

# The Impact of Technology Changes in the Relationship between Lean Manufacturing and Performance of Manufacturing Firms

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## ABSTRACT

Manufacturing industries are one of the most prosperous industries in the 21st century. No economy can continue its life without manufacturing industries. Therefore, evaluation the performance of firms is one of the most important issues of investors, creditors, governments and managers. In this regard, the main purpose of this study is to investigate the impact of technology changes in the relationship between lean manufacturing and the performance of manufacturing firms in Terengganu province. The research method is correlation and statistical population is all active companies in industrial towns of Terengganu province. The sampling method is convenience non-probability sampling. The sample includes 209 manufacturing firms. After collecting data by standard questionnaires, structural equation modeling technique with partial least squares approach was used to evaluate the relationships between variables. Totally data were analyzed by SPSS and PLS software. The result of the research hypotheses indicates the positive impact of cooperating with supplier and customer relationship management on the performance of firm's lean manufacturing. The positive impact of performance of lean manufacturing on the financial and non-financial performance of the firm was confirmed. The moderating role of technology changes in the relationship between the performance of lean manufacturing and firm's financial performance was confirmed. In addition, the moderating of technology changes in the relationship between the performance of lean manufacturing and non-financial performance of the firm was confirmed.

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## 1. Introduction

Manufacturing industries are one of the most prosperous industries in the 21st century. No economy can continue its life without manufacturing industries (Darzban Azizi et al, 2014). Evaluation the performance of firms is one of the most important issues of investors, creditors, governments and managers. Investors (shareholders) are interested in evaluating the success of management and using their capital and making decisions about maintaining, increasing or selling investment and evaluating the performance of venture capital firms, and creditors in deciding on the amount and credit rating and performance evaluation (Khanlari & Sabzeh Ali, 2014). Information related to performance enables firms to gain competitive advantage (Kordnaeich et al., 2014). Evaluation performance of firms is a phenomenon that firms consider in order to achieve firm goals and desirable outcomes in the direction of achieving better performance (Bhatti et al, 2014). Firm's performance is a multi-dimensional concept and has very important dimensions; two important dimensions are financial performance and nonfinancial performance (Altuntas et al, 2014). Financial performance is a description of the levels of work or goals that lead to desirable and satisfactory outcomes or outputs in a relevant time period (Yildiz et al, 2014). Financial performance of firms is to have the financial ability, to use assets of the firm right and wisely and to achieve their financial goals over competitors (Lu et al, 2015). Financial performance has a positive and significant effect on overall firm's performance (Al-Tally, 2014). Non-financial performance of the firm refers to a set of factors such as the firm's capability to increase customer satisfaction, improve service, and increase employee satisfaction. There are many factors that affect firm performance, but factors such as performance of lean domestic manufacturing, cooperating with supplier, customer relationships, and technological change are the most important factors affecting firms' performance (Chavez et al., 2015).

Performance of lean manufacturing is one of the most important factors affecting organizational performance. Lean manufacturing has been considered one of the most popular applications in removing wastes in the manufacturing and service industry, so companies use it to enhance quality and productivity (Abdul Wahab et al, 2013). The concept of lean manufacturing is used to maximize and optimize resources for production according to minimize wastes. Lean manufacturing is a multidimensional approach that includes a broad set of management methods including just in time production, quality systems, work teams, partial production, supplier management, and so on in an integrated system. Strategy of lean manufacturing is positively influenced by evaluating objective performance and it is also positively used for costing value flow. In addition, lean management activities directly affect operational performance through lean management activities. Customer relationship management is another factor that affects the performance of organizations. Customer relationship management can be defined as the executive and management effort to manage business interactions with customers through a combination of business processes and technologies that seek to understand company's customers (Lehmann, 2013). Customer relationship management is an approach that empowers organizations to utilize domestic resources to manage customer relationships for whole their lifecycle to create a competitive advantage and improve an organization's performance (Mohammed et al, 2014). This factor is a business strategy that its aim is to create and

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extend relationships based on the knowledge of customers that provide the ground of customer relationship using information technology (Garrido-Moreno & Padila-Melendez). According to the statistics and information of the standard organization of industrial research of the country, Terengganu province faces a serious problem in terms of industry and activity of companies active in its industrial towns. One of the most important reasons for failure of these companies is lack of attention to factors affecting financial performance and index affecting organizational performance. According to the report of chamber of commerce, the status of industry in Terengganu is in the third rank of the weakest provinces in the country after Sistan-Baluchistan and Kurdistan. Many of the industries active in the province are facing problems. For example, the textile industry of Terengganu province, which has long been considered as one of the top industries in the country, has experienced an unprecedented recession. In not so long ago, many of the country's famous textile companies such as coating factories, Malaysia Burke and Malaysia Poplin, known in the world, have been closed completely, only Malaysia Poplin company is operating with about 15% of nominal capacity. Also among the companies active in the industry, food industry companies play a very important role in this cycle, and food industry companies have one of the most complex supply chains according to experts in the field (Feyz et al., 2012). The importance of the food industries is due to employment and increase direct or indirect participation in national income production and its low foreign exchange rate compared to other industries, but food industry companies have not provided a desirable performance at all, despite the potential facilities of the region. The food industry has been faced many problems in recent years and has failed to provide a desirable performance. Many of these units of food industries have been forced to work under nominal capacity and dismissal of employees due to sanction and shortages of raw materials, excessive imports of commodities, bearing a lot of overhead costs and other problems, eventually they have declared bankruptcy. Therefore, it can be realized that the performance of food industry companies is in line with other manufacturing companies that have not in an undesirable situation. Therefore, the main research question is:

Do technology changes affect the relationship between lean manufacturing and the performance of manufacturing firms in Terengganu?

## 2. A review of the literature and research background

Today, manufacturing firms in developed countries act as a facilitator, professional consultant, specialist in increasing financial resources of companies and collecting and sharing information needed for their clients and are considered one of the economic driving forces of any country. Regarding the countries' sustainable growth and development, paying attention to the growth of organizations is one of the policies of all managers. Identifying and determining the impact and type of relationship between these components and the success of firms in equipping monetary resources is an important issue. Nowadays, the conditions and positions of firms are not the same, and the factors affecting the equipping of monetary resources may vary for each branch of a group. In the meantime, volatility of the performance of firms in relation to various issues and internal processes of the firms has been the issues discussed by specialist of this industry. Performance is one of the important concerns of shareholders and managers of firms. Managers are trying to better manage the organization and provide superior performance using new methods (Kordestani and Hadi Lu, 2011). An organization's performance is a criterion for measuring and determining the efficiency and effectiveness of organization over a certain period of time, which is determined by the signs in market, customer, and sales of that organization. This criterion has recently become an important and widely used concept in management research. Especially in research that researchers have studied and investigated organization-related topics such as structure, strategy and planning. Performance measurement assists managers in the decision making process and also provides the ability to monitor and control the activities of the organization (Azevedo et al, 2011). Overall, the goal of performance evaluation is to improve organizational effectiveness, which is the basis for organizational productivity (Roghani et al, 2012). Organizational performance has many dimensions that the financial dimension is one of the most important. The financial performance of a company is defined as achieving organizational goals or as an active, constructive and effective performance. Financial performance was defined as anything that helps to value-cost improvement that not only helps to reduce cost but also increases value (Karaye et al, 2014). On the other hand, organizations should pay particular attention to the non-financial dimension in addition to the financial dimension, because focusing on financial dimension alone cannot support the success of the organization in all aspects. Therefore, organizations must correctly identify the factors affecting financial and non-financial performance and take steps to improve it (Lee et al, 2015). One of the key ways to improve decision making is to measure performance within the organization regularly and constantly. Many organizations have realized the importance of regular and continuous evaluation and have developed a variety of performance evaluation systems. To create a performance evaluation system, criteria must be selected that reflect the strategies of the organization. These criteria can be key factors in the success of the present or future of the organization that are derived from organizational strategies. Recent research shows that only 5% of the manpower is aware of company strategies, and only 15% of managers consider organization strategies, and 60% of organizations do not communicate between organization budget and organization strategies, and 15% of executives teams less than an hour a month discuss on company strategies. In addition, focusing on traditional methods of evaluating financial performance caused many problems. Because managers replace short-term profits to long-term profits and don't pay attention to criteria such as developing products, improving processes, improving human resources, etc. that caused long-term profits (Nematizadeh and Hayeri Meibodi, 2015).

One of the approaches of effective management is the lean manufacturing system, which is used by many manufacturing companies in different forms and names. Lean manufacturing is one of the most important steps that many major businesses have attempted to implement it for continuing competitiveness in the growing global market. The main goal of the lean manufacturing approach is to reduce costs by reducing valueless activities. Tools and techniques of lean manufacturing such as timely production, preserving overall production and production synchronization have been applied in various manufacturing systems. Improvements in lean manufacturing are achieved based on reducing cost of all extra cases associated with all activities performed to provide services and order to a customer. Wastes and extra cases include all activities that use resources through applying production cost but they don't have a significant value to the customer (Mohd Rohani & Zahraee, 2015).

There is no guarantee for long-term survival in the market by the complexity of the economic environment and the presence of business competitors. On the other hand, according to the development of companies and the separation of ownership from management, performance evaluation has played a significant role. Therefore Balanced Scorecard, which consists of both financial and non-financial measures, has been developed as a framework for evaluating appropriate and comprehensive performance with an integrated view to the performance of organizations. According to the above, the performance of an organization indicates the survival status of the organization in the environment, so that management's emphasis on the role of employees in improving performance has revealed its importance and it can be in the form of infrastructure investments in the human resources sector, investments that are made by influencing the scope of work. Despite these conditions, it can expect high and desirable performance from the organization. According to the definitions used for knowledge management and organizational performance, it is concluded that knowledge management can be a

successful tool and method in the organization by using hidden and explicit reservoirs of knowledge and creating knowledge-based culture in the organization for making them more efficient. By taking a look at the performance evaluation of an organization in today's business, we conclude that it cannot have an effective evaluation system by focusing on financial information that is traditionally provided for management and control purposes. Inappropriate performance evaluation system is an obstacle to the development of the organization, while evaluation is as a link bridge between strategy and practice. Therefore organizations should tend towards new ways of evaluating performance, which may be one of the most effective criteria of performance evaluation that includes current, past and future performance indicators and puts non-financial criteria alongside financial criteria. A balanced evaluation provides a comprehensive view of what is happening inside and outside the organization (Nemati Zadeh and Haieri Meibodi, 2015). According to the importance of manufacturing firms in the economy, the issue of organizational performance is very important to them. Therefore, these firms must correctly identify the dimensions and factors affecting their performance and take steps to strengthen them. A summary of the research records are provided in the following:

**Table 1. Overview and summary of the background of domestic research**

Source	Results	Title
(Bozazzadeh, 2014)	The results of the statistical analysis show that companies whose managers use non-financial criteria for their decisions perform better. But environmental uncertainty has a significant effect on the relationship between the use of non-financial criteria and the performance of the firm, and this effect, unlike the results of Hook's research, reduces the impact of non-financial measures. Further analytical results also show that non-financial criteria based on internal processes have no effect on company's performance.	Managers' decision making based on non-financial criteria of performance measurement in the conditions of environmental uncertainty
(Yazdan Panah & Soltani, 2014)	Research findings indicate that strategic planning have a positive and significant effect on flexibility and flexibility on performance and the mediating role of flexibility in the relationship between strategic planning and performance was confirmed. Also, research flexibility has had a significant positive effect on financial performance and the dimensions of structural flexibility and technological flexibility on non-financial performance. Results showed that there was a significant difference between educational and financial flexibility on financial performance and non-financial performance on financial performance and there was no significant positive relationship between them.	Identifying and analyzing the relationships of strategic planning, flexibility and performance of Universities and Higher Education Institutions; Case Study: Shahid Beheshti University
(Kurdistani and Abashi, 2014)	Findings show that customer focus has a positive relationship with financial performance which is statistically significant. Therefore, increasing customer focus improves the financial performance of companies. Companies with high customer focus also experience better inventory management. The findings of this study support the importance of having major customers in the market. (Kurdistan and Abashi, 2014)	Investigating the effect of customer focus on financial performance of company
(Yazdan Panah, 2013)	The results of the study of the relationship between educational and financial flexibility on financial performance as well as the relationship between non-financial performance and financial performance showed a significant difference and did not show a positive and significant relationship	Investigation of multiple flexibility relationships on organizational performance in organizational strategic planning process
(Zanjbirchi and Tahmours, 2010)	The present study is a quantitative study that the necessary questionnaire was developed and it has been used for data collection by extensive review of literature and structured interview. After doing the statistical analysis, the result of this research was stated how is the effect of the factors and dimensions of lean manufacturing and its implementation on the performance of companies?	Evaluating manufacturing performance with lean approach using data envelopment analysis technique

**Table 2. Overview and summary of the background of foreign research**

Source	Results	Title
(Chavez et al., 2015)	The results of the research hypotheses indicated the positive and significant impact of cooperating with supplier and customer relationship with domestic lean manufacturing performance. The positive and significant impact of domestic lean manufacturing performance on financial and non-financial performance has been confirmed. Finally, the final hypotheses of the research also confirmed the moderating role of technology changes in the relationship between domestic lean manufacturing performance with	Measures of domestic lean manufacturing and performance: according to the role of technology changes

	financial and non-financial performance.	
(Nawanir et al, 2013)	The results indicate that activities of lean manufacturing should be implemented holistically. Activities of lean manufacturing had a significant impact on operational performance and business performance. In addition, operational performance mediates the relationship between activities of lean manufacturing and business performance.	Impact of activities of lean manufacturing on operational performance and business performance
(Giro Moori, 2013)	The results showed a positive relationship between lean manufacturing and operational performance according to the variable mediating role of competitive skills.	Lean manufacturing and operational performance in Brazilian companies
(Aksoy & Ozturk, 2011)	The results of further analysis show that supplier selection has an impact on performance evaluation and non-financial criteria based on domestic processes have no impact on company's performance.	Supplier selection and performance evaluation and timely production and environmental variables
(, 2010Granstrom)	The results showed that lean manufacturing had a significant positive effect on company's performance (both financial performance and non-financial performance).	The Relationship between lean manufacturing and corporate performance: A Case Study: Manufacturing companies in Sweden

### 2.1. The conceptual model of research

The research model is derived from the research model of Chavez et al. (2015). In this model, cooperating with supplier and customer relationship has a role as independent variables, performance of lean manufacturing as mediator variable, technology changes as moderator variable and financial performance and non-financial performance as dependent variable. Lean domestic manufacturing performance is one of the factors affecting financial and non-financial performance of firms (Chavez et al., 2015). Among the studies in the field of lean manufacturing has been conducted by Lockamy Archie. This study is one of the doctoral dissertations of the University of Georgia in the United States that has been defended entitled "The Impact of Performance Measurement Systems on the Selection of Factories and Manufacturing Firms in Worldwide." In this thesis, the factors and criteria of recognizing factories as worldwide or lean manufacturing have been investigated, and the most important factor in non-achieving worldwide manufacturing is the lack of performance evaluation criteria. Performance evaluation and its continuity with manufacturing, sales, warehousing and preparations, maintenance, logistics and support systems have been identified as important tools for reducing product price, increasing the quality of manufactured goods, and reducing waiting times for delivering goods to customer (Seyyed Hosseini and Yat Turk, 2005). How to implement lean manufacturing correctly is a challenge that should be considered. This issue becomes even more serious by considering the implementation of lean activities in other sectors of the economy (manufacturing, services and commerce, etc.). Lean manufacturing is a coherent technical social system that its main purpose is to eliminate waste by simultaneously reducing or minimizing internal variability, supplier variability, and customer variability. This definition can be the basis of many researches including this research due to its properties of transparency, transferability, stability, permissibility, separability, recall and precision (Jafarnajad et al, 2011)

According to the research by Chavez et al. (2015), technological changes are another factor that affects the financial and non-financial performance of the firm (Chavez et al., 2015). Today, our societies and environments are affected by technological changes. Technological advances, especially in recent decades, have had profound structural and content effects on economic and social communities and institutions and the competitive power of various firms and industries. As a result, technology evaluation has been focused by technology development planners in countries. Also, in any system, information from performance status is one of the most important pillars of management. One of the information tools in any system is performance evaluation (Sade Naiy et al., 2007). Technology changes are a critical determinant of transformational economies and challenges the structure of firms (Chen & Wu, 2011). Technological changes are related to the extent of changes and unpredictability of changes in the technology of services or products. When technological changes are minor, a close link and relation between the buyer and the supplier act as an unstable environmental deterrent (Terawatanavong et al, 2011). In turbulent markets, cooperating with supplier has a stronger impact on corporate performance (Chen & Wu, 2011). Thus, relationships and cooperating with suppliers help firms to access to technology information and causes to achieve superior performance of firms (Campo et al, 2014).

Cooperating with suppliers and customer relationship are other factors that influence the performance of lean manufacturing of firms (Chavez et al., 2015). Today, establishing coordination mechanisms among supply chain members has been one of the major concerns of researchers in recent times (Mohajer Tabrizi et al., 2009). Each firm has a close cooperation with supply chain members, including suppliers, to maintain competitive advantage. For this reason, supply chain and supplier selection have become an important issue and researchers have tended to research in this area. It is natural that the level of demand of firms, the level of suppliers' capacity, the level of quality of products, etc. varies over time. The supplier determined for one period may not be suitable for the next period to supply the same set of goods. Therefore, the problem of supplier selection is dynamic in practice (Nemati et al., 2014). On the other hand, the importance of functions of supply chain management is being increased day by day, because maintaining and gaining competitive advantage is strongly depended on supplier, distributors and customers. Most scholars acknowledge that in the current era, the firms do not perform all the activities related to manufacturing and selling the products themselves, this issue led to increase independence and the independent nature of supplier and distributor's firms. As a result, promotion of productivity and performance of the processes of manufacturing and selling the products have a direct relationship with the level of relationships and quality of interaction with other members of the supply chain and it is influenced by it (Torabi et al., 2015). On the other hand, the needs and desires of customers and manufacturing priorities are changing rapidly and the strategy of the manufacturing companies must change adapting to these changes. Therefore, these factors led to the manufacturing firms to be faced new challenges and to use different methods and technologies to meet customer needs that lean manufacturing is the most important of these strategies because it can be effective in improving firm's performance (Maran Juri & Alikhani, 2009). According to the proposed theoretical framework, the relationships among the research variables have been showed in model number (1) below:

According to the research model, the following hypotheses have been developed:

1. Cooperating with suppliers has a positive impact on the performance of lean manufacturing of manufacturing firms in Terengganu province.
2. Customer relationship has a positive effect on the performance of lean manufacturing of manufacturing firms in Terengganu province.
3. Performance of lean manufacturing has positive effect on financial performance of manufacturing firms in Terengganu province.
4. Performance of lean manufacturing has positive effect on non-financial performance of manufacturing firms in Terengganu province.
5. Technology changes have a moderating role in the relationship between performance of lean manufacturing and financial performance of manufacturing firms in Terengganu province.
6. Technological changes have a moderating role in the relationship between performance of lean manufacturing and non-financial performance of manufacturing firms in Terengganu province.

### 3. Methodology

This research is applied objectively. Research is divided into two categories based on the way of achieving data needed: Descriptive research and experimental research. Descriptive research consists of a set of methods that its purpose is describing the conditions or phenomena under study. Therefore, this study is a descriptive research. On the other hand, the present study is a descriptive-survey research, since it studies the characteristics and traits of individuals in the society and examines the current status of the society in the form of several traits or variables. This research is a correlational research in terms of the type of method. Statistical population of research is all manufacturing firms in Terengganu province that its statistics are obtained by referring to Malaysiaian Industrial Research Organization's website. The sample size is 209 firms. The sampling method is a convenience non-probability sampling. It should be noted that the latest site update was announced in March 2016, so the information on the number of companies active in the industrial towns of Terengganu is accurate. The number of these companies is presented in Table (3).

**Table 3. Number of active manufacturing firms**

Number of firms	Industrial town
115	Bandar Anzali
51	Taslesh
4	Kharshak
2	Darya Sar
126	Rasht (Sefid Rud)
22	Rudsar
35	Siyahkol
57	Shaft
54	Soume Sara
6	Fuman
27	Lahijan
20	Langroud
65	Lushan
3	Masal
33	Astaneh Ashrafiyeh
11	Astara
651	Total number

Given that the statistical population in the study is from limited type, the amount of sample is estimated by Cochran formula:

$$n = \frac{N * (Z_{\frac{\alpha}{2}})^2 * s^2}{\varepsilon^2 (N - 1) + (Z_{\frac{\alpha}{2}})^2 * s^2}$$

$\alpha$ : Error level 2

N: sample size

$\varepsilon$ : Maximum error accepted by the researcher.

$Z_{\frac{\alpha}{2}}$ : The variable size in normal in distribution extracted from the table at the considered confidence level.

$ss$ : Dependent variable's standard deviation

= 207

The sample size of the study is 207 companies. The questionnaire was distributed among 220 companies and 209 questionnaires were returned to the researcher. It is necessary to distribute a questionnaire in each company, considering the level of organizational analysis. Senior managers of

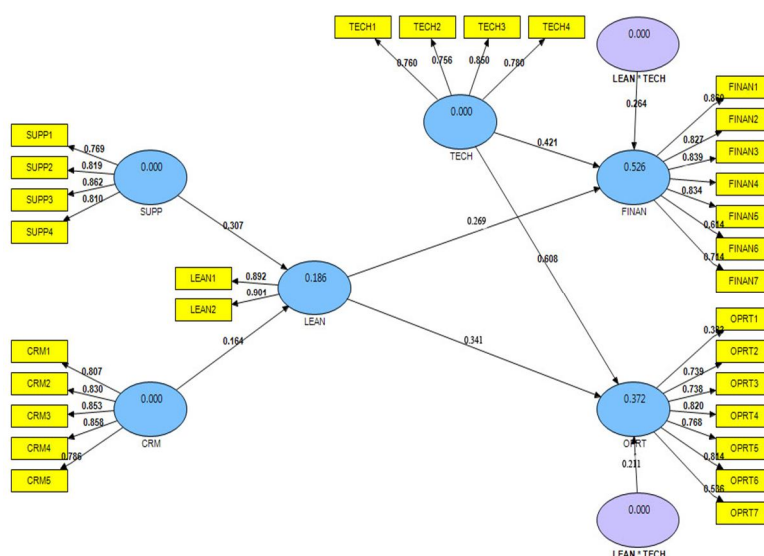
manufacturing companies were responsible for answering the questionnaires. To investigate the content validity, the research questionnaire was provided to the respectful supervisor and experts and at several meetings, their considered reforms were applied to the structure and content of the questionnaire. The researcher distributed 30 questionnaires experimentally. As the Cronbach's alpha coefficient was higher than 0.7 for all variables in the questionnaire, the reliability of the questionnaire is confirmed. The exact values of these coefficients are presented in Table 4:

**Table 4. Reliability coefficients of questionnaire variables**

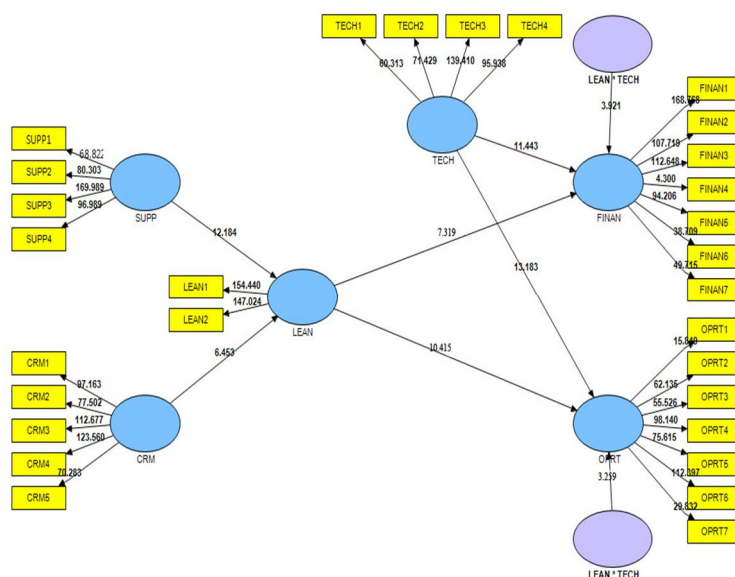
Cronbach's alpha coefficient	Model variables
908/0	Financial performance
914/0	Non-financial performance
896/0	Technology changes
872/0	Performance of lean manufacturing
796/0	Cooperating with suppliers
893/0	Customer Relationship

Investigating research hypotheses using structural equation modeling

Figure (1) and (2) show the outputs of the model in the standard estimation mode and the significance of coefficients and the obtained parameters, all of obtained coefficients have been significant. The basis for confirming or rejecting the research hypotheses is to examine the model in a state of significant coefficients. According to the above materials; all the research hypotheses are confirmed. The results of the research hypotheses are presented in Table 5.



**Figure 1. Research Model in the state of standard estimation**



**Figure 2. Research model in the state of significant coefficients**

Table 5. Summary of the results of the research hypotheses

1. Cooperating with suppliers has a positive impact on the performance of lean manufacturing of manufacturing firms in Terengganu province.
2. Customer relationship has a positive effect on the performance of lean manufacturing of manufacturing firms in Terengganu province.
3. Performance of lean manufacturing has positive effect on financial performance of manufacturing firms in Terengganu province.
4. Performance of lean manufacturing has positive effect on non-financial performance of manufacturing firms in Terengganu province.
5. Technology changes have a moderating role in the relationship between performance of lean manufacturing and financial performance of manufacturing firms in Terengganu province.
6. Technological changes have a moderating role in the relationship between performance of lean manufacturing and non-financial performance of manufacturing firms in Terengganu province.

Table 5.

research hypotheses	Significant number	Standard effect coefficient	Result
Cooperating with suppliers has a positive impact on the performance of lean manufacturing of manufacturing firms in Terengganu province.	184/12	307/0	Confirmed
Customer relationship has a positive effect on the performance of lean manufacturing of manufacturing firms in Terengganu province.	453/6	164/0	Confirmed
Performance of lean manufacturing has positive effect on financial performance of manufacturing firms in Terengganu province.	319/7	269/0	Confirmed
Performance of lean manufacturing has positive effect on non-financial performance of manufacturing firms in Terengganu province.	415/10	341/0	Confirmed
Technology changes have a moderating role in the relationship between performance of lean manufacturing and financial performance of manufacturing firms in Terengganu province.	921/3	264/0	Confirmed
Technological changes have a moderating role in the relationship between performance of lean manufacturing and non-financial performance of manufacturing firms in Terengganu province.	259/3	211/0	Confirmed

Indicators related to model fit are presented along with the desirable values.

Table 6. Fit indices of the research model

Commonality	Cronbachs Alpha	Coefficient of determination	Mean variance extracted	Combined reliability	Variable criteria
<i>communality</i>	Cronbachs Alpha	R Square	<i>AVE</i>	<i>CR</i>	Abbreviation signs
665102/0	832179/0	---	665102/0	888031/0	Cooperating with supplier
684588/0	884752/0	---	684588/0	915545/0	Customer Relationship
804508/0	757100/0	185774/0	804508/0	891662/0	Performance of lean manufacturing
619982/0	797346/0	---	619982/0	866859/0	Technology changes
532476/0	828625/0	5262388/0	532476/0	876480/0	Financial performance
492777/0	818595/0	371976/0	492777/0	866376/0	Non-financial performance

#### 4. Discussion

According to investigating the research model through structural equation modeling, the following cases are important according to the research results:

- ✓ According to the results of structural equation modeling, it is observed that cooperating with suppliers has a positive effect on the performance of lean manufacturing of manufacturing firms of Terengganu and the standard effect coefficient is equal to 0.307, so it can be said that by increasing one unit of cooperating with suppliers, the performance of lean manufacturing increases 0.307. The results of this test are consistent with the results of Chavez et al. (2015), Aksu and Osterk (2011), Bozazadeh (2014), Yazdan Panah (2013).
- ✓ According to the results of structural equation modeling, it is observed that customer relationship has a positive effect on the performance of lean manufacturing of manufacturing firms of Terengganu and standard effect coefficient is equal to 0.164, so it can be said by increasing one unit of customer relationship, the performance of lean manufacturing performance increases 0.164. The results of this test are consistent with the results of Chavez et al. (2015), Yazdan Panah and Soltani (2014), Kurdistan and Abbasi (2014).
- ✓ According to the results of structural equation modeling, it is observed that performance of lean manufacturing has a positive effect on the financial performance of manufacturing firms of Terengganu and standard effect coefficient is equal to 0.269, so it can be said that by increasing one unit of lean

manufacturing, financial Performance increases 0.269. The results of this test are consistent with results of Chavez et al. (2015), Navanir et al. (2013), Granstrom (2010), Zanjirchi and Tahmores (2010).

✓ According to the results of structural equation modeling, it is observed that performance of lean manufacturing has a positive effect on the non-financial performance of manufacturing firms of Terengganu and standard effect coefficient is equal to 0.341, so it can be said that by increasing on unit lean manufacturing performance, non-financial performance increases 0.341. The result of this test are consistent with the results of Chavez et al. (2015), Navanir et al. (2013), Gyromori et al. (2013), Granstrom (2010), Zanjirchi and Tahmoures (2010).

✓ According to the results of structural equation modeling, it is observed that technological changes have a moderating role on the relationship between the performance of lean manufacturing and financial performance of manufacturing firms in Terengganu and the standard effect is equal to 0.264, so it can be said technology changes have a moderating role in the relationship between performance of lean manufacturing and the financial performance of manufacturing firms in Terengganu. The results of this test are consistent with the results of Chavez et al. (2015).

✓ According to the results of structural equation modeling, it is observed that technological changes have a moderating role on the relationship between the performance of lean manufacturing and non-financial performance of manufacturing firms in Terengganu and the standard effect is equal to 0.211, so it can be said technology changes have a moderating role in the relationship between performance of lean manufacturing and non-financial performance of manufacturing firms in Terengganu. The results of this test are consistent with the results of Chavez et al. (2015).

## 5. Conclusion

Industrial towns are one of the most important components of a country's industry. The experience of many developing and developed countries shows that the industrial sector can play a central role in economic and industrial development for different reasons. The importance of industrial development in developing countries caused many countries to consider the formation and strengthen of large industries in industrialized areas in the form of cluster as a regional industrial development strategy. So strengthening active units in these towns can be very helpful for strengthening the economy of the country and the region. Terengganu province is one of the provinces with a great potential in the field of main and heavy industries, and industrial units of this country have been one of the most powerful manufacturing units in the country's industry in past years. For example, Malaysia Poplin and Malaysia Burke, one of the largest textile factories in the world, have been closed completely. Industry experts have acknowledged in their official reports that more than 50 percent of Terengganu's manufacturing capacity has been closed completely. On the other hand, a great deal of debt in active companies to banks indicates a problem in terms of investment return rate, sales rate, net profit and cost effective management. On the other hand, the low competitive power of these companies has practically provided the market for other manufacturers. Inastan is one of the provinces that despite its good past in the industry is considered the weakest provinces in the country. According to statistics published by the Institute of *Standards & Industrial Research* every year, it has placed Terengganu in the list of provinces of Kurdistan, Sistan and Baluchistan in terms of industrial development indices. However, several companies are closed in these industrial towns every year. Industry experts believe one of the reasons for the failure and closure of these units is the unwillingness to innovate in new products and the low rate of introducing new products. So many companies supply products to market that do not create value added to the company and have no place in the shopping basket of customer regardless of market demand and customer need. Of course, there are many reasons for the problems of manufacturing companies, but one of the most important reasons is the non-attention to market-oriented principles. On the other hand, the main problem of the manufacturing companies in the country is the lack of cooperation or reduction of cooperating with foreign partners, which is the most important factor of sanctions that have faced the country's industry with difficulty in recent years. According to this problem, most organizations that sought to invest and joint cooperating with foreign countries were only able to establish limited cooperating with partners. According to the planning of the Ministry of Industry, Malaysia's share in world trade will reach a good level by 1404 and Malaysia's industrial and commercial firms and companies will be among the paramount. By the year 1404, the share of Malaysia's industrial value added will reach 0.5% in the world and the share of added value of industry, mining and trade from GDP will reach 35% which the share of industry added value from GDP will be equal to 18.5%, from mine will be 2% and from trade will be 14.5%. But many experts and critics believe that achieving this position by 2014 will be out of access with the current trend in the country's industry. On the other hand, the issue of market volatility and competitiveness is one of the basic issues that there are several criteria to evaluate it. Competition in market is an important and central issue that is referred to as a tool for achieving optimal economic growth and sustainable development. Understanding the modern space of the global economy in order to obtain a suitable position in the new system of international production has a particular importance. Nowadays, by the expansion of markets and the importance of competitiveness in international trade, the countries of the world need to have a correct understanding of their relative position compared to other countries in order to be able to adapt their economic policies and especially their industrial policies according to their relative position and based on modern approaches of global economy, that the manufacturing companies have not provided a proper performance in this relation. In this regard, the researcher has presented the following suggestions for providing practical suggestions regarding the relationship between variables and weak structures:

1. According to the confirmation of first hypothesis, the impact of cooperating with supplier on the performance of lean manufacturing of manufacturing firms in Terengganu, it is suggested that senior managers of companies should try with suppliers to reduce costs, because on average 70% of the value of the final product of factories is the cost of raw materials and services from outside. This ratio is even 80% in high-tech companies. Obviously, increasing the cost of raw material has a direct impact on the finished price and product pricing. Therefore, by joint decision making can reduce the costs of raw materials and thereby increase manufacturing performance. It is recommended that senior managers of companies to focus more on long-term interaction with suppliers and considered monthly meetings with suppliers in the organizational calendar and try to identify various issues through the expert group work and place immediate actions on their agenda to resolve them.
2. According to the confirmation of the second hypothesis, the impact of customer relationship on performance of lean manufacturing of manufacturing firms in Terengganu, it is suggested that corporate marketing managers to identify customer needs and desires by coordinating with marketing experts and to create distinct performance for their customers by providing distinct products from competitors. In this regard, the company should investigate and resolve all customers' complaints through the formation of various organizational group works. In this regard, the company should increase their communication channels with the customer and gather their views in ways such as in-person meetings, telephone interviews and sending questionnaires and consider in developing and designing new products.



3. According to the confirmation of the third hypothesis, the impact of performance of lean manufacturing on the financial performance of manufacturing firms in Terengganu province, it is suggested that senior managers of companies to increase the budget needed to develop new products and to try consider tastes and views of customers in manufacturing their new products through techniques such as quality home matrix as well as to strengthen the pilot line in the company by planning with the unit of innovation and product development to the rate of introducing new products to be increased. It is also suggested that companies to design their internal processes based on the analysis of preventive processes. Because, as it has been observed, most corporate processes are designed on a proactive basis and this factor can lead to a decrease in organizational productivity and effectiveness. To strengthen this factor, companies should identify their patient processes and take the necessary strategies before stopping and problems.
4. According to the confirmation of the fourth hypothesis, the impact of performance of lean manufacturing on the non-financial performance of manufacturing firms in Terengganu province, it is recommended that senior managers of manufacturing companies to increase their investment in monopoly technologies and to increase the rate of introducing new products by strengthening the R&D process. In this regard, the marketing managers of the company should identify products that do not create value added for the organization and plan to reduce production and stop it from providing to market.
5. According to the confirmation of the fifth hypothesis, the moderating role of technological changes in the relationship between the performance of lean manufacturing and financial performance of manufacturing firms in Terengganu province, it is suggested that senior managers of companies to prioritize the capabilities by evaluating empowerment and attractiveness of technological areas to the attractiveness of technology to be more for the industry. The more the empowerment of major research and technology centers to develop technologies in that field is higher, that field has a more priority for the focus and development of related technologies. And finally, these strategies will affect the performance of company.
6. According to the confirmation of the sixth hypothesis, the moderating role of technological changes in the relationship between the performance of lean manufacturing and non-financial performance of manufacturing firms in Terengganu province, it is suggested that managers of manufacturing companies should use the firm's competitive strategy to determine technological needs and the technological needs of the firm must be determined based on key factors of market success.

### **5.1. Future limitations and suggestions for conduction research**

1. In this study, all industrial manufacturing companies of Terengganu province were selected as the statistical population of the study and the information obtained from them was investigated in the research model. This issue is one of the major limitations of this study. Without this limitation, the researcher could investigate the relationship between the independent and dependent variables of the research in each group by classifying the companies by type of mission and goals, the type of industry operating, and the number of people employed in them. It is suggested that future researchers examine the relationship between independent and dependent variables of this research among different industries and compare the results with the results of this study.
2. In this study, all manufacturing companies have been investigated, regardless of whether the performance is desirable or not. It is suggested that companies which at a desirable level in terms of performance to be investigated in future research in order to be examined more precisely the impact of factors affecting financial and non-financial performance according to the research model.
3. Supplier's expertise and skill, especially in projects of products' development and manufacturing, is one of the most important factors affecting the improving financial and non-financial performance that has not been investigated in this research. It is suggested that the supplier's expertise and skill variable as a moderator variable to be entered the research model in future research.
4. In this study, organizational performance has been evaluated in terms of financial and non-financial dimensions and other dimensions have not been investigated. It is suggested that in future research, the organizational performance to be examined in terms of balanced scorecard dimensions.
5. In this study, questions related to customer relationship management variable were answered by senior managers of manufacturing companies and managers may be given high rating in this section. In future research, it is suggested that the questions related to the customer relationship management variable to be provided to the customers and they answer the considered questions.

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