Standardization and Certification in Lean Manufacturing for Technology and Product Development in Service Oriented Industries

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Abstract: *An organization's success rate completely depends on its effort to continuously innovate and develop products. Having the capabilities to launch products at the opportune time and the ability to tightly integrate them into an organization's revenue and growth plans is the other essential factor. Critically, for a product's success in the market, the product's requirements must factor in the right balance of faster time-to-market and total value derived. Another important customer perspective is the quality and innovation that differentiates them from the competition. By being proactive in developing these aspects into the product development lifecycle, the success factors emerge.*

Lean principles and apparatus are extensively used in every tread of an entire process, from customer service to supply chain management. Although there are a lot of success stories about lean implementations, many companies are also under pressure to become accustomed their culture towards the execution of lean ideology. In this thesis, consistency of lean mechanized is calculated and an examination is providing to thrash out if standardization would help remove the major obstacles that delay successful lean implementation. Potential profit and disadvantages of having standards for lean enterprises are analyzed. As a part of the examine a survey was conducted to get reaction from lean professionals about standardization. The survey results propose that there is a largely support for incline standardization. However, there are both positive and negative views about the probable benefits and disadvantages of using lean standards as an implementation guide. A case study is also provided to measure the benefits of lean and to appreciate how lean standards may help companies implement lean principles. Based on a reproduction model that was develop to prove the benefits, a 15 % decrease in supply carrying cost and a 5% reduction in total line time was predicted.

Keywords: *Certification; Standardization; Service; Product development; Lean Manufacturing; Design and Manufacture.*

I.   Introduction

Lean manufacturing has abruptly increased and many companies are using it as an improvement stage. Implementation gradually helps the companies to increase their success bar. Proper and detailer information about lean is required by the professionals. The details can be provided by the lean manufacturing perspective. The pros and cons of standardization will also be studied.

II.   Basic Concepts of Lean

The basic values behind Lean Manufacturing are to afford superior quality products for more Customers at a extensively lower price and to contribute to a more affluent society.

It is imperative to build a corporation manufacturing system based on this philosophy. Lean Manufacturing has endeavored to diminish production by:

- Wholly eliminating waste in the manufacturing process
- To construct superiority into the progression
- To decrease costs - efficiency improvements
- To build up its own exclusive approach toward company association
- To generate and expand integrated technology that will help to company processes.

III.   Standardization and Certification of Lean

For an organization, all the processes, activities should be done in a proper system. When a company is smaller, all these things can be done without a proper system. All the information's is in the head of the employees and managers and everyone has their own way of doing things. However, when a company becomes larger and more people get involved in it, it is very difficult to keep all the business information in mind without written procedures. And for this matter, the concept of Management standards introduced. In written procedures, all the forms and records are maintains in written policies. People keep on changing in company but the system remains same. So, based on this concept, various management standards are available in industry. International

Organization for Standardization (ISO) is one of the world's largest developer and publisher of international standards for business, government and society. ISO 9000 is the most popular and widely implemented standard. At least 897,866 ISO 9000 certificates had been issued in 170 countries (ISO, 2006) up to the end of December 2006.

The first version of ISO 9000 was published in 1987 which was an international quality system standard. The Five different sections: 9000, 9001, 9002, 9003 and 9004 were there in ISO 9000:1987. ISO 9000:1987 and 9004:1987 were support material for the companies that intended to get certified in one of the ISO 9001, 9002 and 9003. In 2001 ISO standards were updated. ISO 9001:2000 was only one standard by which companies could get certificated after this change. Arbuckle (2004) indicates that with this change, ISO also took more of a Total Quality Management (TQM) approach. ISO 9000 is a very important and useful tool for many companies which help to improve their quality systems. It is also considered as an vital aspect for marketing. In 2000 version of ISO 9000 there are 21 elements in five categories which specify activities that need to be considered when a company implements the ISO system.
These categories are:

- Overall requirements for the quality management system and documentation
- Responsibility in Management, focus, policy, planning and objectives
- Resource management and allocation
- Product realization and process management, and
- Measurement, monitoring, analysis and improvement (ISO, 2000).

Organizations which are using ISO 9000 certification are required to develop documentation to prove that their system works is based on quality standards. This documentation consists of four levels: quality manual, system procedures, job instructions and documentation of proof that the quality system. Later, Management standards are also developed for a specific industry and QS 9000 Standard is one of them. The main objective of QS 9000 quality system was to create a uniform set of requirements related to existing or planned quality systems of suppliers to the US automotive industry. Standardization of quality system documentation to be developed and maintained by each supplier was an important part of this quality system. In 1994, the QS 9000 quality system was developed and published in the USA by a team which consists of representatives of the USA's big three automotive manufacturers (General Motors, Ford and Chrysler) and the US truck manufacturers (Bramorski etal, 2000). There were three main sections in QS 9000 standards. In the first section, with the addition of both requirements i.e. automotive and heavy trucking requirements, there are common requirements and this has the same text as ISO 900. The second section includes the approval process of production parts, continuous improvement, and manufacturing capabilities and the third section includes customer-specific requirements which are unique to General Motors, Ford and Chrysler (Kartha, 2004).In December 2006, all QS9000 certifications were terminated and QS9000 was considered superseded by ISO/TS 16949. These ISO/TS 16949 are the standards that were developed by ISO for all automotive industry worldwide. After inclusion of ISO/16949 and QS9000 was no longer valid, businesses had a choice between either ISO9001 or ISO/TS16949 (Reid, 2007). Another example for industry specific standards is Wood mark. The Wood mark Quality Certification Program is the first quality management program which was specifically designed for the wood products manufacturing industry in Canada. And it was developed by the Wood Products Quality Council in cooperation with researchers at the University of British Columbia in 1999. There are following seven standards under which 30 elements are organized in Wood mark Quality System: (Maness and Kozak, 2002)

- Management commitment
- Quality plan
- Inspection of incoming material
- Measurement and control of in-process work
- Traceability
- Training
- Continuous improvement

The other aspect of standardization and certification is the certification programs for individual professionals. A formal recognition that an individual has proficiency of a specified body of knowledge related to an area can be defined as Individual Certification. There are various certification types for almost every profession. Certified in Production and Inventory Management (CPIM) is such an example of certification. APICS (The Association for Operations Management) offers CPIM for professionals who work in production and inventory management, operations, supply chain management and procurement (APICS, 2008). To earn CPIM designation candidates must pass all exams for the following modules:

- Basics of Supply Chain Management
- Master Planning of Resources
- Detailed Scheduling and Planning

- Execution and Control of Operations
- Strategic Management of Resources

APICS offers computer-based exams throughout the year after passing all exams and getting the designations, It is important for CPIM certified professionals to maintain their certification every five years through a certification maintenance program another example of certifications Project Management Professional for individuals. PMP certification is offered by the Project Management Institute (PMI). Individuals who hold PMI's PMP credential demonstrate a proficient level of project management and leadership skills (PMI, 2008).

Continuous Improvement in Lean System			
6 Sigma Root Cause Problem Solving			
Pull/ Kanban	**Flow**	**Total Productive Maintenance**	**Source Quality**
Point of Use Storage	**ISO Work**	**Teams**	**Visual Control**
Plant Layout	**Quick Setup**	**Lot Size Production**	**SS System**
Value Stream Mapping			

Fig. 1: Continuous Improvement in Lean Manufacturing

An individual must meet certain educational and professional experience requirements and must pass a 4-hour exam that has 200 questions for eligible in PMP credential. Similar to CPIM, once PMP certification has been attained, a PMP certified person must participate in the Continuing Certification Requirements (CCR) program to maintain an active certification status. The PMP certification cycle lasts three calendar years.

IV.   Survey about Lean Standards

From the above heading i.e. survey about lean standards, we can easily understand that we have to do survey for lean standards, survey simply means that how much anything is get a response worldwide. In the field of companies and industries, survey of anything plays a vital role. In term of lean standards, people have different views and opinion about the lean standards and certification. Some people have good opinions; they think that lean standard is a great tool which will help companies in their lean journey. But on the other hand, some professional think that setting such standardization would not work for lean. According to the conducted literature survey, there is no such survey conducted about the lean standard. So to change the thinking of professionals about the subject, we decide to organize a survey, so that there thinking can change for lean standards. Through survey, we have a chance to quantify various motives and objectives of individual industry and lean professionals.

4.1 Approaches to Survey

The main goal of our thesis is to study the potential benefits and limitations of lean standards and certification and analysis that whether the standardization would be helpful in implementing lean principles or not, so before starting the surveying; we should first know the opinion from lean practitioners about how standardization will help to eliminate major problems in implementing the lean tools and their principles.

The initial step towards reaching our aim was to determine the major obstacle comes during the successful Lean implementation. The lean enterprise institute (LEI) was found in 1997 by james womack co-author of the book "the machine that changed the world is a non profit, education and management research centre. This institute LEI was found to promote advance the principles of lean thinking in every aspects of business. Since 2003, LEI has surveyed manages to get their opinion and views on lean implementation. One of the question asked in their surveys was on key obstacles that lean professionals face in companies in transforming mass production to lean based on 2,444 responses in 2007 survey, the following obstacles were determined as the biggest problem in lean implementation (LEI,2007):

- Lack of implementations know-how
- Middle management resistance
- Employee resistance

These three obstacles were on the top three in the obstacles list with an average of 30% votes in each of last three years surveys. So based on this information we decide to ask the votes that what they think about standardization and certification of lean manufacturing and their views in removing these obstacles. Participants had the following five opinions to choose:

- Strongly agree

- Agree
- Neither agrees nor disagrees
- Disagree
- Strongly disagree

4.2 Sources for Survey Distribution

Table 1: Survey Distribution

Lean Organizations	Lean institutions and associations Lean consortiums and alliances Lean consulting firms Other professional organizations
Corporations	The researcher's employer corporations and its divisions Suppliers of the researcher's employer Some other companies
Online Sources	Lean forums Discussion groups Online magazines Lean networks
Other Sources	Industry magazines Authors Academics Personal contacts

V. Survey Results and Discussion

Thus the survey results for each question will be presented and the outcome will be discussed. First, the participant profile questions will be reviewed to provide some background information:

5.1 Geographic Location

North America which includes USA, Canada and Mexico alone has 70% participants. Remaining 22% are from Europe and 8% of that is from Asia/Pacific. Since, the majority of the participants are located in North America. Hence the results will mostly indicate opinions of lean professionals from this part of the world. This is significant since most of the lean implementation issue statistics and case studies in literature usually originate from North American companies.
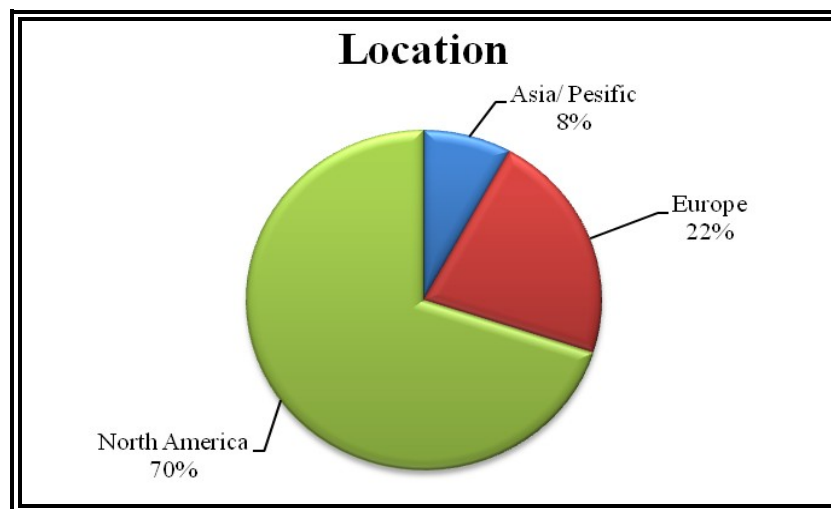

Fig. 2: Geographic Location

5.2 Position

Among all, the major group in the participants is managers making up 50% of the respondents, 24% of that are staff (engineers, analysts, coordinators etc.). The percentage of senior management is 11%, and the directors are 8%. Thus, overall 19% of the participants are in executive positions such as Director, VP or Senior VP. This group of participants is vital, since the executives will have a major impact on lean standards and certification. Among the rest 3% of the participants are consultants and the remaining 4 % belong to other positions.
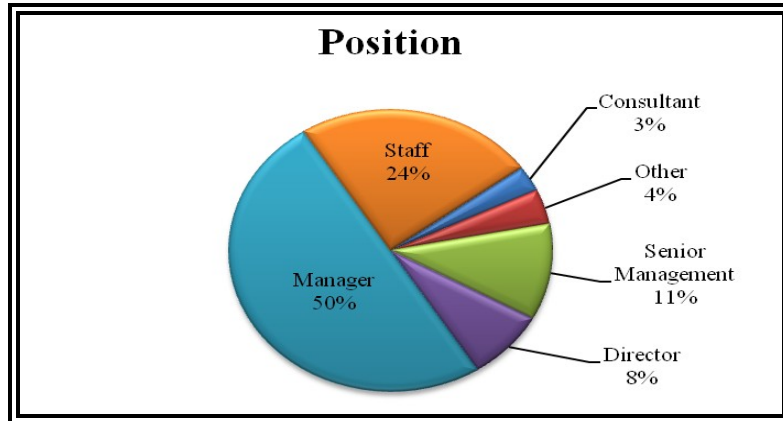
Fig. 3: Position

5.3 Sector

The manufacturing sector has the most of the lean manufacturing implementations. Although there are other sectors, such as healthcare and information technology, where lean is becoming very popular, yet the manufacturing sector is very advanced and highly developed in lean implementations. This is also reflected in our survey. 90% of the participants are from the manufacturing sector and the other 10% are from construction, mining, transportation, and technical sectors.
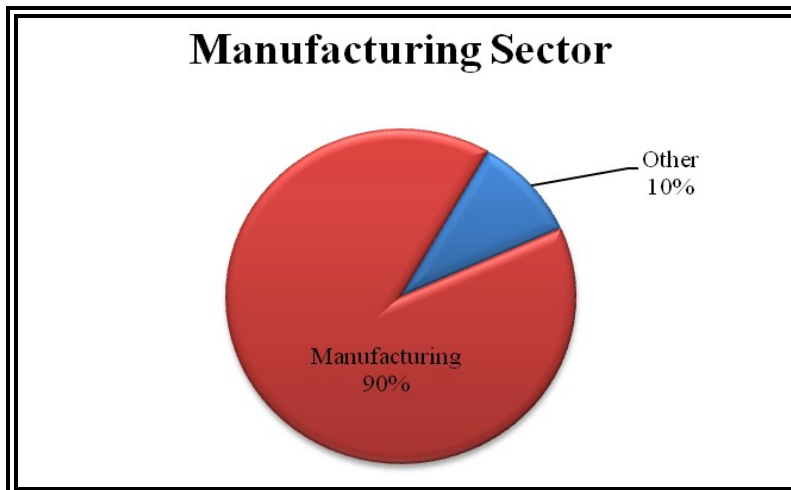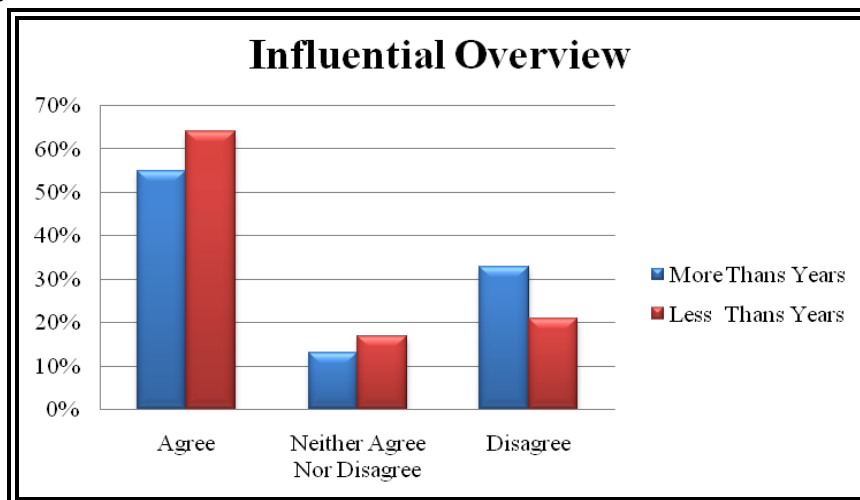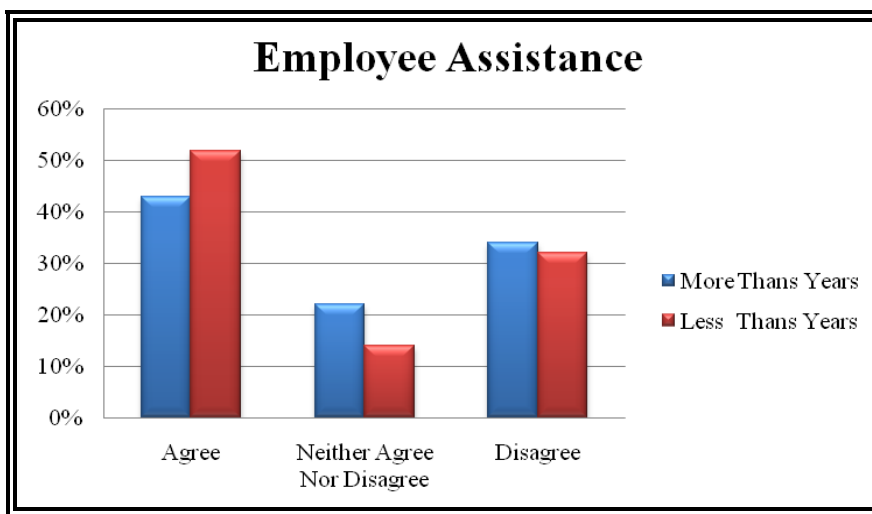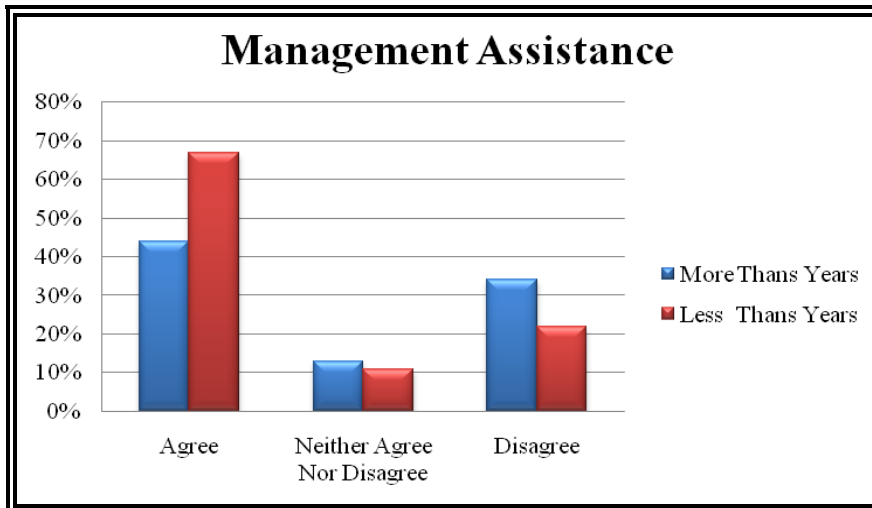

Fig. 4: Manufacturing Sector

Overall Result

Management Assistance

Employee Assistance

VI. Conclusion

Information is provided on conducting the survey about lean standards. The design and distribution of the survey is reviewed and the results from 244 participants are presented. A detailed analysis is also performed in order to measure the impact of different factors on the support level about standardization. Based on these results, the following main conclusions can be suggested:

- The overall results show that the percentage of the participants supporting standardization of lean is higher than those who do not.
- There is less support from participants about eliminating the employee resistance problem.
- The executives are less supportive about standardization than the other level participants. This could make introducing lean standards more difficult, since executives are typically in a more influential position to initiate the implementation of lean standards in their organization.
- The participants from companies with less lean experience show higher support for standardization, since they think that this would help them in their lean implementation.
- More experienced companies are less supportive about standardization. This could be due to resistance to implementation of a new system which is different that the company's current practice.
- There is consensus on the benefits of lean certification for individuals.

VII. Future Work

Possible studies to expand and further the results that were obtained in this thesis can be summarized as follows:

- The simulation models can be improved by adding more criteria and applying different scenarios. The current parameters can be changed and their impact can be measured. For example, impact of batch sizes and machine efficiencies on the results can be measured.

- The requirements for an effective lean management standards system can be studied. As a part of this possible research, J4000 can be revisited to evaluate its strengths and determine possible improvement areas, after nearly 10 years that this standard was published.
- A feasibility analysis can be done to investigate if a new international lean management standard can be introduced by ISO and if it would be beneficial for lean implementations. For this purpose, more detailed research can be done and another survey can be conducted possibly by ISO or another large international organization. Included in this future research, QS9000 and its conversion to an ISO standard could be investigated in detail and potential outcomes could be discussed if a similar approach was implemented for J4000 standards.

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