International Journal of Research in Finance and Marketing (IJRFM)
Available online at : http://euroasiapub.org/current.php?title=IJRFM
Vol. 7 Issue 10, October- 2017, pp. 1~19
ISSN(o): 2231-5985 | Impact Factor: 6.397

INFLUENCING FACTORS TO EFFECTIVE APPLICATION OF LEAN MANAGEMENT IN VIETNAM

Ngo Phuc Hanh
Assoc. PhD, Academy of Policy and Development – APD, Ministry of Planning and Investment.

Abstract. Lean Manufacturing (Lean) has long been a model used by many Vietnamese enterprises due to its primary focus on the elimination of waste, the production potential of the products, the standardization of processes, and continuous improvements. However, the application of Lean in Vietnamese enterprises has not yet been effective. In this journal article, the author studies the factors that affect the effectiveness of Lean. It is believed that there are four main factors which have an impact on the effectiveness of Lean implementation in Vietnamese enterprises, namely: leader; employee; management policy; infrastructure and corporate culture. To investigate the impact of these factors, quantitative research was applied to three data analysis techniques, including descriptive statistics, scale reliability analysis, and regression analysis to verify the hypothesis. Data analysis shows that the "leader" factor has the strongest impact on Lean implementation results. The second most powerful factor is "employee"; the third is "management policy" and the last is "infrastructure and corporate culture". The "employee" factor is the only factor that has a negative impact on the effectiveness of Lean.
Keywords: *Lean Manufacturing, Enterprises Management*

1. Introduction

Lean manufacturing research is not a new field. Several previous studies focused on the analysis of production, especially Kiichiro Toyoda and his adoption of the JIT idea into Toyota Motor Corporation, along with the use of the production line in the 1940-1950s. Toyota production system is the premise of the theory and model of lean management. After Toyota demonstrated the effectiveness of its own production system, Lean has been gradually deployed and applied in leading manufacturing companies all over the world. Today, Lean is becoming increasingly popular in developing countries. There are other views that compare production systems in Lean-applied companies in Japan with other companies around the world (James Womack, 2000).

Currently, Vietnam has about 500,000 active enterprises, only about 200 of which are applying Lean, and only 2% have successfully adopted Lean, (GSO, 2016). This is a very small number for a developing country like Vietnam. This research will prove its usefulness for businesses who are and will apply Lean in Vietnam in the future. It helps to identify not only the causes but also proposes basic solutions to improve the awareness and application rate of Lean in Vietnam, such as improving the production capacity of businesses, reducing waste, increasing profits as well

as contribute to the economic development of the country. This is also the ultimate goal of the study. The research also explores the relationship between concepts related to this field of study, which gives managers a more general view of the application of lean in Vietnam.

2. Overview of theories, research models and methods of analysis

2.1. Overview of theories and research models

From the late 70s of the 20th century, Lean was chosen by many American executives to improve business efficiency (Imai, 1986, Monden, 1986). James Womack (2000) released the first book on Lean: "The Machine That Changed the World" and the definition of Lean Manufacturing, which compared manufacturing systems in Japanese automakers to other companies in the world. James Womack, Daniel Jones and Daniel Roos (1990), also are the first Lean book authors in the world, provided a theoretical framework for Lean systems.

"Lean" is a relatively open concept. According to Liker (2004), Lean is a production philosophy that shortens the time between receiving orders from customers and delivering them by cutting down on waste. In 1996, in their book "Lean Thinking", James Womack and Daniel Jones defined Lean by these factors: the production line - each producing a single product; the pull manufacturing model - attempting to achieve perfection via the Kaizen tool; and the defining of value and manufacturing through the product's value chain. Manufacturing towards perfection comes from the concept of Lean: a system of production methods that minimize waste by focusing on exactly what the customer wants.

Lean Manufacturing is being increasingly adopted by leading manufacturing companies in the world, led by major automobile manufacturers and equipment suppliers of these companies. Lean Manufacturing is becoming a trending topic among manufacturing companies in developed countries as they seek to compete more effectively in Asia.

The goals of Lean manufacturing are to reduce errors and waste; shorten production time; reduce stock levels; improve labour productivity; to effectively utilize infrastructure; enhance flexibility, and improve overall productivity. Lean Manufacturing consists of six basic principles, namely: Identification of waste; Standardize the process; Continuous process; Pull mechanism in production (Pull Manufacturing); Quality from the bases; Continual improvement.

Typical Lean tools include: 5S Tools; Kaizen; Visual management; Jidoka, and some other tools such as Poka Yoka; ZenJidoka; Value chain map; Production level; Problem-solving; Single-product line;

Research on the factors that influence the application of Lean, Tracey and Flinch (2006) have shown some success and failure factors in applying Lean. The authors argued that Lean adoption is highly dependent on the teamwork of the business, as these groups will work together to create value for the customer. Worley and Doolen (2006) investigated the relationship between commitment, support of senior personnel, internal communication and the application of Lean in the manufacturing company. Achanga et al (2006) studied in order to identify key factors

contributing to the successful application of Lean to small and medium enterprises. Through this analysis, the authors found out several factors that cause the failure in applying Lean in projects in small and medium enterprises. Drew, Mccallum, and Roggenhofer (2004) pointed out that while many companies applied Lean manufacturing, most are not as successful as the case of Toyota and some other large firms. The authors also noted that the lack of commitment and positive support of senior management in the enterprise will lead to the failure of Lean application. Emiliami and Stec (2005), analyzed the cause of modest results in Lean adoption, despite the great efforts of the business. The authors identified several reasons behind the success of Lean projects. Bhasin and Burcher (2006) based on the theory and application of fieldwork survey methods such as observations, in-depth interviews, questionnaires to find success factors and failures of applying Lean in business. Wong (2009) studied Lean application in Malaysia's electronics industry. The author surveyed the fourteen major aspects of Lean application such as production process, quality, equipment, staff, customers... Anna (2014) studied the difficulties facing enterprises when applying Lean. The author uses the Benchmarking method to compare the success factors of Toyota in applying Lean in comparison with other businesses.

Based on the opinion of the factors influencing the application, the following figure studies the factors affecting the effectiveness of lean application:

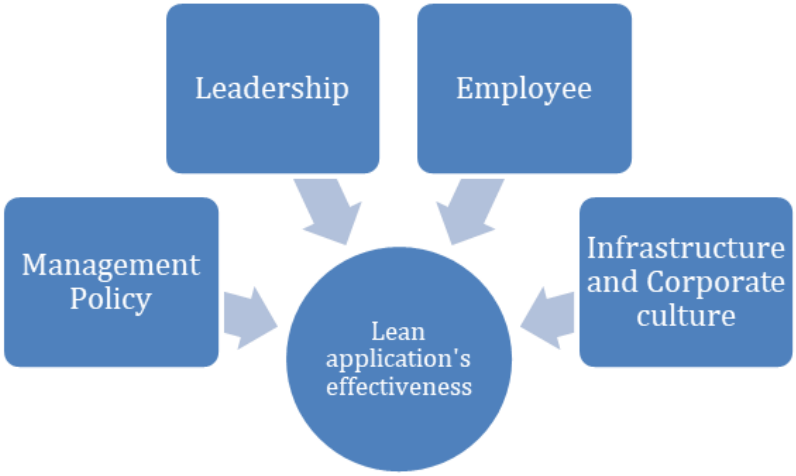

Figure 1: Research model

Research hypotheses include:

H1: The "Leadership" factor has a positive impact on the effectiveness of Lean implementation in the enterprise. Leadership factors include long-term commitment, leadership ability, understanding of Lean ... When the business leaders possess these qualities, the application of Lean will be supported and deployed effectively. International studies by authors such as Mefford (2009), Czabke (2008), Herron (2008), Motwani (2003), Crute (2003), Kettinger (1995), Herron (2008), Womack (2003) Jeffrey (2013) also claimed that "Leadership" is one of the factors leading to the success of Lean adoption.

H2: The "Employee" factor has a positive impact on the effectiveness of Lean implementation

in the enterprise. The "Employee" factors include qualification, receptivity, attitudes towards Lean practice, teamwork ability ... If the leader is often the initiator of Lean practice, the staff are the people who directly practise Lean, putting the Lean policies into practice. If the corporate employees have such positive factors, then Lean will be able to successfully deploy. Womack (2003), Mefford (2009), Herron (2008), Motwani (2003), Achange (2006), also confirmed this finding.

H3: The "management policy" factor has a positive impact on the effectiveness of Lean implementation in enterprises. The "management policy" factor includes such factors as personnel policy, labour efficiency, assessment policy,... Management policy will help implement the commitment and strategies of leaders when applying Lean. Good management policies also encourage employees to actively participate in the process of Lean. International studies such as Kettinger (1995), Achange (2006) Crute (2003),... have confirmed the positive relationship between management policies and the effectiveness of applying lean.

H4: The "Infrastructure and corporate culture" factor has a positive impact on the efficiency of Lean implementation in enterprises. The "Infrastructure and corporate culture" factor includes elements such as organizational structure, corporate culture, accounting system or financial resources. When businesses have a strong financial strength and a facilitating corporate culture and structure, the implementation process will be successful. Studies such as Czabke (2008), Herron (2008), Achanga (2006), Motwani (2003)... have demonstrated the positive effect of this factor on the efficiency of Lean application.

2.2. Research Methods

To assess these hypotheses, linear regression analysis was applied. Independent variables of the regression model include: "Leadership", "Employee", "Management Policy" and "Infrastructure and Corporate Culture"; The dependent variable of the model is "Lean Effectiveness". The scales of variables were constructed through exploratory factor analysis (EFA) and Cronbach Alpha coefficients, which performed a linear regression to estimate the effect of the researched factors on the effective application of Lean in Vietnam.

Ethical research issues are also considered. The study was conducted with the following principles: (i) Ensure the voluntary participation or withdrawal of individuals in the study; (ii) Apply the anonymous rules in the investigation to avoid harming the interests (if any) of the individuals involved in the study; (iii) Do not use internal data if it has not been disclosed, because the use of internal data can harm the interests of researched enterprises and the information can not be verified.

In this study, empirical philosophy was selected as the study was established to explore causal relationships between the four factors: Leadership, Employee, Management Policy; Infrastructure and Corporate culture. Such argument is supported by previous researchers such as Jeffrey (2013), Worly (2006), Czabke (2006), Motawani (2006), Crute (2003) in their research of in-depth situation analyses of Lean-applied companies; Todd (2011), Achange (2006), Emiliami (2005) in their large-scale questionnaire surveys to find out the influencing factors to the

application of Lean. Heron (2006) and Mefford (2009) use quantitative methods to find relationships among the factors. However, many studies in the world used a combination of qualitative and quantitative research methods such as Tracey (2006), Bhasin (2006), Wong (2009).

The author wants to apply the survey method to gather more opinions of the enterprises affected by the mentioned four factors. The method of data collection was done through questionnaire surveys to current Lean enterprises in Vietnam. 180 questionnaires were sent and 165 valid answers were used for this study. The linear regression equation was cited by Cresswell (2002) and Hair (2011) as follows:

$$HQ\ Lean = W_0 + W_1 * LĐ + W_2 * NV + W_3 * QL + W_4 * CS + e \quad (1)$$

Of which: HQ is the effectiveness of the application of Lean in Vietnam; LD is the leadership factor, NV stands for Employee factor; QL represents Management Policy; and CS is the Infrastructure and Corporate Culture factor; e is the estimated error. The data is analyzed by the SPSS 20 software. Muijs (2011) claims that SPSS is not the best tool, but it is the most popular software in academic research.

3. Research results and discussion

Establishing the variables and influencing factors to the effectiveness of Lean application.

Table 1. The observed variables influencing Lean application results

Symbol	Observed variables	Reference	
		Success	**Failure**
LD1	Leaders have long-term commitment to the application of Lean	Mefford (2009), Czabke (2008), Herron (2008) , Motwani (2003),Crute (2003), Kettinger (1995), Worley (2006), Todd (2011)	Tracey (2006), Worley (2006), Achange (2006), Drew (2004), Emiliami (2005), Bhasin (2006), Wong (2009)
LD2	Leaders with good leadership abilities	Herron (2008) , Womack (2003), Jeffrey (2013)	Emiliami (2005)
LD3	Leaders and stockholders fully understand the benefits of Lean application.	--------	Achange (2006), Anna (2014)
LD4	Effective internal communication between the Board of Directors to the employees	Motwani (2003), Worley (2006), Czabke (2008)	Achanga (2006), Tracey(2006), Worley (2006), Bhasin (2006)
LD5	Leaders have a clear and specific vision and strategy to the application of Lean	Mefford (2009), Czabke (2008), Womack (2003), Crute (2003), Kettinger (1995),	Emiliami (2005), Bhasin (2006), Anna (2014), Achange (2006)

Symbol	Observed variables	Reference	
		Success	**Failure**
NV1	Employees possess good networking and teamwork skills.	Womack (2003)	-------
NV2	Employees actively take part in the application of Lean	Mefford (2009), Herron (2008) , Motwani (2003),	Achange (2006), Bhasin (2006),
NV3	Employees possess skills and ability to learn quickly.	--------	Achange (2006), Anna (2014), Wong (2009)
NV4	Employees possess good knowledge on project management implementation and Lean.	--------	Achange (2006), Bhasin (2006)
NV5	Employees receive good training and are facilitated to apply Lean.	Herron (2008), Achanga (2006), Kettinger (1995), Todd (2011), Jeffrey (2013)	--------
QL1	HR policies supporting Lean application of employees	--------	Tracey (2006), Emiliami (2005), Bhasin (2006),
QL2	Enterprises possess process-based business management.	Kettinger (1995)	--------
QL3	Enterprises possess satisfactory performance management and assessment system	Kettinger (1995), Crute (2003), Achange (2006)	--------
QL4	Value chain based management system.	Crute (2003)	--------
CS1	Corporate infrastructure and culture are suitable for the application of Lean.	Czabke (2008), Herron (2008), Motwani (2003), Crute (2003), Kettinger (1995), Achanga (2006),	Bhasin (2006), Achanga (2006)
CS2	Enterprises possess an accounting system capable of assessing Lean benefits.	--------	Achange (2006)
CS3	Enterprises possess financial strength to fund Lean projects.	--------	Achanga (2006), Bhasin (2006), Wong (2009)

Table 2. Rotated Component Matrixa

Variable	Component			
	1	2	3	4
LĐ1	.763			
LĐ2	.708			
LĐ3	.705			
LĐ4	.660			
LĐ5	.641			
NV1		.658		
NV2		.646		
NV3		.635		
NV4		.601		
NV5		.589		
QL1			.658	
QL2			.645	
QL3			.567	
QL4			.473	
CS1				743
CS2				656
CS3				596

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Data extracted from questionnaires were analyzed by Exploratory Factor Analysis method, in order to find the main influential factor on Lean application. The premilinary result of EFA shows 17 observed variables, forming 04 groups. However, the QL4 factor possesses a factor loading of less than 0,5 – which does not fulfill the requirements of EFA. The author eliminates this variable and redo the EFA. The result of the 2nd analysis is as follows:

Table 3. Rotated Component Matrixa

Variable	Component			
	1	2	3	4
LĐ1	.760			
LĐ2	.716			
LĐ3	.707			
LĐ4	.668			
LĐ5	.646			
NV1		.670		
NV2		.647		
NV3		.643		
NV4		.620		
NV5		.598		
QL1			.729	
QL2			.720	
QL3			.581	
CS1				792
CS2				666
CS3				510

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

The 2nd EFA result shows that every variable possesses a loading factor of more than 0,5, which fulfilled the requirement. Further inspecting KMO result with KMO = 0,756 (between 0,5 – 1,0) confirms that it is appropriate to analyze the factors. Meanwhile, Barlett test's statistically significant result (sig. <= 0,05) shows that the variables are related. The cumulative variance results show that four groups of factors account for 74,817% variability of the observed variables.

Table 4. KMO and Bartlett's Test

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.161	41.074	41.074	6.161	41.074	41.074	3.840	25.603	25.603
2	2.760	18.400	59.474	2.760	18.400	59.474	3.290	21.933	47.536
3	1.365	9.101	68.575	1.365	9.101	68.575	3.156	21.039	68.575
4	.936	6.242	74.817	.936	6.242	74.817	2.836	19.242	74.817
5	.743	4.954	79.771						
6	.619	4.124	83.896						
7	.588	3.920	87.815						
8	.448	2.986	90.801						
9	.371	2.475	93.276						
10	.289	1.929	95.206						
11	.243	1.618	96.824						
12	.155	1.035	97.860						
13	.135	.901	98.761						
14	.104	.694	99.455						
15	.082	.315	99.770						
16	.074	.023	100.000						
KMO and Bartlett's Test				Kaiser-Meyer-Olkin Measure of Sampling Adequacy					.756
				Bartlett's Test of Sphericity			Approx. Chi-Square		533.382
							Df		105
							Sig.		.000

Extraction Method: Principal Component Analysis.

The result of EFA shows 16 variables formed 04 main groups; based on the nature of the observed variables, the 04 groups can be named as follows:

Table 5. Groups of factors influencing the Lean application

Factors	Observed variables	Content
Leadership	LD1	Leaders have long-term commitment to the application of Lean
	LD2	Leaders with good leadership abilities
	LD3	Leaders and stockholders fully understand the benefits of Lean application.
	LD4	Effective internal communication between the Board of Directors to the employees
	LD5	Leaders have a clear and specific vision and strategy to the application of Lean
Employee	NV1	Employees possess good networking and teamwork skills.
	NV2	Employees actively take part in the application of Lean
	NV3	Employees possess skills and ability to learn quickly.
	NV4	Employees possess good knowledge on project management implementation and Lean.
	NV5	Employees receive good training and are facilitated to apply Lean.
Management policy	QL1	HR policies supporting Lean application of employees
	QL2	Enterprises possess process-based business management.
	QL3	Enterprises possess satisfactory performance management and assessment system
Infrastructure and corporate culture	CS1	Value chain based management system.
	CS2	Corporate infrastructure and culture are suitable for the application of Lean.
	CS3	Enterprises possess an accounting system capable of assessing Lean benefits.

Therefore, the names of the groups of factors are: “Leadership”, “Employee”, “Management policy”, “Infrastructure and corporate culture”.

Establishing the “Lean application effectiveness” measure. Using the same approach to establishing factor measure, the author created the measure based on the widely-used measure of Lean application effectiveness. The observed variables used to reflect Lean application were shown in the following table:

Table 6. The expected observed variables reflecting "Lean application effectiveness"

Symbol	Observed variables	References
HQ1	Lean helps in reducing waste.	Tapping (2002), Rahani AR (2012), Salah (2013), Noorvali (2013), James (2013)
HQ2	Lean lessens errors and mistakes.	Rahani AR (2012)
HQ3	Lean lowers the cost of production.	Salah (2013)
HQ4	Lean raises the quality of products.	Salah (2013), Anand (2011), Minh (2013)
HQ5	Lean raises productivity.	Rahani AR (2012), Anand (2011), Minh (2013)
HQ6	Lean contributes in sustainable enterprise development	Martinez (2013), Charbel (2013).
HQ7	Lean improves the competitive advantages.	Michael (2000), Anand (2011),

The EFA results for the observed variables are shown below. As we can see, HQ6 and HQ7 variables possess factor loading of less than 0,5 – which do not fulfill the requirements of EFA. The author then eliminates the two variables and redo the analysis. The 2nd result are as follows:

Table 7. Component Matrixa

Variable	Component
	1
HQ3	.825
HQ2	.786
HQ4	.714
HQ1	.697
HQ5	.560
HQ6	..493
HQ7	.476
HQ3	.827
HQ2	.790
HQ4	.710
HQ1	.698

Extraction Method: Principal Component Analysis.

The 2nd result shows that every variable possesses loading factor value > 0,5. Further inspecting KMO result, with KMO = 0,838 (between 0,5 – 1,0) confirms the suitability of EFA method. Meanwhile, Barlett test's statistically significant result (sig. <= 0,05) shows that the variables are related.

Table 8. KMO and Bartlett's Test

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.462	69.245	69.245	3.462	69.245	69.245
2	.582	11.648	80.893			
3	.435	8.697	89.590			
4	.395	7.899	97.489			
5	.126	2.511	100.000			
KMO and Bartlett's Test			Kaiser-Meyer-Olkin Measure of Sampling Adequacy			.838
			Bartlett's Test of Sphericity		Approx. Chi-Square	164.613
					Df	10
					Sig.	.000

Extraction Method: Principal Component Analysis.

Result shows that "Lean application effectiveness" is reflected in the following variables:

Table 9. Variables reflecting "Lean application effectiveness"

Symbol	**Observed variables**
HQ1	Lean cuts production costs
HQ2	Lean lessens errors and mistakes
HQ3	Lean lowers the price of products
HQ4	Lean raises the quality of products
HQ5	Lean improve productivity

Evaluation of the reliability of the measure. Evaluation result of the reliability of the measure shows that the variables fulfilled the requirements with Cronbach Alpha of > 0,6. This shows that the research concepts built from the observable variables are internally consistent and are good measurement concepts.

Table 10. Summary of evaluation of reliability of measure

Observed variables	Corrected Item- Total Correlation)	Cronbach's Alpha If Item Deleted
Leadership factor		
Cronbach's Alpha: 0.769		
LD1	.581	.599
LD2	.718	.660
LD3	.476	.719
LD4	.714	.710
LD5	.622	.681
Employee factor Cronbach's Alpha: 0.787		
NV1	.593	.678
NV2	.715	.650
NV3	.725	.547
NV4	.747	.642
NV5	.775	.538
Management policy factor Cronbach's Alpha: 0.822		
QL1	.809	.801
QL2	.786	.708
QL3	.858	.692
Infrastructure and corporate culture factor Cronbach's Alpha: 0.765		
CS1	.646	.717
CS2	.797	.684
CS3	.872	.669
Application effectiveness		
Cronbach's Alpha: 0.818		
HQ1	.682	.774
HQ2	.804	.803
HQ3	.866	.731
HQ4	.704	.569
HQ5	.593	.691

(Source: Compiled by SPSS by the author)

Table 11. Mean evaluation result of variables

Attributes	Mean	Std. Deviation
"Leadership" factor group	**3.119**	
Leaders have long-term commitment to the application of Lean	4.143	0.126
Leaders with good leadership abilities	2.857	0.196
Leaders and stockholders fully understand the benefits of Lean application.	3.286	0.138
Effective internal communication between the Board of Directors to the employees	2.411	0.182
Leaders have a clear and specific vision and strategy to the application of Lean	2.893	0.179
"Employee" factor group	**2.657**	
Employees possess good networking and teamwork skills.	2.571	0.165
Employees actively take part in the application of Lean	2.178	0.178
Employees possess skills and ability to learn quickly.	2.697	0.194
Employees possess good knowledge on project management implementation and Lean.	2.732	0.179
Employees receive good training and are facilitated to apply Lean.	3.107	0.192
"Management policy" factor group	**2.753**	
HR policies supporting Lean application of employees	2.392	0.150
Enterprises possess process-based business management.	3.178	0.185
Enterprises possess satisfactory performance management and assessment system	2.732	0.166
"Infrastructure and Corporate culture" factor group	**2.677**	
Corporate infrastructure and culture are suitable for the application of Lean.	2.714	0.158
Enterprises possess an accounting system capable of assessing Lean benefits.	2.750	0.165
Enterprises possess financial strength to fund Lean projects	2.927	0.135
LEAN application effectiveness		
Lean helps in reducing waste.	3.589286	0.168602
Lean lessens errors and mistakes.	3.464286	0.172763
Lean lowers the cost of production.	3.5	0.163167
Lean raises the quality of products.	3.107143	0.162526
Lean raises productivity.	3.732143	0.14071

Of the variables, the observed ones with the mean values range from 2,4 to 4,1 shows that some factors are being undervalued. Of the three groups, the "Leadership" factors are ranked the highest (3.1); next is the "Management policy" with mean value of 2,7; and the last two with near equal values are "Infrastructure and Corporate culture" and "Employee" groups with 2,65 and 2,67, respectively. The surveyed enterprises ranked "Leadership" the highest, with "Leaders have long-term commitment to the application of Lean" having mean value of 4,14. This factor is also the highest ranked of the surveyed factors. The second highest ranked factor is "Leaders and stockholders fully understand the benefits of Lean application", while "internal communication" is not fully appreciated (2,4).

The "Employee" group is the lowest ranked of the 4 groups. This shows the issues facing enterprises are mostly employee-related. The "Employees actively take part in the application of Lean" factor ranked the lowest, which shows the fact that the employees are not participating in the application of Lean. Factors such as training policies, basic knowledge of Lean, and employees' skill level are higher ranked. This also reflects the fact that enterprises did implement Lean supporting policies and employees did possess some knowledge on Lean, but the problem lies with the proactivity or the attitude of the employees.

The second highest ranked group is "Management policy". Results show that enterprises possess process-based activities, while maintaining an effective system of human resource management. The lowest factor of the group – HR policies – is the most immediate policy affecting the benefits of employees.

"Infrastructure and corporate culture" ranked the third, with the lowest factor being "Enterprises possess financial strength to fund Lean projects". It is understandable as the surveyed enterprises do not possess much capital. The other factors "Corporate infrastructure and culture are suitable for the application of Lean" and "Enterprises possess an accounting system capable of assessing Lean benefits" are both average in ranking.

From this analysis, we can see "leadership" and "management policy" are highly regarded among surveyed enterprises. However, these factors are not properly transferred to the employees, making the ranking of "employee" factor lowest. Besides, due to the scale of enterprises, the "infrastructure" factor had to face a lot of difficulties when applying Lean.

Lean application effectiveness is evaluated as average through the evaluated factors. The two main benefits of Lean application are confirmed to improve productivity and reduce waste. These are the main achievable benefits when applying Lean for a moderate amount of time. The other benefits such as lowering errors and mistakes, reducing the cost of product, and improving the quality of the product are also rated at average.

Result of regression analysis and the evaluation of hypotheses. After the EFA analysis, the factors are used in regression analysis. The results are as follows:

Table 12. Regression analysis results

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.615	.184		3.338	.001		
LD	.027	.004	.347	3.523	.001	.641	1.560
NV	-.723	.205	-.278	.3.244	.002	.779	1.284
QL	.148	.133	.123	2.327	.022	.648	1.544
CS	.088	.115	.078	2.616	.010	.701	1.426
R		**0.765**			**Adjusted R Square**		**0.542**
R Square		**0.586**	-----	-----	**Sig**		**.000**

The basic regression analysis results show: (i) ANOVA analysis shows the F parameter has Sig. = 0,005, which translates into a regression model suitable to the data; (ii) Adjusted R Square value is 54,2%, which means the accuracy / suitability of the model is 54,2%, and at the same time, 54,2% is the variability of the dependent variable explained by four independent variables; (iii) the regression coefficients obtained from the four factors were statistically significant (Sig. <0,05); this demonstrates that the four independent variables affect the dependent variable; (iv) examine the hypothesis of multi-collinearity through the values of tolerance or Variance inflation factor; Tolerance > 0,2 and VIF < 10 show no multi-collinearity; (v) Standardized Beta Coefficients beta indicate the degree of impact of independent variables on the dependent variable; This effect is expressed through standardized regression equations as follows:

HQ LEAN= 0.374 LD – 0.278 NV + 0.123 QL + 0.078 CS (2)

The results from standardized regression equations show that the "Leadership" factor has the biggest impact to Lean application due to its beta value of 0,374, which is higher than other factors. The second most influential factor is "Employee", the third is "Management policy", and lastly, "Infrastructure and Corporate culture". Three out of these four factors are positively affecting Lean application, namely: "Leadership", "Management policy", and "Infrastructure". The only negative factor is "Employee". In other words, the hypotheses H1, H3, and H4 are supported; H2 hypothesis is denied.

This result is in accordance with other international researches. The positive effect of "Leadership" is confirmed by Mefford (2009), Czabke (2008), Herron (2008)… The negative effect of "Employee" factor is also confirmed by Achange (2006), Anna (2014), Wong (2009)… Positive impacts of "Management policy" are discussed in the studies of Kettinger (1995), Achange (2006) Crute (2003)… And "Infrastructure and Corporate culture" positive influence is confirmed in the works of Czabke (2008), Herron (2008)… Since the studies are carried out in different contexts and

different scales of sample, the result will be further discussed in Section 4 in Vietnam's research context.

4. Conclusion and recommendation

The result of analysis indicates that "Leadership" factor plays a significant role in the first period of Lean application in Vietnamese enterprises; this factor is further improved when the enterprises promote their internal communication. Contrary to theoretical impact forecast, the "Employee" factor lower the effectiveness of Lean application. The lack of proactive participation of the employees pose a difficulty in Lean application. The other factors, "Management policy" and "Infrastructure and Corporate culture" are effective in promoting the application of Lean, but Vietnamese enterprises should pay more attention to the rewarding and motivating policies, as well as diversify the financial investments for Lean projects to further improve the impact of these factors.

REFERENCE

1. Achanga, P. et al. (2006). Critical Success Factors For Lean Implementation Within SMEs, Journal of Manufacturing Technology Management, 17 (4), p460-471.
2. Anand Gurumurthy & Rambabu Kodali, (2011). Design of Lean manufacturing systems using value stream mapping with simulation. A case study. Journal of Manufacturing Technology Management, Vol. 22 No. 4, pp. 444 - 473.
3. Anna Dorota Rymaszewska (2014). The challenges of Lean manufacturing implementation in SMEs, Benchmarking: An International Journal, Vol. 21 Iss 6 pp. 987 - 1002
4. Bhasin, S. and Burcher, P. (2006). Lean viewed as a philosophy. Journal of Manufacturing Technology Management, 17(1), 56-72.
5. Charbel José Chiappetta Jabbour et al (2013). Environmental management and operational performance in automotive companies in Brazil: the role of human resource management and Lean manufacturing. CLeaner Production. 47, 129-140.
6. Creswell, J. W. (2007). Research design: Qualitative, quantitative, and mixed methods approaches (2nd ed.). Thousand Oaks, CA: Sage
7. Crute, V. et al (2003). Implementing Lean in aerospace - challenging the assumptions and understanding the challenges. Technovation, Vol. 23, no. 12, pp. 917-928
8. Czabke, J., Hansen, E.N. & Doolen, T.L. (2008). A multisite field study of Lean thinking in US and German secondary wood products manufacturers. Forest Products Journal, Vol. 58, no. 9, pp. 77-85.
9. Drew, J., McCallum, B. and Roggenhofer, S. (2004). Journey to Lean: making operational change stick. Published by PALGRAVE MACMILLAN, New York.
10. Emiliani, M.L. and Stec, D.J. (2005). Leaders lost in transformation. Leadership & Organisation Development Journal, 26(5), 370-387.
11. General Statistics office of Vietnam (GSO) (2016), Enterprise Situation in 2016.

12. Hair, J. R., et al. (2006). Multivariate analysis. Upper saddle River, NJ: Pearson Prentice Hall

13. Herron, C & Hicks, C (2008). The transfer of selected Lean manufacturing techniques from Japanese automotive manufacturing into general manufacturing (UK) through change agents', Robotics and Computer-Intergrated Manufacturing, No.24, pp.524 – 531.

14. Herron, C. and Braident, P.M., (2006). Defining the foundation of Lean manufacturing in the context of its origins (Japan). Proceedings of the IET International Conference on Agile Manufacturing. United Kingdom

15. Imai, Massaki (1986) Kaizen: The Key to Japan's Competitive Success. McGraw-Hill Publishing Company.

16. James C.Chen et al (2013). Supply chain management with Lean production and RFID application: A case study. Expert System with Application. 40, 3389-3397.

17. James Womack, Daniel Jones & Danile Roos, (1990). The machine that changed the world, Rawson Associates, New York.

18. Jeffrey Liker & Michael Ballé (2013). Lean Managers Must be Teachers, Journal of Enterprise Transformation, 3:1, 16-32.

19. James Womack (2000).Lean thinking, published in 1996 by Simon & Schuster, New York

20. Kettinger, W. J. and Grover (1995). Toward a Theory of Business Process Change. Journal of Management Information Systems (12:1), pp. 9-30.

21. Liker (2004). The Toyota way: 14 management principles from the world's greatest manufacturer", Second Edition, McGraw-Hill

22. Martinez Jurado, Moyano Fuentes (2013). Lean management, supply chain management and sustainability: a literature review. Journal of CLeaner Production. 1-17.

23. Mefford, R.N. 2009. Increasing productivity in global firms: The CEO challenge, Journal of International Management, vol. 15, no. 3, pp. 262-272.

24. Michael A. Lewis, (2000). Lean production and sustainable competitive advantage, International Journal of Operations & Production Management, Vol. 20 Iss: 8, pp.959 – 978.

25. Motwani, J. (2003). A business process change framework for examining Lean manufacturing: a case study, Industrial Management & Data Systems, Vol. 103, no. 5-6, pp. 339-346

26. Nguyen Dang Minh et al (2013), The situation of 5S application in small and medium enterprises in Hanoi, Science Magazine, Vietnam National University, Hanoi, No. 1, 2013, p. 24-32.

27. Noorvali (2013). Apply Lean and Taguchi in diffirent level of variability of food flow processing system. Procedia Engineering. 63,728-734.

28. Rahani AR, Muhammad al-Ashraf (2012). Production Flow Analysis through Value Stream Mapping: A Lean Manufacturing Process Case study. Energy Procedia .41,1727-1734.

29. Salah A.M. Elmoselhy (2013). Hybrid Lean- agile manufacturing system technical facet, in automotive sector. Journal of Manufacturing System. 32,598-619.

30. Taiichi Ohno, Toyota Production System, Productivity Press, 1998

31. Tapping, D., Luyster, T., & Shuker, T. (2002). Value stream management: Eight steps to planning,

mapping, and sustaining Lean improvements. New York, NY: Productivity Press.

32. Todd A. Boyle Maike Scherrer-Rathje Ian Stuart, (2011). Learning to be Lean: the influence of external information sources in Lean improvements, Journal of Manufacturing Technology Management, Vol. 22 Iss 5 pp. 587 – 603

33. Tracey, Monica W. and Flinchbaugh, J. (2006). HR's role in the Lean organisational journey. WORLDATWORK Journal, Fourth Quarter, 49-58.

34. Womack, J, & Jones, D. T. (2003), Lean Thinking: Banish Waste and Create Wealth for Your Corporation, 2nd Edtn, Simon and Schuster, New York.

35. Wong, Y.C., Wong, K.Y. and Ali, A. (2009). A study on Lean manufacturing implementation in the Malaysian electrical and electronics industry, European Journal of Scientific Research, Vol. 38 No. 4, pp. 521-535.

36. Worley, J.M. and Doolen, T.L. (2006). The role of communication and management support in a Lean manufacturing implementation. Management Decision, 44(2), 228-245.