

## Evaluating the Level of Leanness for Iranian Food Packaging Industry Based on the Liker's 4P Model

Behdad Kheirkhah (Corresponding author)<sup>1</sup>, Mohammad Torkabadi<sup>2</sup>

<sup>1</sup>MSc student of Industrial Management, University of Tehran, Tehran, Iran

<sup>2</sup>MBA, Universiti Teknologi Malaysia, Malaysia

**Abstract:** The expansion of lean philosophy in today's cutting-edge industries; urges the need to evaluate the level of lean implementation in the organizations. The purpose of this research is to evaluate the level of lean implementation in Iranian food packaging industry based on Liker's 4P model. This research applies the survey method to testify the hypothesis and to make comparisons. The questionnaire is obtained from Meilling et al. (2012) research and spread among employees from two groups of organizations that either practice lean production or failed to practice it by now. The results show that factors including: long-term philosophy, process and problem-solving have positive relation with the level of leanness in studied organizations. Moreover; the results proved that the long-term philosophy factor is of greatest importance for lean organizations while the process is of least importance. However, in case of organizations that are not implementing lean production, the most important factor is people and partners; and the less important factor is problem-solving.

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### Introduction

Nowadays, designing and presenting superior and high quality products and services is a vital demand to be survived in global competing market. Lean production philosophy could be a suitable solution to achieve this important goal (Oliver, 1996). This method was suggested by Taiichi Ohno as "Toyota Production System" and is used by Toyota Company since three decades (Shah & Ward, 2007). Womack et al. have defined lean production as follows:

Lean production uses half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half the time. It requires keeping half the needed inventory, results in many fewer defects, and produces a greater and ever growing variety of products (Womack & Jones, 1990).

However, a lot of efforts and attempts are applied to implement lean production, yet a specific indicator is not introduced to evaluate the level of leanness in organizations. During recent years, some of the researchers have evaluated the level of leanness in organizations by presenting different approaches. Soriano-Meier and Forrester (2003) have investigated the level of leanness in organizations that are involved in the ceramic industry. They have also evaluated different factors of lean production which using a questionnaire. Asadi and Panahi (2011) have also presented a model to evaluate the level of leanness. According to the results in diary industries, the rate of incompatibility among different parts of

production management in terms of lean production has been shown. These results have defined differences between equipment and hardware management and lean production in high level and on the other hand, differences between supplies and purchase system and lean production is partial. Moreover, Bayou and de Korvin (2008) investigated the level of leanness in car manufacturing industry by using Fuzzy system method. They compared the level of leanness in production departments of Ford and General Motors by developing their algorithm steps. They have suggested that the concept of leanness is defined based on the specific pursuing goals of certain organizations (Bayou & de Korvin, 2008). Finally, Meilling et al. (2012) compared and evaluated the effectiveness of the Liker's 4P factors to improve the level of leanness in Swedish wood industry.

The main goal of this research is to evaluate the level of lean implementation in Iranian food packaging industry based on Liker's 4P model. Licker has classified principles of lean production into four main frames: philosophy, process, people and partners, problem solving and their 14 principles. It's noteworthy that factors including the growing demand for food, increasing number of food packaging manufacturer and the sensitivity of food packaging process in consumers' health would cause to pay absolute attention to the research in this industry.

### Licker 4P model

Jeffrey Licker (2003) developed his 14 principles in frame of 4P model. These factors of are: long-term philosophy, process, people and partners, and problem solving.

### 1. Philosophy

- ❖ Principle 1: Base management decisions on a long-term philosophy, even at the expense of short-term financial goals.

### 2. Process

- ❖ Principle 2: Create continued process flow to bring problems to the surface.
- ❖ Principle 3: Use pulls systems to avoid overproduction.
- ❖ Principle 4: Level out the workload
- ❖ Principle 5: Build a culture of stopping to fix problems, to get quality right the first time.
- ❖ Principle 6: Standardized tasks are the foundation for continuous improvement and employee empowerment.
- ❖ Principle 7: Use visual control so no problems are hidden.
- ❖ Principle 8: Use only reliable, thoroughly tested technology that serves the people and the processes.

### 3. People & Partners

- ❖ Principle 9: Grow leaders who thoroughly understand the work, live the lean philosophy, and teach the lean philosophy to others.
- ❖ Principle 10: Develop exceptional people and teams who follow the organization's philosophy.
- ❖ Principle 11: Respect the organization's extended network of partners and suppliers by challenging them and helping them improve.

### 4. Problem solving

- ❖ Principle 12: Go and see for you to thoroughly understand the situation.
- ❖ Principle 13: Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.
- ❖ Principle 14: Become a learning organisation through relentless reflection (Hansei) and continuous improvement (Kaizen).

### Research Method

The research is investigating the importance of the main Licker's 4P model factors in lean organizations, and the organizations that have not take actions to implement the lean production. Then by comparing results, the effective leanness factors in organizations are identified and the level of effectiveness is measured. To testify the correlation

between the leanness of organizations and 4P factors the following hypothesizes are developed. Finally the significance of each factor is determined in both samples.

To investigate the interrelationship between main factors of the 4P model and the level of leanness in organizations, hypothesizes of the problem can be defined as follow:

H1. Long-term philosophy has a significant effect on the organization leanness.

H2. People and partners have a significant effect on the organization leanness.

H3. Process has a significant effect on the organization leanness.

H4. Problem Solving has a significant effect on the organization leanness.

Statistical sample of this research is consisted of two active statistical samples in food packaging organizations. The first statistical sample is the organizations that are in the process of implementing lean production and the second statistical sample is the organizations that have not taken actions to implement lean production. The first statistical sample in this research is demonstrated by "L" and the second statistical sample is demonstrated by "NL". After sending questionnaires, finally, 83% (124 items out of 150 items) of the questionnaires sent to the organizations of sample L and also 79% (114 items out of 145 items) of the questionnaires sent to the organizations of the sample NL were collected.

In this research, methods of theoretical studies were used to collect information and documentation. Also a questionnaire was used to collecting data in order to testify the research hypothesizes and to investigate significance of 4P factors in determining the leanness level. The questionnaire used in this research is designed and presented by Meiling et al. (2012). This questionnaire is consisted of 32 questions according to how person, team and organization are related to each principle (Meiling, Backlund, & Johnsson, 2012). The questionnaire uses a five-point Likert scale.

The task of translating a questioner for the people with another cultural background and language is a critical and complicated task. Some cross-cultural researches suggest that the concepts in one culture cannot be completely meaningful for another culture (Sperber, 1994). The back-translation technique is used by the use of bilingual translators is used to translate the questioner from English to Persian.

In order to assess questionnaire, the Chronbach Alpha test was used. Chronbach Alpha test is a reliable test that is used normally for

assessment of internal stability of a questionnaire. The results arising from Chronbach Alpha calculations, shows that  $\alpha=0.72$ . The fact that  $0.7 \leq \alpha \leq 0.8$ , proves the reliability of the questionnaire (Cortina, 1993). As a result, this questionnaire can be used as a reliable tool to test hypothesizes of the research.

**Results**

Descriptive statistics for the data of the research variables is shown in

Table 1. Variables classified in four groups; long-term philosophy, people and partners, process and problem solving have been classified. For more

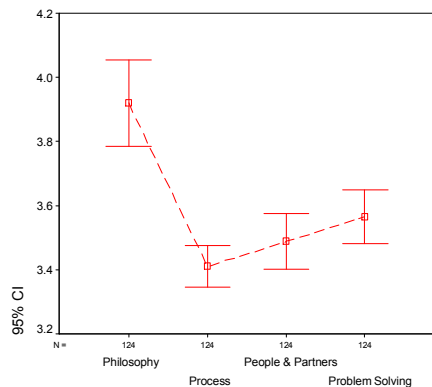
analysis, the results related to the means and standard deviations of each question are demonstrated in **Error! Reference source not found..** Due to the

Table 1, the most mean is related to the long-term philosophy and the mean of this variable is equal to 3.92. Of course, it's noteworthy that deviation of the mentioned variable is equal to 0.753 and dispersion of the answers is more than the other variables. Mean of problem solving is equal to 3.57 which are more than both people and partners and process mean. Finally, the least mean is for the process that is equal to 3.41.

**Table 1**

	Philosophy	Process	People & Partners	Problem Solving
Mean	3.92	3.41	3.49	3.57
Std. Deviation	0.753	0.361	0.483	0.465

In order to analysis of the discrepancy related to the means, the error bar has been shown in Figure 1. The small squares show the size of mean and specified limit for each variables, show reliable distance of 95 percent. Due to the Figure 1, the item of long-term philosophy is a meaningful discrepancy with other factors. Therefore, it can be said that long-term philosophy mean is more than other means.



**Figure 1**

In order to investigate interrelationship of the factors with hidden variables of the level of leanness in the organization, the structural equation between these were testified by Lisrel v8.0. Before investigating the results of interrelationship test, at first, the criteria of structural equation of the variables related to the factors of the level of leanness in the organization has evaluated. The results have been shown in

RMSEA in level of 1 percent is meaningful, because its value has been less than 0.01. Also the value of RMR in the level of 10 percent is meaningful (RMR=0.066). Other related scales have been shown in **Error! Reference source not found..**

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Statistic measures	
Normed Fit Index (NFI)	0.98
Non-Normed Fit Index (NNFI)	0.98
Parsimony Normed Fit Index (PNFI)	0.33
Comparative Fit Index (CFI)	0.99
Incremental Fit Index (IFI)	0.99
Relative Fit Index (RFI)	0.93
Critical N (CN)	73.34
Root Mean Square Residual (RMR)	0.066
Standardized RMR	0.034
Goodness of Fit Index (GFI)	0.99
Adjusted Goodness of Fit Index (AGFI)	0.96

The approximate value of 0.9 for these scales is calculated as favorable value. The value of critical number is 73.34, which is less than the value of the sample (124). In general, the validity of the model is evaluated in good standing. According to these results, the value of The value of the coefficient of determining between problem solving and the level of leanness is equal to 0.64. Also, the value of this coefficient for process and the level of leanness is equal to 0.63 and these figures are equal to 0.29 and 0.21 for the other two factors. Whereas the rate of interrelationship coefficient of the second root of the coefficient has been determined, for this reason, the size of the interrelationship coefficients will be according to the Table 2.

**Table 2**

Variable	Correlation coefficient
Philosophy	0.54
Process	0.79
People & Partners	0.46
Problem Solving	0.80

In order to determine meaningfulness of the routes, the Figure 2 has been presented. According to this figure, meaningfulness of the coefficients is

shown according to the statistics T. The value of any one of these rates is compared by Figure 1.96, and if the Figure is more, it can be understood completely that relationship between variables is meaningful. Due to the results, relationship between the long-term philosophy, process and problem solving with the variable of the level of leanness in the level of 95 percent, is meaningful, but relationship between the people and partners with the level of leanness in the level of 95 percent is not meaningful, because the size of T for it is less than 1.96. The final results are as follows:

- H1: Long-term philosophy with 95% reliability is effective on the organization leanness.
- H2: People and partners are not meaningful on the organization leanness in the level of 5 percent.
- H3: Process with 95% reliability is effective on the organization leanness
- H4: Problem solving with 95% reliability is effective on the organization leanness

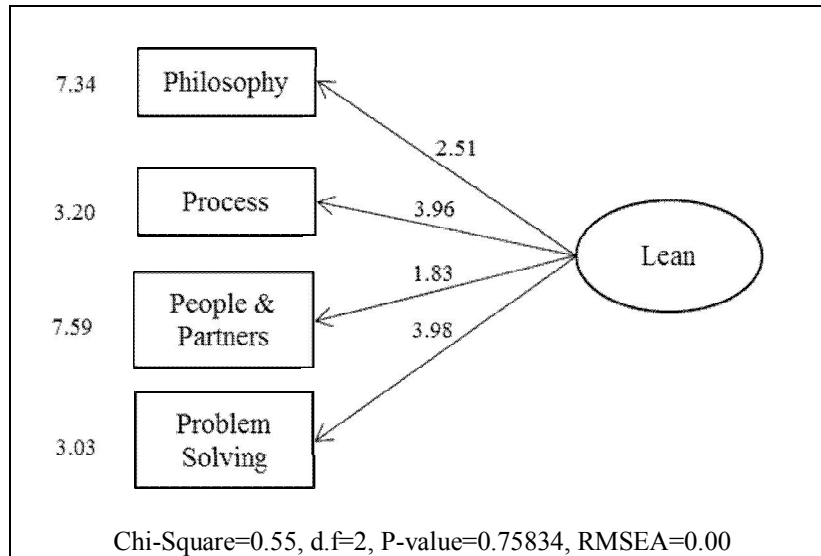


Figure 2

**Discussion**

After testing the research hypothesizes, the level of the effect in any one of the 4P model factors in two samples was investigated and the results were compared. For this reason, at first, any one of the 4P model factors was compared for every one of the two samples in Figure 3, then level of value of any one of the 14-principle were demonstrated in frame of a

Radar chart in Figure 4. It should be noted that value of 3 showing this matter that some efforts are done in order to implement the lean production, the value 4 showing puberty of the organization in implementing lean production and finally the value 5 indicates excellent implementation of lean production in the organization (Meiling , Backlund, & Johnsson, 2012).

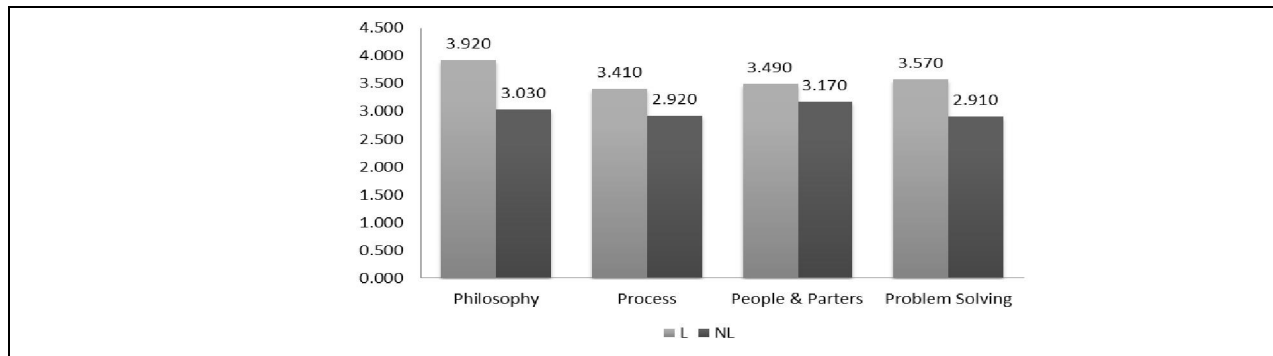


Figure 3

According to the results of the Figure 3, value rate of the long-term philosophy in the organizations of sample L is equal to 3.92, whereas in organizations of the sample NL, this rate is equal to 3.03. According to this comparison, those organizations that have tried to implement leanness production (sample L) are in the development threshold in relation to have a long-term philosophy for their organization, but organizations of the sample NL shall pass a long path to reach to this step. Also, the personnel of the organizations of the sample L have a better understanding about the organization's long-term philosophy in comparison with the personnel of the organizations of the sample NL. Licker and Meier (2006) suggested that writing and applying the philosophy of Toyota for the organizations is not enough, every organization shall have its own philosophy and execute its plan accordingly. Also, Licker (2003) believes that philosophy of each organization is the base of the other activities either in present or in future of the organization.

The second factor is process. Process is the total operations that include flow, pull system to avoid overproduction, leveling workload, standardized work tasks as a requirement for continues improvement, visualization in order to control standards and to hinder problems from being hidden, applying reliable technologies and, finally, set-up the production line to be stopped anytime by anyone as soon as a problem occurs (Liker, 2003). Value of this factor is the organizations of the sample L is 3.41 and in the organizations of NL is equal to 2.9. Accordingly, organizations of the sample L could promote their production processes to a considerable level by using lean production, in comparison with the organizations of the sample NL. It should be noted that using any one of the methods of lean production, will not change the organization to a lean organization. Tools, methods and technologies shall be access to promote and develop the function, but on the other hand, despite success of some of the organizations by using such factors, other organizations have not obtained satisfactory results by using such factors (Repenning & Sterman, 2001).

The third factor emphasizes on the importance of people and partners. The value rate of the organizations of the sample "L" is equal to 3.49 and organizations of the sample NL value are 3.17. Regarding the results, both samples have satisfactory function in relation to people, partners and suppliers. Pay attention to people and partner in lean organizations perform a key role in the success of the organizations. The lean goals will be obtained just in the shadow of the effort of the personnel. In other

word, as the only people are able to constitute a lean organization, it is individuals who are able to bring a lean system to life (Drew, McCallum, & Regenhofer, 2004).

The fourth factor is problem solving. Problem solving is based on the organization's philosophy in which existing a problem in an organization is not a threat but it can be determined as a value, meaning that the problems shall not be just solved, but their roots shall be identified and prevent from such problems for the future. Researchers believe that Toyota attempt for the purpose of finding the roots of the problem is the main reason of placing Toyota as a pattern of quality, reliability and productivity (Bicheno, 2004). Finding roots of the problems meanwhile solving them will change the organization to a learning organization and it will provide an opportunity for future progress and development (Womack & Jones, 2004). According to the results, the value of the organizations of sample L is equal to 3.57 and the sample NL is equal to 2.91.

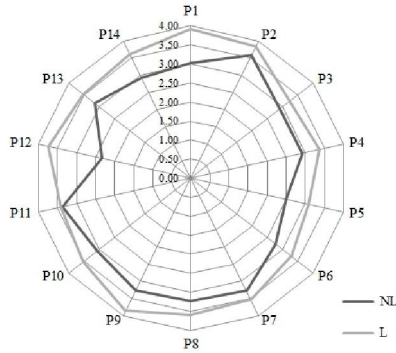
Finally, the values of the 14-principle of the Licker's 4P model was compared between two statistical sample. According to the Table 3 and Figure 4, it is obvious that the most discrepancy is related to the principle 12, meaning "Go and see for yourself to thoroughly understand the situation" and the least discrepancy is related to the principle 11, meaning, "Respect the organisation's extended network of partners and suppliers by challenging them and helping them improve".

**Table 3**

	Sample L	Sample NL
Principle 1	3.92	3.03
Principle 2	3.85	3.58
Principle 3	3.23	2.90
Principle 4	3.38	2.92
Principle 5	3.08	2.49
Principle 6	3.28	2.77
Principle 7	3.54	3.28
Principle 8	3.60	3.23
Principle 9	3.87	3.27
Principle 10	3.52	3.07
Principle 11	3.42	3.37
Principle 12	3.75	2.34
Principle 13	3.53	3.15
Principle 14	3.60	2.92

## Conclusion

Despite of this issue which in the first glance, the instructions of lean production seems simple, but implementation of lean production would not be always simple (Mora, 2003). According to the Mora's research, only 10 percent or less of companies succeed at implementing TPM and other lean manufacturing practices.



**Figure 4**

Hence, existing measures to evaluate the level of leanness is necessary for organizations. In this research, our main goal is to evaluate the level of leanness in the Iranian food packaging organizations based on the Licker's 4P model. This evaluation was done on two samples; organizations that have taken actions to implement lean production (L) and the organizations that have not take actions to implement lean production (NL). The data were collected by a questionnaire that has been distributed among personnel. The results were used to testify the research hypothesizes and comparing two samples.

According to the results, the factors of long-term philosophy, process and problem solving with 95 percent reliability are effective on the level of leanness in the organizations. However the factor of people and partners affecting on the level of leanness in organizations in the level of 5 percent reliability is not meaningful. Despite that personnel and suppliers are main components of the philosophy of lean production, but the importance of their role in internal industries has not been understood completely. On the other hand, value of the four general sections of the 4P model and its 14-principle was compared between two samples and the results showed that the most discrepancy is related to the long-term philosophy and most discrepancy in the Licker's principles is related to the principle 12 "Go and see for yourself to thoroughly understand the situation".

The results of this paper can be a guideline for the organizations that want to implement lean production, and a criterion to evaluate their function in lean implementation. On the other hand, the using model in this research can provide an opportunity for the future researches in other manufacturing fields. In addition, in order to have a more precise evaluation and an unbiased prejudice, separate questions can be formulate for any part of organizations and the results can be compared with each other.

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