The selected problems of Lean Manufacturing Implementation in Mexican SMEs

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Abstract. This paper presents the results of investigation of selected problems concerning Lean Manufacturing Implementation at SMEs in México. The analysis is a result of survey conducted in a sample of 24 manufacturing enterprises and it has been supported by some Mexican governmental information sources as well as additional studies which have been conducted before. The paper presents also a preliminary proposal of a methodology of implementation of lean manufacturing and the model of lean manufacturing appropriate in Mexican industrial plants conditions.

The findings of this research are the following: a)The most important problems related to Mexican manufacturing SMEs, b) The problems related to the implantation of lean manufacturing in Mexican SMEs

The limitations presented in this research are the following:

a)The Lean Manufacturing is the concept developed in Toyota and it seems difficult to implement it in Mexican SMEs because of different organizational and social culture of Mexican enterprises and labour.

b)The concepts related to lean manufacturing have been frequently misunderstood in Mexican enterprises because of poor employees training and educational program.

The future research will concentrate on the development of a methodology of implementation of Lean Manufacturing in Mexican industrial plants .This methodology is expected to be a key to the successful implementation of lean manufacturing in Mexican SMEs. This paper does not have any practical implications. Any practical observations can be develop after a practical validation of a proposed methodology in practical industrial conditions.

The main value of the paper is the presentation of:

-current practical problems related to the lean manufacturing concepts application in Mexican SMEs

-a proposal of a lean manufacturing implementation methodology appropriate to Mexican industry. It should be mentioned that this kind of methodology does not exist in México yet.

1 Introduction

According to INEGI (National Institute of Statistics, Geography and Informatics) [3] the institution that is in charge of recollecting, processing and publicizing all statistical and geographical information generated in Mexico, the distribution of different types of enterprises in Mexico is as shown in table 1.

Table 1. Distribution of Enterprises in Mexico by Size

Enterprise size	Number of enterprises	Enterprises percent	Number of employees	Employees percent
Micro	2,673,257	95.43	5,315,309	39.09
Small	95,773	3.42	1,939,169	14.26
Medium	22,631	0.81	1,872,146	13.77
Large	9,719	0.35	4,470,137	32.88
TOTAL	2,801,374	100	13,596,761	100.00

According to the same source, in the case of industry, enterprises employing 10 to 250 people belong to the first three categories. These enterprises generate 65.5% of incomes gained by all industrial companies in Mexico.
In manufacturing industries there are 379,341 enterprises, of which:

- 99.6% are medium and small companies
- 0.4% are large companies.

Manufacturing companies are generating 21.1% of total Mexican exports.

As a part of the integral Mexican policy of the enterprises' development to help micro, small and medium companies, these will be assisted by technical training and relevant information that would provide impulses to their activities.

The Mexican "National Development Plan 2001-2006" [5] includes the documents called "Enterprise Development Program"(EDP) submitted by the Secretary of Economy.

The introductory part of the Enterprise Development Program tells that the SMEs would benefit by a support making them suppliers of large companies in the locations, where those are predominant.

The most important activity for the Government of Mexico [3] supporting the competitiveness of SMEs consists of providing the institutional support which gives legal assurance of establishment, promotion, development and maintenance of the enterprises, especially the micro, small and medium ones.

This new policy of enterprise development is going to increase the creative potential of the employees and of the technological innovation of the small and medium enterprises. The Mexican government wants to:

- create national financial support net for SME enterprises by creation of flexible productive units with high potential to develop and to improve their management and to adapt quickly the new technologies to their needs
- increase governmental attention paid to SMEs
- create the Intersecretarial Commission of Industrial Policy (ICIP) that will reinforce the coordination of the government programs which support the development of SME's in Mexico, and evaluate and report the impact of these programs on the national economy
- promote aggressively the support programs through governments of Mexican states.

In spite of ambitious plans of the Mexican government related to the development of Mexican SMEs one can notice that their competitiveness is based mainly on cheap workforce. According to the present research carried out on a sample of SMEs operating in central Mexico they face a wide range of problems that create low efficiency (63–65%) in their management and manufacturing processes.

In order to improve the level of competitiveness of Mexican SMEs the authors suggest developing and implementing in Mexican SMEs the concept of Lean Manufacturing.

2 Most important problems related to Mexican Manufacturing SMEs

The Mexican small and medium size enterprises live a problematic situation really hard, they have a lot of problems, which inhibits their development, and some of them are shown in this paragraph.

Enterprises Development Program establishes the following factors as the most frequent problems identified in Mexican companies [5,6]:

1. High costs associated with regulations and legal topics. (Source: Federal Commission for Regulatory Improvement. Program of Regulatory Improvement 2000 – 2006)
2. Limitations in training and development of human resources (Source: National Financial. Mexican enterprise in front of modernization challenge. 1999)
3. Exiguous information systems, ignorance of the markets and commercialism problems. (Source: Microbussines National Survey '98)
4. Lack of links with the instruments for the development and technology innovation (Source: National Council of Science and Technology. Special Program of Science and Technology 2001 – 2006)
5. Difficult accesses to get financial support with opportunity adequate to its needs and in competitive conditions. (Source: Bank of México, Survey of Credit Market 2000 – 2001

Points two and four can be considered directly related to the topic of this paper.

Intersecretarial Commission of Industrial Policy (ICIP) has identified some problems for Mexican SME's too, in year 2002, the Secretary of Economy with Inter-American Development Bank, University of Bologna in Argentina and National Institute of Statistics, Geography and Informatics developed the first study that integrated a group of more than 1,000 Mexican SME's, which answered a survey designed to determine its strengths, tendencies, problems and opportunities (The sample was considerate statistically representative of the total of Mexican SME's). Some problems identified in this report, related directly with the paper are presented as follows:

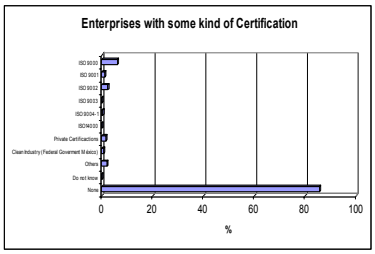

Fig. 1. Enterprises vs. quality system certification

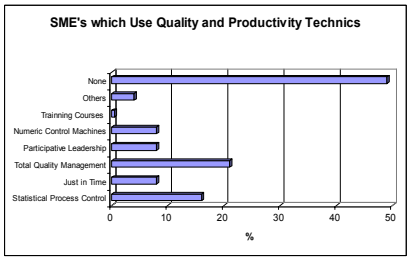

Fig. 2. Enterprises using quality or productivity techniques

The figures 1 and 2 show some important aspects to be considered:

a) Lean manufacturing is not specified in this list of techniques, so it must be included in "Others" that represent only 4% of companies.
b) Just in time as a system very similar to lean manufacturing is used by approximately 9% of the SME's in México.
c) According to these results, 21% of Mexican SME's are using Total Quality Management. If less than 10% of enterprises are certified ISO 9000, can the other 11% of enterprises work in a TQM environment? This is a result of the lack of knowledge that the enterprises have about real concepts applied in modern productivity techniques.

3 Problems related to the implementation of Lean Manufacturing in Mexican SME's

Talking about lean manufacturing and in order to analyze the problematic situation in operative level, a survey was applied by the authors in October and November of 2005.The survey was sent to 300 enterprises and 96 manufacturing enterprises answered.

From the enterprises which answered the survey, 33 of them mentioned they have implanted lean manufacturing. But, at this point it is necessary to review the concept of lean manufacturing system that every enterprise uses, because some of them have

different perceptions about what lean manufacturing really means.Five levels were established with the different perceptions that Mexican SMEs used more frequently related to lean manufacturing. These were used to identify the level of enterprises knowledge about final objectives of lean manufacturing.

Level I. Misunderstanding of the concept.
Level II. Use of several tools to get down costs and/or improve the enterprise's productivity
Level III. Waste elimination
Level IV. Lead time reduction on production and delivery
Level V. Improvement on process flexibility to target the client's and market's requirements.

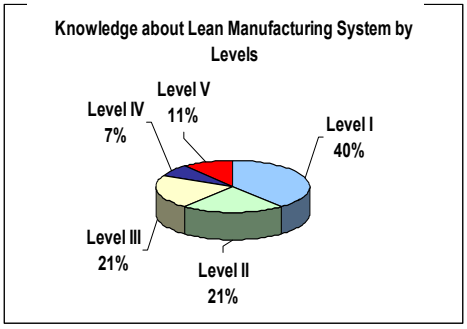

Fig. 3. Knowledge of Lean Manufacturing System. The levels of different perceptions of Lean Manufacturing concepts

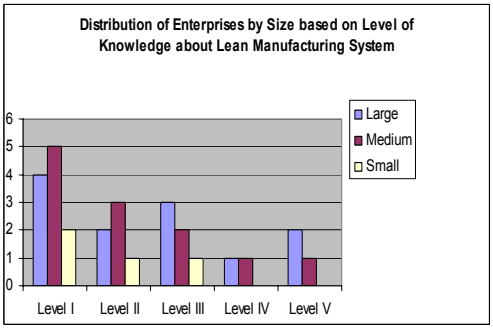

Fig. 4. Distribution of Enterprises by its size based on level of knowledge of Lean Manufacturing concepts

In the same survey the respondents were also asked about the time of implementation of Lean Manufacturing in the company. The data below relate to enterprises in which the implementation of Lean Manufacturing is between the third and the fifth level.

- 38% of the enterprises are just planning the implementation of Lean Manufacturing in the nearest - but not clearly defined - future.
- 45% of the companies started implementation two years ago and still continues it.
- 17% started the implementation of Lean Manufacturing this year.

The analyzed companies were also asked about the most difficult impediments in the implementation of Lean Manufacturing. The most frequent problems mentioned by the respondents include:

- difficulties in changing corporate culture;
- insufficient knowledge of the implemented tools and methods;
- focusing on individual, short-term objectives not considering the development of the enterprise as a whole;
- resistance of the employees;
- using models not adjusted to the specific character of Mexican enterprises;

- lack of adequate implementation plans;
- lack of adequate training;
- lack of resources necessary for project implementation;
- no engagement of the board of directors and managers in project implementation.

Lack of Lean Manufacturing models and implementation methods adjusted to the specific character of Mexican enterprises, corporate culture and Mexican employees was considered one of the most vital problems. The model and a general outline of its implementation is presented below.

4 The model of Lean Manufacturing

The model of the proposal is shown in Figure 5. It presents the elements of the model and the sequence of their application. The model consists of four levels of enterprise "maturity". The central part of the model, running from the lowest to the highest level, includes the following methods [2]:

- Total Quality Management
- Knowledge Management
- Kaizen

On the first level the ISO 9001:2000 is implemented in the company. Basing on the standardization and repeatability of the quality achieved on the first level the following processes can be implemented (level 2):

- Business Process Reengineering (BPR)
- Group Technology (TG)
- Theory of Constraints (TOC)

As a consequence, flexible processes, the real base for planning and flattening of company structure are created. Improvement of service processes (level 3), such as maintenance and set up of machines and equipment will constitute the base for creation of production system (level 4) eliminating waste, producing the exact amount of goods that is needed at the right time, what will enable to achieve high quality and to optimize costs.

Implementation of the methods in the sequence shown in Figure 5 will support the company in achieving the last, fourth level, the Lean Manufacturing.

The methods of TQM, Kaizen and Knowledge Management presented in Figure 5 constitute the "core of the system" linking all levels in the company. It is the graphic presentation of the following assumptions of the model:

- Each level of the model generates knowledge that should be analyzed and adopted to the company by Knowledge Management rules
- On each level of its development the company applies rules of team work, management based on the theory of systems, the managers become coaches and leaders and quality improvement stimulates to action and integrates all company employees

The company operates on the basis of continuous improvement of all processes with participation of all its employees.

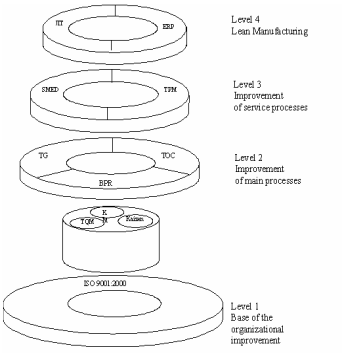

Fig. 5. The proposal of the model of Lean Manufacturing [2]

Implementation of the methods presented in Figure 5 has iterative character. That means a company that has already achieved a certain level of development, can apply methods from the lower levels of maturity. It may have complimentary character, connected with e.g. implementation of additional ISO procedures in the company.

Implementation of the Lean model may begin with the implementation of any of its elements and it will depend on the company's maturity level before starting the program of changes. The only limitation there will be compliance with the suggested by the model sequence of implementation of the methods.

5 The proposal for model implementation

Figure 6 presents a diagram for implementation of the model of Lean Manufacturing. It starts from enterprise analysis and assessment based on the three following elements [2]:

- Internal efficiency of the management and production system
- Assessment of customers point of view
- Human resources management efficiency.

The analysis is carried out by an auditing team in order to identify:

- Relations between inefficiencies in the company and their negative effects on company's performance
- Characteristics of the company manufacturing cells which activities directly or indirectly lead to the inefficiencies.

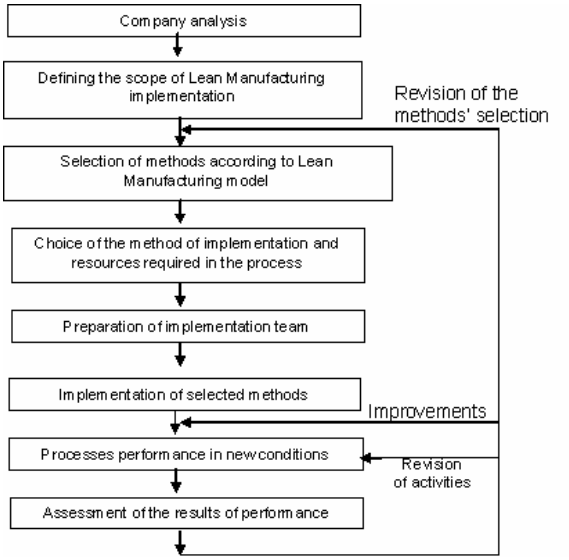

Fig. 6. The diagram of implementation of the Lean Manufacturing model [2]

In order to define the scope of Lean Manufacturing implementation it is advised:

- To keep to the sequence of methods suggested in the model
- To consider resources that the company can assign for implementation activities
- To consider education and work experience of employees.

Implementation of selected Lean Manufacturing methods is a difficult and complex process because:

- It is constantly being revised according to achieved business results
- It is constantly being improved, because of implementation of, in particular:
  - Total Quality Management(TQM)
  - Kaizen.

6 Conclusions

1. Implementation of the model can be used to restructure the enterprise thus starting a period of stable and balanced development. This can also lead to the improvement of economic parameters of performance. It has also enhanced competitive position of the enterprise on Mexican market.
2. Pilot implementation of the model has evidenced, that subject to the situation, and based on the results of analysis of the situation, there is a need to select specific methods in order to restructure the enterprise effectively and efficiently. The set of these methods has to be selected on the case-by-case basis, without resentments to create one uniformly applicable model.

3. Efficiency of implementation of the model depends upon:
   - people working in the enterprise;
   - features of the enterprise;
   - all surrounding restructuring program.

One of the main issues is related to education level, norms and values, attitudes and goals of employees. These elements impact upon cause-result effects of implemented changes, reduce resistance to change, and find means to adapt to new conditions. The other relates to knowledge and dedication of managers, that if on adequate levels, may guarantee success of restructuring. Finally, an important element depends upon methods of human-resource management, and in particular, whether or not these management practices are innovative and positively motivating employees.

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