than 10% of SMEs enterprises can achieve success when applying Lean for a year [7].

Secondly, the technology level of Vietnamese enterprises recently backward compared to other countries by 10 to 20 years, especially the state enterprises, and SMEs [40]. In 2016, more than 52% of Vietnam businesses using foggy technology when sole 10% of them is applying state-of-the-art technology into the production. Especially, in accordance with the report of the Vietnam Chamber of Commerce and Industry (2019), 60% of Vietnam enterprises using more than 6-year-old equipment and most of them came from China with 26.6%, Japan, EU, and Korea (32%) with 18% are imported before 2005 [41].

Thirdly, the production management capacity of Vietnamese enterprises recently has certain limitations [42]. Management competency of enterprise managers and leaders have not met the requirements in competitive and flexible production conditions [38]. Lean implementation is a transformational process and needs to support organizational development alongside process improvement. Therefore, given contextual knowledge of the organization, to predict which Lean methods are most important in the situation [43].

Fourthly, the value of Vietnam labor productivity has tended to increase at a relatively fast pace over the years. However, the manufacturing industry has low labor productivity. Regarding international comparison, Viet Nam's labor productivity is compared to Northeast Asia countries and ASEAN. The results show the Viet Nam's labor productivity was lowest among the countries, including Cambodia [49]. According to statistics of the General Statistics Office of Vietnam (GSO) in 2020, only 24.1% of worker has been trained and more than 70% of them are unskilled labor [44]. Low quality of human resources leads to a low chance of self-awareness and perception changing for applying Lean.

Fifthly, the corporate culture of Vietnamese enterprises reflexes the culture of Vietnamese [45]. A group of authors Duong Thi Lieu & Nguyen Van Ha (2008) indicated the limitation of Vietnamese culture affecting the development process and integration of the enterprise, such as

(1) small business and unplanned habits, (2) limited vision and short-term thinking, (3) lack of connection, community, (4) rely on the relationship, (5) does not keep the trust [46]. While, Lean culture focuses on team works, sharing information, and continuous thinking innovation [22, 31]. Apparently, cultural characteristics in Vietnamese businesses do not fit the Lean features.

Sixthly, Lean applying successfully means that the enterprise need to achieve pull system from up-stream to down-stream. Unfortunately, the supply chain system in Vietnam has not created a stable chain from suppliers to manufacturers yet, producers need to import goods abroad costly with large quantity, high risk and unstable quality. Connection and cooperation among Vietnamese businesses are not really good [47]. Additionally, uncertainty in a supplying chain and the lack of linkage among partners are barriers to perform JIT successfully.

The Vietnam local enterprise's characteristics effecting the choice and applying Lean successfully are summarized in this Table 4 below.

Table 4

Summary of Vietnam manufacturing enterprise's features

No	Features	Description
1	Business size	<ul style="list-style-type: none"> – 97.2% of businesses are small and medium-sized; – Resources of finance, human, machines and equipment are very limited.
2	Technology level	<ul style="list-style-type: none"> – Backward technology more than 10 years compared to the world; – 70% of businesses is small and medium-sized possessing foggy technology; – 18% of equipment are imported from 2005 and before.
3	Management competency	<ul style="list-style-type: none"> – Low level of management competency leads to inefficient control ability – and change managing.
4	Labor quality	<ul style="list-style-type: none"> – 24.1% of worker has been trained; – 70% is unskilled workers; – Awareness of the role of Lean implementation is not heightened.
5	Business culture	<ul style="list-style-type: none"> – Dissociative, uncooperative; – Lack of connection and rely in communication; – Small business and unplanned work.
6	Linkage of Supplying chain	<ul style="list-style-type: none"> – Unstable supplying chain; – Low Cooperation ability between producers and suppliers.

In conclusion, the characteristics of manufacturing enterprises in Vietnam are different compared to others. Therefore, to apply Lean in Vietnamese enterprises, there will be a strategy and a specific path to adapt that feature. In the next part, through Lean application outcome in the case study, this paper will propose the critical factors that ensure to applying Lean with purposes and tools appropriate for Vietnamese business at this moment.

Lean application in case companies

Toyota Motor Vietnam after 20-year business in Vietnam increase the productivity up to 300% from 16,000 cars as designed to 44,800 cars in 2015 without massive investment. Production cost reduced more than 15% in the period 2013-2015 (Example: Production cost of Vios model was reduced from 20,167 USD/car to 17,169 USD/car). On average, number of faults per car decreased from 0.14 faults/car in 2011 to 0.07 faults/car in 2015. The outcomes of productivity, quality and cost are always maintained continuously by TMV when applying Lean until now.

VPIC1, after 9-year of Lean applying, reduced the Die-change time more than 60% (Stamping workshop), areas of factory cut back to 65.7% (Hub workshop), and increased capacity to 32% (welding workshop), inventory reduction to 90% (Welding components warehouse No. 1). In some states, the probability of defective products is eliminated up to 96% and that of failure is cut back by 10% per year. In 2016, VPIC1 continues to set a goal of production cost saving more than 5%.

LeGroup increases the productivity more than 200%, probability of defective products for 2 production lines occurred frequently have been reduced more than 96% in the 3-year period 2012-2015. Inventory of semi-produced products decreased 68%, reduce 78% of Leadtime, which contribute vastly to reduce production cost. LeGroup’ Strategy is to keep investing Technology, human and Lean methods to improve production capacity in the factory more than 10% each year.

In the case of Fomeco, applying Lean helps to improve the productivity, the revenue of the enterprise increased continuously with approximately 47% per year, lead time decreased 32% while investment of infrastructure and labour is insignificant. In 2014, the rate of defective products of the enterprise compared to FDI is smaller than 10 ppm (part per million) and errors in all stages producing domestic goods is reduced to more than 2%. Additionally, there is no customers’ complain about the product’s quality, production cost in some lines providing for FDI clients is reduced more than 30%. Fomeco keeps maintained production control and processes Kaizen to ensure the quality and declined defective products rate to 0% in 2018.

Ha Yen and Disoco after applying Lean did not obtain expected outcomes. The results of productivity, quality, cost, delivery are not gained and maintained above one year. The author summarizes the applying Lean results in the case studies from the criteria mentioned above. The result of Lean application as shown in Table 4.

The results from six case studies indicated that the successful of Lean application depend on what tools of Lean were chosen to apply at right time and right situation of management. Case of Lean success is TMV showed that Lean tools are applied step by step from easy tools first (such as 5S, VM, Kaizen) to more complex tools (such as Kanban, Heijunka, Pull, Andon, Poka-yoke). Similarly,

VPIC1, LeGroup, Fomeco are currently on the road of standardize production by applied Standardized work, Job instruction, SPC... after several years implemented Kaizen, 5S, VM. Ha Yen and Disoco, although after 4 years implemented J.I.T and Kanban to set a pull production system, the production lines are still not achieved any good success.

Table 4
The summarization of the applying Lean results in cases

Lean Tool applied	Case company					
	TMV	VPIC1	LeGroup	HaYen	Fomeco	Disoco
Wastes/Muda	√	√	√	√	√	√
5S & Visualize	√	√	√	√	√	√
Kaizen	√	√	√	√	√	√
Standardized work	√	√			√	
TPM	√					
VSM	√					
Cell Layout			√			
SMED	√	√				√
Kanban/Pull	√			√		√
One Piece Flow	√					
Heijunka/Leveling	√					
Poka-Yoke	√		√	√		
SPC	√	√	√		√	√
Job instruction	√	√	√	√		
JIT	√			√		√
Andon	√					

Lean outcome evaluation
↓

Case company	TMV	VPIC1	LeGroup	HaYen	Fomeco	Disoco
Conclusion	Successful	Successful	Successful	Unsuccessful	Successful	Unsuccessful

The research results also indicated that the characteristics of the enterprise has significant effected to the Lean applying’ outcome due to the affection because of the limited of Lean’s apply from their lack characteristics. That explains why the foreign enterprises attain more success than Vietnam’s.

Firstly, size and infrastructure of Vietnamese companies are in poor conditions. According to the statistics of General Statistics Office in 2016, Vietnam has more than 97% of businesses is SMEs. Thus, there is the lack of finance and human resources quality needed to guarantee the success of Lean application. Besides, SMEs is not capable of negotiating for positive deals to applying Lean. Ha Yen enterprise is the typical one for SMEs whose the resources are inadequate for establishing and following the principle systems as well as reward policies long enough. Similarly, the state businesses and SMEs in this research are independent on the systems provided by the suppliers while responding maximally the customers’s requirements.

Secondly, the technology level of businesses is much more backward than that of the other countries in the region [40], that trigger the impossibility of applying the techniques of Lean (Example: SMED), the standard cannot be controlled fully. For example, Disoco enterprise applied SMED into the Motorbike starter parts process but the whole system of drill and lathe machines are operated for more than 30 years, therefore, it is very difficult to conduct any Kaizen ideas.

Thirdly, the management and operation competency of Vietnam’s companies is still weak, especially SMEs and the state ones. Recognition and controlling ability lead to the

commitment is low. The production director of Disoco has been always committed to Lean projects in the interview but still missed the meetings and reports. Level of commitment for joining in the process weakly brings about the fact that decisions made in the meeting can not be proposed. After 6 months, applying Lean firstly failed. Fourthly, the quality of Vietnamese workers is very low with 81% is unskilled labour. Low-quality labour is a reason for low awareness and cognition. Impaired cognition is in charge of inefficient training activities or rewards. Fifthly, Vietnamese citizens tend to personalize, have a short-term vision, and lack sharing and teamwork spirit. Meanwhile, the Lean culture highly respects the teamwork spirit and sharing information. The cultural difference makes the changing effort to Lean of the enterprise more difficult.

Sixthly, the production network and supply chain system are unstable and uncompleted. The connection and cooperation between Vietnam businesses are not good. Each enterprise just pay attention to only their benefit but not to the partners. Instability of the supply chain and the loose relation between partners are the barriers for businesses applying J.I.T completely. Two unsecured components "Participant of suppliers" and "Participant of customers" trigger 5 out 6 businesses taking part in the research can not using Lean successfully. Only TMV can succeed at the highest level thanks to the support of providers and customers systems.

In conclusion, the results of case studies of six typical businesses shows that the successful of Lean application for enterprises are depended on features of enterprise (Fig. 3). Besides, the level of Lean achievement for each case company are also depended on which tool of Lean are implemented in suitable period or not. For example, a SMEs enterprise is hard to success with some high level of Lean tools at the first year such as Kanban, Andon, Pull production... but also some simple single tools and principles as 5S, VM, Kaizen are more easy to applied and achieved first success. The authors propose a suitable model for roadmap of Lean application in section.

	TMV	VPICI	LeGroup	Ha Yen	Fomeco	Disoco
Experience of LEAN application (up to 2018)	20 years	9 years	8 years	4 years	8 years	6 years
LEAN tools applied	Apply step by step. . Step 1: Kaizen, Muda, VM . Step 2: SW . Step 3: SMED, One piece flow, Leveling . Step 4: Kanban, Cell, Takt time	Implemented Kaizen, Muda for first 2 years. Implemented SW after 2 years	Implemented Kaizen, Muda for first 2 years. Implemented SW after 3 years	Implemented Kanban and Pull system at first. Did not implement 5S, SW	Focus on implemented 5S, Kaizen (4 years)	Only implemented 5S and Kanban
Result of applied	Successful	Successful	Successful	Unsuccessful	Successful	Unsuccessful
Level of production achieved						
Slim production	★					
Smooth production		★				
Standardize production			★		★	
Stabilize production			★	★	★	★

Note: ★ Level of LEAN Achieved

Fig. 3 Lean application results within case companies

Success factors and enablers for successful Lean implementation

Owing to general apathy of Vietnam enterprises towards affecting manufacturing performance improvement through strategic maintenance initiatives, there has been sluggish growth in the Industry and hard to compete effectively in highly dynamic global marketplace. However, Vietnam enterprises have realized and understood the true potential for enhance manufacturing performance, and major proactive maintenance initiatives have been adapted in the manufacturing organizations, since 1990s, due to the burgeoning pressure due to multi-national corporations, rapid product development, increased quality consciousness, cost optimizations, waste reductions and lead time optimization. Lean has not gained wide acceptance in Vietnam industry as prime mover for increasing competitiveness. Lean is being looked upon as a potential profit source, capable of leading the organizations to meet the challenges posed by globalization.

However, these companies have faced a lot of difficulties and barriers in effectively adapting to aggressive Lean principles. The systematic identification and recognition of barriers to effective Lean implementation program can lead to fostering of a favorable environment in the organization and helping the organizations to develop focused Lean implementation program for successfully overcoming the obstacles for Lean implementation in Vietnam manufacturing sector. The present study highlights the difficulties faced by Vietnam manufacturing organizations in their quest to effectively implement Lean initiatives in the pursuit of improving organizational efficiency. In this regard, a detailed survey of the Vietnamese manufacturing enterprises had analyzed for ascertaining the obstacles affecting the success of Lean implementation program. The various obstacles hindering the organization's quest for achieving excellence through Lean initiatives have been classified as organizational, cultural, behavioral, misunderstanding, operational, financial, and departmental difficulties or barriers.

This research investigation has realized key main factors that are fundamental, hence critical for the implementation of Lean manufacturing within Vietnamese manufacturing enterprises. They include:

- (1) Top management commitment.
- (2) Cultural transformation.
- (3) Training and consulting.
- (4) Evaluation system (KPIs).

Of these identified factors, it has been hypothesized that top management commitment are the most critical ones in determining the success of a Lean project. Strong leadership ethos and committed management support is the corner-stone to the success of implementing any idea within an organization. These factors have been discussed in detail in the following sections.

Top management commitment

The successful implementation of Lean requires top management support, commitment and involvement. Top management needs to have a strong commitment to the Lean implementation program and should go all-out for evolving mechanisms for multi-level communication to all employees explaining the importance and benefits of the whole program, and whole heartedly propagating the Lean benefits to the organization, employees by linking Lean to the overall organizational strategy and objectives. The first course of action is to establish a strategic direction for Lean. This can be achieved by evolving appropriate Lean policy and master-plan towards Lean implementation in the organization. This must be followed by evolving structured Lean secretariat in line with organization's policies involving employees from various organization functions and hierarchical levels. The management contributions towards successful Lean implementations can include revising business plans to include Lean goals, affecting appropriate cultural transformations in organizational culture, building strong success stories for promoting motivation for Lean implementations, communicating the Lean goals to the entire organization, providing adequate financial resources for affecting business improvements, promoting cross-functional working in the organization, providing training and skill enhancements for production and maintenance workers, evolving reward and incentive mechanisms for promoting proactive maintenance, supporting changes and improvements in the workplace, removing barriers related to middle level management and enhancing inter-department synergy in the organization.

Cultural transformation

The biggest challenge before the organization is to be able to make radical transformation in the organization's culture for ensuring overall employee participation towards the maintenance and manufacturing performance improvement through Lean initiatives. For long, Vietnam organizations have been strongly resisting any changes at the workplace. Thus, focused and concerted efforts have to be made by the top management to bring about motivating organization culture by creating awareness to the employees about the true potential of Lean and by communicating to the employees about the contributions of Lean towards the employees in particular. In this regard, organizations should go in for "union buy-in", since by roping in employee's union representatives in the Lean implementation planning and execution, many of the employee behavioral barriers and obstacles to Lean implementation can be appropriately addressed. The unions can directly be convinced that the affected employees will be helped by developing additional skills that make them more valuable to the organization and Lean can effectively be used to create a more multi-skilled workplace, which usually improves employee job security. This practice can effectively help the top management to

foster successful Lean implementation program in the organization while avoiding the misconceptions about myths regarding Lean in the organization. Moreover, many other strategic initiatives can also be successfully deployed in the organizations for motivating and aligning the employees to the organizational goals and objectives of growth and sustainable development for meeting the global corporate challenges.

High-performing companies are those with a culture of sustainable and proactive improvement. Manufacturing, almost more than any other sector, is a global industry. The study further confers that the ability to operate in diverse environments is a pre-requisite for managers. The investigation has clearly indicated that it is highly desirable to have some degree of communication skills, long-term focus and strategic team while intending to implement any new initiative.

Training and consulting

The success of the organization in fully realizing the benefits through effective implementation of traditional and proactive maintenance initiatives including Lean is critically dependent upon the competencies of the employees towards the job. Therefore, an adequate training and consulting (if needed) for employees at all levels should be treated as key strategic initiative for successful Lean implementation. The employees must be provided with not only technical job relates skills and competencies, but also need to be well equipped with quality improvement and behavioral training for changing the mind set of employees from "I operate, you inspect, you maintain" to "I produce, I inspect, I maintain". The training objectives must include the systematic development of the knowledge, skill and attitude required by an individual to adequately perform a given job. The top management responsibility in this regard becomes identification of training needs, setting training targets, training plan, preparation of training calendar, designing of training programs and material, execution of training and evaluation of training effectiveness. The top management must endeavor to train and develop the employee competencies by updating their skill, knowledge and attitude to enable higher productivity and achieve highest standards of quality, to eliminate product defect, equipment failure (breakdowns) and accidents, to develop multi skilled work force, and to create a sense of pride and belonging among all employees. The results of an effective education and training program will include improvement in employee competencies, reduction in absenteeism, idle hours, wastage/scrap and breakdowns, zero accidents, and increase in number of multi-skilled workmen and number of Kaizen.

Evaluation system (KPI)

The reliability of success factors and enablers in achieving success through strategic Lean implementation programs can be evaluated by deploying Key Performance Indices (KPI) for assessing the manufacturing performance. KPI's

are widely used within industry to measure specific parameters across all the classes of metrics. The strategic KPI's should be adopted and appropriately deployed for assessing the success of Lean implementation programs. KPI's are necessary to establish objectives, measure performance and reinforce positive behaviors. The comparison of the current maintenance performance level must be made against future maintenance performance level to evaluating the strategic impact of Lean implementation program. The results of the Lean program should be realistically explored and shared with the employees so as to improve the employee satisfaction, motivation, and ensuring enhanced employee participation and organizational contributions in the future too.

Finally the concerted efforts should be made for affecting manufacturing system performance improvements through emphasizing upon maintenance prevention initiatives and enhancing focused production system improvements by fostering competencies related to production facilities by deploying feedback from customer and various departments, focusing upon learning from existing equipment to new systems, incorporating design related improvements, improving safety at workplace, improving workplace organization through focused 5S initiatives, and integrating Lean with other performance improvement initiatives.

CONCLUSION

Currently, more than 97.2 percent of companies in Vietnam are Small and Medium scale Enterprise (SMEs). In the context of international economic integration and industry 4.0, the participation of Vietnam more and more into the international trade agreements will create both business opportunities and challenges for enterprises. There is an only way for Vietnamese SMEs to ensure the advantage competition is build a smart production system step by step and based on the philosophy of continuous improvement. In order to enhancement the competitiveness capability of these enterprises in the viewpoint of Lean production, some encourage policies for Lean application through improve technology, management capability. Thus, to achieve the high level of the combination between Lean production and industry 4.0, some issues need to be considered as below:

- Develop a suitable policy for SMEs, supporting industrial to improve human resource and enhance the management level.
- Develop a national training program to update knowledge of Lean production and information technology for SMEs in parallel.

This paper has described the realization of challenge features and success factors for Vietnamese manufacturing enterprises to implement Lean. The identified have provided a useful insight for the enhancement of critical decision-making process, needed for the delivery of corporate strategic ambitions towards the implementation of Lean manufacturing.

The difficulties faced by the organizations have been categorized into organizational, cultural, behavioral, operational, financial, and departmental obstacles. The issues related to various obstacles have been critically analyzed to evolve strategic enablers and success factors for successful Lean implementation program for Vietnam enterprises. Nevertheless, it has also been revealed by the study that successful implementation of strategic Lean initiatives can be realistically achieved in companies by bringing out successful cultural transformations and ensuring the whole hearted commitments by the top management. In order to ensure the successful implementation of Lean initiatives and practices in the challenging of Vietnam manufacturing environments, the organizations must be willing to foster an environment that is willing to support change in the workplace, and create support for Lean concepts. The top management's contributions for successful Lean implementation have been found to be highly critical and successful managers must know how to use Lean initiatives in the different situations to develop employee involvement in every step of the manufacturing process and facilities maintenance to optimize production flow, increase product quality, and reduce operating costs and lead time. Moreover, it can be concluded from the research that the successful organizations need to strategically integrate proactive maintenance initiatives into their manufacturing strategies and successfully boost organization's productivity, improve maintenance performance, reduce costs, improve plant profitability, minimize unnecessary downtime, ensure better utilization of resources, thereby enhancing the competitiveness of the organization.

Finally, it should be pointed out that a further limitation to this study through case study. Six case companies are not very willing to provide useful information and data. Future research should lead to a wider spectrum of companies in order to derive a more concrete multi-variant analysis on the relations between the variables of Lean implementation.

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