

Barriers to Implementation of Lean Accounting in Manufacturing Companies

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Abstract

According to previous researches and foreign studies, there are various barriers to implementation of lean accounting and this research aimed at studying these barriers. The data was collected using a questionnaire. This research is applied in its purpose, and a field study regarding its methodology. Student's t-Tests method was used to test hypotheses. The results show that cultural, technical, organizational and economic factors were barriers to implementation of lean accounting. Moreover, regarding the four groups of factors, technical factors had the highest degree of impeding and economic factors the lowest.

Keywords: lean accounting, lean production, lean thinking, value flow cost, Barriers to lean accounting.

1. Introduction

Manufacturing and industrial companies in Iran are facing numerous challenges and to overcome these challenges¹ they need to transform their business strategies, methods and structures. However, this transformation requires a deep organizational insight in which organizational management, in the process of development and moving away from the tradition as a continuous challenge and its main mission, has broad perspectives in organizational development. Necessary parts of this transformation are transition from traditional thinking and achieving a lean way of thinking. Lean thinking is the foundation for implementation of modern methods in manufacturing, services, and industry, and transition to a lean state, necessitate changes in systems of measurement, control and accounting. In this regard, lean accounting, as a coordinated approach, along with lean thinking provide administrators with reliable, accurate and timely information for decision-making and controlling, and implementation of these two becomes necessary for the implementation of lean production as a strategic management approach (Nikoomaram&mohammadi, 2008).

¹ These challenges include old manufacturing systems, lack of adequate markets, lack of access to the needed capital, obsolete technology being used, surplus manpower, frequent economic fluctuations, etc.

With companies moving toward becoming lean, companies which first started implementing lean strategies were often unsatisfied with inaccurate financial reports on operations and stated that they had done their jobs well, resulting in increased productivity and reduced inventory, but this had appeared as a negative in company's financial statements. To borrow a medical term, this phenomenon is a false negative and is the result of the mechanics of the standard cost-absorption accounting model (Cunningham, Fiume 2003).

According to studies by Johnson and Kaplan(1987), at the beginning of Twentieth Century, in the early part of the twentieth century, the typical American manufacturer had a product cost structure of about 30 percent material content, about 60 percent touch labor content, and about 10 percent overhead content. Today, the typical American manufacturer has a product cost structure of about 60 percent material content, about 10 percent touch labor content, and about 30 percent overhead content. The standard cost accounting system that we use today was created to support the "yesterday" environment when a small amount of overhead was allocated to products on the basis of their touch labor. That environment doesn't exist anymore, but we are still using its accounting system (Stenzel, 2007,55).

Traditional methods of determining the cost and management accounting were not designed to support lean production, but to support mass production. Therefore, measurement systems and lean accounting should replace traditional measurement systems and accounting (maskell,2006).

Although Iranian companies have a long way to become lean enterprises, regarding the experience of other countries in the implementation of lean production and the necessity of establishing a lean accounting system, it is needed for companies to replace the traditional accounting with the related analyzed accounting system before implementing lean production system. But,as for any other new process,we face some barriers in implementing lean accounting. According to the previous literature, there are several barriers to the implementation of lean accounting which this study aims to investigate in manufacturing companies.

Lean manufacturing requires a cohesive strategy for implementation and the base of the strategy is a lean accounting. The lean accounting approach is consistent with lean thinking that provides reliable information for decision-making and controlling, so that the profitability of the company will increase through making decisions based on information on production cost.

Implementing any new approach in any country could be faced with some obstacles and lean accounting is no exception. To achieve lean business, it is needed to review the barriers and some solutions should be adopted to overcome to these barriers, because lean accounting saves available time and resources by eliminating non-value-added activities associated with traditional accounting and internal control system. It also increases customer value, and maximizes the company's cash flow and the wealth of shareholders and owners.

This research aimed to study barriers to implementation of lean accounting in manufacturing companies.

2. Theoretical Literature

Since lean is a business strategy, it affects everything the company does, including accounting. Experience shows that approaching lean as a manufacturing tactic rather than an enterprise strategy is the most common reason for companies to fail at their lean implementations. In lean, when viewed as a tactic,

responsibility gets delegated to the operations people and none of the barriers are removed (Stenzel, 2007).

The resistance to lean accounting has little to do with the accounting and a lot to do with resistance to lean management and a cooperative, continuous improvement culture. Accountants need to locate the sources of resistance to cultural change, especially if the source is within their own hearts and minds. Discovering this root cause is the first step toward overcoming it and removing the barrier to the lean accounting transformation (ibid, 202).

Many of the obstacles to lean accounting are at least in part caused by a lack of understanding of lean management. To support a lean accounting transformation, accountants must understand the lean management system. Understanding lean overcomes the barriers of fear, lack of education, and the resistance to cultural change (ibid, 203).

Most lean transformations begin in production. Production workers and managers are more likely to have had exposure to lean management concepts in their training, and many companies try to implement some lean tools or concepts in production to keep up with competitors. Often, lean is mistakenly seen as a set of tools for production efficiency rather than as a management system requiring a cultural change. The chances for a successful transformation are much greater if top management understands lean as a management system and supports the transformation to lean. Accounting, however, can support the spread of lean management even if it is currently viewed as a production system (ibid, 204).

Many companies are organized in functional silos, with sales, marketing, engineering, accounting, and finance personnel isolated in their own areas, physically segregated from other functional areas. Consequently, accountants operating in a traditional silo structure are less likely to understand lean or have the opportunity to see its power in practice (Grosso, 2006).

What about companies not currently undergoing a lean transformation? Can accounting drive a lean transformation? Accounting need not trail in the lean transformation, but it would be very difficult to lead a lean transformation from accounting without strong support from top management and support in production. Still, accounting can plant the seeds for a lean transformation by gathering and reporting on operational metrics that support lean management (Stenzel, 2007,206).

According to previous researches in accounting and its development, there is a positive correlation between the level of economic development and development of accounting. This study has focused on cultural, technical, organizational and financial barriers to manufacturing companies.

2.1 Background of Research

In a historical view to the evolution of this new method, after World War II, at first we come across two people, Ohno and Toyoda, who are known as the founders of this system in the description of the system of Toyota company. Ohno(1988) recognized Toyota Production System as a reasonable method for production and reducing costs through eliminating unnecessary elements. The main goal, he believes, is to reduce costs (Monden,1995).After Toyota Production System being introduced by Ohno and Monden other Scientists began criticizing it and comparing it with the traditional production system.

Suzaki (1987), while emphasizing on continuous improvement and elimination of waste, introduced seven aspects of waste in production systems.

Johnson and Kaplan (1987) acknowledged that "the company's management accounting systems are inadequate for today's environments".

Johnson and Kaplan (1987) believe that the standard cost accounting system that we are Applying were created to support of the "external" environment so that a small amount of overhead costs would be allocated to products based on their touch labor. However, this environment exists no longer, and this is while the same accounting system is being used for lean environment.

In 1990 James Womack wrote a book called "The Machine That Changed The World". Womack's book was a straightforward account of the history of automobile manufacturing combined with a comparative study of Japanese, American, and European automotive assembly plants. What was new was a phrase-- "Lean Manufacturing." Lean Manufacturing caught the imagination of manufacturing people in many countries. Lean implementations are now commonplace. The knowledge and experience base is expanding rapidly.

In a research for I.M.V.P after closely analyzing the lean production system, they analyzed the effectiveness of elements of lean production in different parts of the mass production, and stated that "not only work power was reduced to half and the rate of defects to one third, but also inventory levels and space required for the production greatly reduced. They developing the concept of lean production to lean enterprise, later considered lean management as the fundamental component of his movement toward lean and discussed it in three areas of finance, personnel management and global coordination.

Womack and Jones (1996) considered their previous mission toward lean a failure, and later introduced lean thinking as the base of their movement toward lean manufacturing, and summarized it in five principles.

Burton and Boeder (2003) defined lean manufacturing as timely production, and following that definition, he provided new concepts such as lean management, lean enterprise and lean thinking in the factory, product design, administration, distribution and after-sales services.

The latest attempt for developing lean manufacturing concepts was the research by Maskell (2004) who generalized the concepts of lean manufacturing to the software engineering systems.

Haskin (2010) developed and expanded the concepts of lean production to factory design. His research showed that some of the characteristics of lean manufacturing can be expressed in the layout of a lean company.

Baggaley (2003) researched on lean accounting in business environment and realized that all requirements of modern management accounting were founded before 1930 without any major changes.

Ward and Saha (2003) provide answers to some questions in the field of lean accounting, including whether a cost management and an accounting approach exists for companies which accept lean principles and practices. If yes, which aspects does this process include? And so on. Finally, by highlighting its functional applications, they consider the implementation of lean accounting and lean thinking necessary against the changes reflected in lean production.

Furthermore, Maskell and Baggaley (2004) provided a definition for lean accounting, lean accounting mission, and principles, methods and technique of lean accounting.

Kennedy (2008), too, in his article "Accounting for Lean Production" pointed out some reasons behind the reduced speed of lean production techniques, including lack of sufficient training and proper understanding of the production.

Internal researches that have done in the field of lean Production in Iran are as follows.

Soroush (2007), in his Ms Thesis in Islamic Azad University, Research & Science Branch, Analyzed the Degree of uniqueness in Behran Oil Company. In fact he considered conformity of principles of lean production in Behran Oil Company that shows company distance from lean production. Second: Scales of uniqueness indicators in engine oil industry and third, he suggested the pattern for movement of Behran Oil Company to lean production.

Ayoogh (2006), in his Ms Thesis Shahid Beheshti University, designed the process of lean management implementation with foundation of Jackson system in mazandaran Electric Board Company for designing of lean management implementation process in mazandaran Electric Board. With base of executive methodology and step by step system of lean management with suggestion of Jackson & Jones. The strategic improvement cycle process renewed in business and process of focus and standardization. In result, level of company learning in development keys, 3 to 5 years development plan company, annual improvement plans and plans and necessary structure determined. In sum two keys of production and lean engineering specified as improvement indicators for principles of strategic keys and market sharing increasement and speed of product exposure to employer.

Tavakoli (2003), in his PhD thesis in Tehran University designed a suitable mathematical model for increase of production and flexibility in lean production systems. in this thesis current models in field of transfer from lean production analyzed and then the model suggested by basic of transfer from lean production analyzed and then the model suggested by basic of straight and weak points. That in cause of this model transfers from traditional production systems. To lean production systems possible by 6 steps with preparing suitable and organizational culture in period of 5 years and then with investigated of lean production specification and role of flexibility important specificity. Main component and effective on flexibility identified and formulated in two levels mathematical model in order to increase of system flexibility.

3. Research Hypotheses

The following hypotheses were formulated in regard to the four research questions:

1. Cultural factors impede the implementation of lean accounting in manufacturing companies.
2. Technical factors impede the implementation of lean accounting in manufacturing companies.
3. Organizational factors impede the implementation of lean accounting in manufacturing companies.
4. Economical factors impede the implementation of lean accounting in manufacturing companies.

3.1. Research Variables

3.1.1 Dependable variable

Lean accounting is a approach coordinated with lean thinking that provides the managers with related and reliable information for decision-making and is also a system toward responding to the role of the companies (Baggaley, 2003).

3.1.2 Independable variable

3.1.2.1 Cultural factors

Culture is a dynamic system of explicit and implicit rules and involves attitudes, values, beliefs, norms and behaviors that are created by groups to ensure their survival and is shared between them, and despite

being institutionalized for the groupmembers, it will change over time (Matsumoto & Juang, 2008). And the components of cultural barriers in this study include the role of leadership, tactical attitude, improper rewarding procedure, the resistance of managers, employees and even customers.

3.1.2.2 Technical factors

Each system has its own features, that, if ignored, will make its implementation face problems. The components of technical barriers in this study include not using lean as a manufacturing strategy, not using multi-purpose machines, not using timely production systems and zero store, and lack of awareness about lean system on senior executives' and employees' side.

3.1.2.3 Organizational factors

Each company has its own organizational chart, and it is possible for the very same chart to serve as a barrier to the implementation of lean system. Components of Organizational barriers in this study include not using process-oriented measuring standard, not applying horizontal organizational structure, not eliminating traditional silos, not using long-term goals and lack of customer relations.

3.1.2.4 Economic factors

The cost of deploying the system and the absence of comprehensive and transparent financial rules, the scope of the internal market and limitation of customers' income, not allocating enough resources for implementation, are the economic barriers in this study.

4. Methodology Research

This research is applied in its purpose, and a field study regarding its methodology. A questionnaire was used as to collect data, which was designed during library studies according to research hypotheses and related literature. The results of the questionnaires were then presented in tables and graphs to analyze the hypotheses. About the validity and reliability of the measurement tool it should be noted that the questionnaire has been revised and finalized in consultation with administrators, teachers and experienced experts in the field, so its validity is confirmed. But to assess the reliability of this study, Cronbach's

Alpha $\alpha = \frac{K}{K-1} \left(1 - \frac{\sum S_i^2}{S_{sum}^2} \right)$ has been used twice and its scale for first to fourth hypotheses were respectively 0.700, 0.696, 0.730 and 0.870.

Reliability test for the first hypothesis

No	Cronbach's Alpha
5	.700

Reliability test for the second hypothesis

No	Cronbach's Alpha
5	.696

Reliability test for the third hypothesis

No	Cronbach's Alpha
6	.730

Reliability test for the fourth hypothesis

No.	Cronbach's Alpha
7	.870

4.1 Statistical Population and the Sampling Method

As for the limitations of the study due to the lack of enough familiarity of the manufacturing companies with lean process, the statistical population of this study included a total of 60 expert; all of whom were professors familiar with lean or experts of manufacturing companies² familiar with lean.

In this study, the sample size was determined using Cochran's formula as follows (1) :

$$n = \frac{Nz_{\alpha/2}^2 PQ}{Nd^2 + z_{\alpha/2}^2 PQ} \quad (1)$$

in this formula d can be chosen from 0.01 to 0.1, and α is the acceptable error level. So the variables in this study were as follow:

$P=0.5$, $1-p=0.5$, $Z_{\alpha/2}=1.96$, $d=0.09$, $N=60$

$$n = \frac{60(1.96)^2(0.5)(0.5)}{[(0.09)^2(60)] + [(1.96)^2(0.5)(0.5)]} \cong 39$$

According to the formula, the 39 experts are selected as the random samples. But due to limitedness of the statistical population, the questionnaire was distributed among the whole community and out of the 60 questionnaires distributed, 45 questionnaires were returned and the sample size was 39 experts, that was put to analysis. After collecting the questionnaires and extraction of answers provided, Microsoft Excel and IBM SPSS software were used for statistical calculations and data analysis.

5. Results

5.1 Data Analysis

After collecting the questionnaires and extraction of answers provided, Microsoft Excel and IBM SPSS software were used for statistical calculations and data analysis. Table 1 shows the statistical indicators that were studied (Table 1).

² Manufacturing companies surveyed ; Marham Daroo, Pars Daroo, Iran Hormone, Marham Razi, Aban Tose'e, Mahsar Tose'e, Iran Egzoz, Iran Transfo, Tanin Behdasht Pars, Sadaf Plastic Sima, Kimia Sadaf Plastic, Mouyan AfshanPouya, Nylper.

K-S test was carried out for variables of each hypothesis, and the significance level for all variables was more than 0.05 which means that the distribution of data is normal for variables under study. Table 2 shows the test results (Table 2).

5.2 Test of Hypotheses

After analyzing the normality of the data distribution for the variables, Student's t-Tests method was used to test four hypotheses.

First stage: null hypothesis and opposite hypothesis are written in the following statistic form.

$$\begin{cases} H_0 : \mu \leq 3 & (1) \\ H_1 : \mu > 3 & (2) \end{cases}$$

- (1) Factors have not impeded the implementation of lean accounting in manufacturing companies
- (2) Factors have impeded the implementation of lean accounting in manufacturing companies

Second stage: is the calculation of test statistic and its statistical distribution. Test statistic has t Distribution (about normal for this data) and its value is calculated as follows (2):

$$t = \frac{\bar{X} - \mu_0}{\frac{S}{\sqrt{n}}} \tag{2}$$

Table 3 shows the result of the test (Table 3).

Third stage: Is determined regarding the previous stage(determining the statistical distribution) and the acceptable error rates and based on the reliability level of the areas of rejecting or not rejecting null hypothesis is. Reliability rate has been considered 95 percent .

Fourth stage: Based on the previous stages, statistical decision is made at this stage. Since the test statistic for all fourth hypotheses is respectively 42.15, 18.11, 14.53 and 5.94, so they are located at the area of rejecting null hypothesis and null hypothesis is thus rejected. Therefore, cultural, technical, organizational and economic factors are barriers to the implementation of lean accounting in manufacturing companies.

5.3 Ranking of Barriers to the Implementation of Lean Accounting

In this part, we deal with the question as to what factors, in participants' opinions, are considered as greater barriers to the implementation of lean accounting

Regarding the dependence of the responses, to compare the effects of four factors the most appropriate test was non-parametric Friedman test.

To achieve this goal, the average rating in the fourth table has been presented in Table 5 for calculating the chi-square value. Null hypothesis and the opposite hypothesis were formulated as follows:

$$\begin{cases} H_0 : \bar{R}_1 = \bar{R}_2 = \bar{R}_3 = \bar{R}_4 \\ H_1 : \bar{R}_i \neq \bar{R}_j \quad \exists i \neq j = 1, 2, 3, 4 \end{cases} \equiv \begin{cases} H_0 : \\ H_1 : \end{cases}$$

H₀: The average rating of the four factors are the same.

H₁: The average rating of the four factors are not the same. (Table 4 & 5)

So null hypothesis is rejected at 95% reliability level because the scale of Chi-square statistic is 40.98 which is located in null hypothesis rejection area, i.e. these barriers vary in their degree of impediment. This variation has been presented in (Table 6 and Graph 1).

7. Conclusion & Suggestions

The purpose of lean accounting is to support the lean enterprise as a business strategy. It seeks to move from traditional accounting methods to a system that measures and motivates excellent business practices in the lean enterprise. However to implement lean accounting, as any other new approach, we face many obstacles. According to previous researches and studies, there are various barriers to implementation of lean accounting and this research aimed at studying these barriers. This research hypothesized that cultural, technical, organizational and economic factors are barriers to the implementation of lean accounting in manufacturing companies. First, normality of variables was validated using K-S test, and all hypotheses were confirmed using the Student's t-Tests method. Next, Chi-square test was used to study the relation between the two variables, and the resulting statistic was 40.984. Therefore, the different factors had different degrees of impeding. Finally, Friedman test was used to rank the factors. According to the results of this study, cultural, technical, organizational and economic factors are barriers to the implementation of lean accounting in manufacturing factories. The results also show that technical factors have the highest level of impediment in the implementation of lean accounting in manufacturing companies and economic factors the lowest. The four hypotheses were confirmed.

Based on the results and findings of the study, following suggestions are made:

1. Considering that cultural factors impede the implementation of lean accounting, it is recommended that:

-The key to changing values and beliefs, and thereby culture, is to require people to behave differently so that they can experience a set of results that are better than what they have experienced in the past.

-To change the culture it is recommended that the chief executive official stake this responsibility.

-To deal with resistance of employees or directors, it is recommended that people who would never accept lean approach as a proper approach, should be carefully removed from the organization.

-Lean environments with production cells that require people to be multi-skilled require only a few, broadly defined pay grades.

-To establish the culture of role-based management, it is recommended that managers work on value-groups to homogenize the organization.

2. Considering that technical factors impede the implementation of lean accounting, it is recommended that:

-Multi-purpose machinery and personnel with diverse skills should be used in production lines.

-For making senior executives and financial executives, or staff aware of lean concepts, it is recommended to provide lean training inside the company.

-Still, accounting can plant the seeds for a lean transformation by gathering and reporting on operational metrics that support lean management.

3. Considering that organizational impede the implementation of lean accounting, it is recommended that:

- For accountants' understanding of lean accounting it is recommended to eliminate traditional accounting silos.

-To apply the process-oriented measurement criteria, it is recommended that managers of the companies should not be judged based on financial figures they present but rather based on the development of the company.

-To draw on aims to achieve lean, it is suggested that the company should consider long-term objectives because long-term goals makes them understand the need to get into practice differently.

-To remove functional structures and to become aware about the material and information flow of this information, it is recommended that the companies should remove their vertical structure and use the horizontal structures in which whoever tries to improve his own part will lead to local optimization.

4. Considering that economic factors impede the implementation of lean accounting, it is recommended that:

-Adequate resources for lean training should be considered in companies.

-Taxation laws or regulation should be administered in a way to encourage lean manufacturing executives to use the lean accounting.

-Customers should be made aware of their rights.

- In order to properly understand the cost of the lean system, it is suggested that the managers consider long-term goals of the companies and profit of the whole company during its lifetime, and then decide about establishing lean.

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Research Variables	Nr.	Average	Median	Standard deviation	Skewness	Elongation
1	39	3.9885	4000	0.55339	0.121	-0.334
2	39	4.1143	4.1429	0.37774	-0.457	0.679
4	39	4.0547	4.000	0.45341	-0.532	2.601
4	39	3.5024	3.4286	0.52809	-0.180	0.735

Table 1 - Statistical indicators

Research Variables	No	Normal parameters(A)		Variance			K-S test	Significance level
		Average	Standard deviation	Absolute	Positive	Negative		
1	39	3.9885	0.55339	0.133	0.133	0.096-	0.829	0.498
2	39	4.1143	0.37774	0.111	0.111	0.111-	0.693	0.723
3	39	4.0547	0.45341	0.163	0.163	0.145-	1.020	0.249
4	39	3.5024	0.52809	0.145	0.145	0.110-	0.908	0.382

Table 2- K-S test

A. The test distribution is normal and is calculated based on test data

Hypothesis	No	Average	Standard deviation	T scale	Freedom level	Significance level	The variance average of the three
Cultural factors	39	3/99	0/55	11/15	38	0/000	0/99
Technical factors	39	4/11	0/38	18/42	38	0/000	1/11
Organizational factors	39	4/05	0/45	14/53	38	0/000	1/05
Economic factors	39	3/50	0/53	5/94	38	0/000	0/50

Table 3 - Result of the Student's t-test

Factors	Average Rating
Technical factors	3.09
Organizational factors	2.85
Cultural factors	2.67
Economic factors	1.40

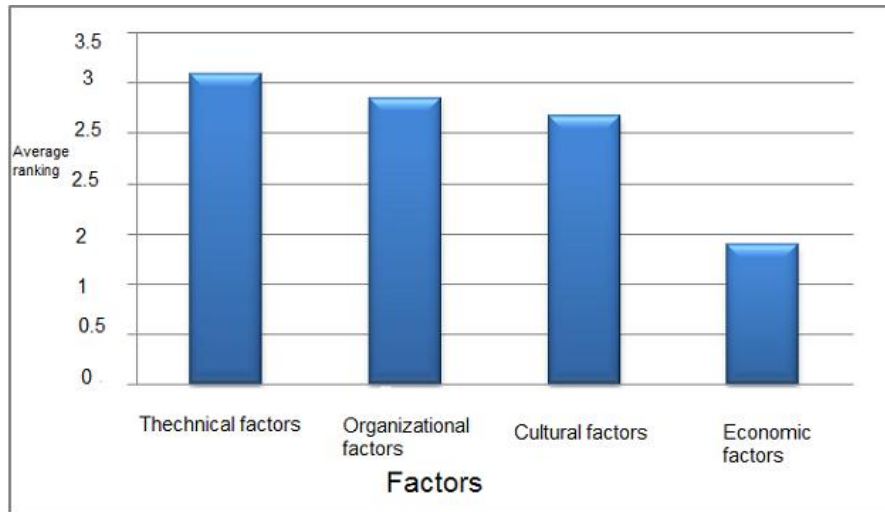
Table 4 - Average rating of barriers

Statistics test	
No.	39
Chi- two scale	40/984
Freedom level	3
Significance level	0/000

Table 5 - Chi-Square test

Factors	Rank	Preventing effect scale
Technical factors	1	The most
Organizational factors	2	
Cultural factors	3	
Economic factors	4	The least

Table 6. Ranking of the degree of impediment of the barriers



Graph1. Average ranking