

# **A Survey on Model for Implementation of Lean Six Sigma in Indian Industries**

Priyesh P Revankar<sup>1</sup>, Kamble. S. G<sup>2</sup>

UG Student, Department of Mechanical Engineering, Government College of Engineering, Jalgaon, Maharashtra,  
India.<sup>1</sup>

Assistant Professor, Department of Mechanical Engineering, Government College of Engineering, Jalgaon,  
Maharashtra, India.<sup>2</sup>

**ABSTRACT:** Implementation failure of Lean Six Sigma in Indian industries has been a big concern. The reasons for many Lean Six Sigma program to fail are cultural, geographical and environmental differences between Indian and foreign industries. As concept and methodology of Lean Manufacturing was developed by Japanese company and Six Sigma by American, implementing Lean Six Sigma in India may have adjustment problems. There is a need of such a methodology which is perfectly compatible to Indian industries. This paper presents a conceptual model of Lean Six Sigma and points out reasons behind failure of such methodologies due to cultural differences between Indian and other countries. The proposed conceptual model utilizes Hofstede's five cultural dimensions to determine and avoid the effect of national culture at every phase of Lean Six Sigma.

**KEYWORDS:** Hofstede, Indian culture, Lean, Six Sigma, Waste

## **I. INTRODUCTION**

Lean Six Sigma is a method that companies can apply to any manufacturing, transactional or service process. Lean manufacturing focuses on the removal of waste so that all processes in the total system add value from the customers' perspectives. The main emphasis of Six Sigma is the application of statistical tools in a disciplined manner, which requires data-driven decision-making. The integration of Lean and Six Sigma provides a synergetic effect, a rapid process improvement strategy for attaining organizational goals [4]. But the particular question that we deal with here in this study is: "How does the national culture moderate the influence on the methods, processes and the outcomes related to Lean Six Sigma implementation across India?" Thus, the conceptual model explained below makes use of Hofstede cultural dimension which links methodology of Lean Six Sigma with Indian culture. Hofstede defined culture as "collective programming of mind which distinguishes the members of one group or category of people from another." Hofstede proposed five unique measurable dimension of culture to determine the national culture at the place of work. These five aspects of culture are (1) collectivism/individualism; (2) power distance (3) masculinity/femininity (4) uncertainty avoidance and (5) long/short term orientation [3].

## **II. MODEL OF LEAN SIX SIGMA**

Model of Lean Six Sigma linked with Hofstede's cultural dimension is as follows:

### **1. SELECTION**

This step consists of selecting the project on which the methodology is to be performed. The selection phase is involved to overcome the problems associated with traditional DMAIC cycle. First the cross-functional team is developed to select and determine the importance of problem/project depending on criteria such as manpower, complexity, resistance against customer satisfaction, cost reduction, supply chain, efficiency, quality, etc. Next step is to find out the resistance & support from stakeholder of project. Put the strategies to gain support from stakeholders, e.g.:

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

discussion, deep meeting, motivation clear coaching, clear action plan and target. Further the team must decide the product on which the project has to be conducted.

## 2. MARKET BASED DEMAND ANALYSIS

This step is used to find out the level of demand of product to be manufactured. It utilizes customer driven, non-rework demand to define needs and access workload volumes. Starting with qualitative methods like survey of collective opinions, buyers' intention, Delphi approach and its variant & also a number of quantitative methods are used for compiling and computing demand forecasts as detailed below:

### a) Collective Opinion Survey:

Sales personnel are closest to the customers and have an intimate feel of the market. Thus they are most suited to assess consumer's reaction to company's products. Herein each salesperson makes an estimate of the expected sales in their respective area, territory, state and/or region, These estimates are collated, reviewed and revised to take into account changes in design/features of products, changes in selling prices, projected advertising and sales promotion campaigns and anticipated changes in competitors. Opinions of all managers involved at various levels of sales organization are also included in the survey. Thus, collective opinion survey forms the basis of market analysis and demand forecasting. Usually in India small scale industries are more as compared to large one. Hence, they prefer short term orientation. This orientation must be changed and the industries must go towards long term projects because collective survey method is suited for long term projects.

### b) Delphi Method of Demand Forecasting:

Delphi method is a group process and aims at achieving a 'consensus' of the members. Herein experts in the field of marketing research and demand forecasting are engaged in analysing economic conditions, carrying out sample surveys of market, conducting opinion polls. Based on the above, demand forecast is worked out in following steps: Co-ordinator sends out a set of questions in writing to all the experts co-opted on the panel who are requested to write back a brief prediction. Written predictions of experts are collated, edited and summarized together by the Co-ordinator. Based on the summary, Co-ordinator designs a new set of questions and gives them to the same experts who answer back again in writing. Co-ordinator repeats the process of collating, editing and summarizing the responses. Above steps are repeated by the Co-ordinator to experts with diverse backgrounds until consensus is reached. If there is divergence of opinions and hence conclusions, Co-ordinator has to sort it out through mutual discussions. Co-ordinator has to have the necessary experience and background as he plays a key role in designing structured 'questionnaires and synthesizing the data.

Direct interactions among experts are avoided nor their identity is disclosed. Procedure also avoids interpersonal conflicts nor strong willed experts are able to dominate the group. But due to presence of political environment in India the experts are unable to give their hundred percent. The support of political personalities results in dominating the group by one expert. Thus, entering of political issues in industrial procedures must be avoided [7].

Other methods of demand analysis are nominal Group Technique, Simple and moving Average Methods, Exponential Smoothing Method, Projection by Curve Fitting, etc.

## 3. DEFINE

The purpose of this phase is the identification of the defect, which has to be solved through the application of Six Sigma. The next step in this phase is to develop the project charter, which is a plan. This plan specifies the boundaries and scope, goals, timeframe and the deliverables of the project. The goals of the project should be aligned strategic plan of the company. All of this definition of the project is in the form of a document which has to be improved formally before the start of the project. But who should define the problem related to organization, which has to be solved? Western countries have generally low power distance culture. This means any employee in an organization has right to identify problem. But in India only upper management can define the problem. Hence, the culture must be changed because employees who actually work on shop floor can identify more minor problems than upper management committee. Therefore, employees must be involved in problem identification phase. Also societies with feminine culture make sure that everybody in group has full participation. But in Indian culture mostly male dominates over female. Here the mentality of peoples must be changed.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

## 4. MEASURE

Quality characteristics are determined at this stage of the Lean Six Sigma methodology. Those quality characteristics or features are selected which emulate product improvements. Then a measurement system is developed, so that data could be collected based on those features. Next step is to develop a process map, which identify inputs for every process step referred by X. For each of these process steps designated by Xs, there is a corresponding output Y. The terminology of Six Sigma is represented by Xs and Ys. Xs represent not only the inputs but also the process which has to be done on that X. Each of those Xs and Ys statistically emulate the array of independent and dependent variables. The project's purpose is to improve the Ys. For the data collection in this perspective, the team members are designated and their roles are defined, this part of the process is again affected by the national culture. In the societies with high power distance usually the higher management has the access to data. Thus for better results every member of lean six sigma team must have access to data, but for the low power distance societies it is not a problem.

## 5. VALUE STREAM MAPPING

Value Stream Mapping is paper and pencil tool that helps us to see and understand the flow of material & information as the product makes its way through the value stream. This technique details the specific actions required to bring a product family to the state of finished goods, based on customer demand. Value Stream Mapping which operates on high level of abstraction, concentrates information management & physical transformation. Using Value Stream Map, cross functional team developed earlier can determine ways to bring the lead time for the product much closer to a value added processing time by modifying bottlenecks & other process constraints. The team must further produce a future state map to show how the preferred process should operate after the bottlenecks are identified.

## 6. WASTE ELIMINATION

The elimination of waste is the primary goal of any lean system. In effect, lean declares war on waste – any waste. Waste or Muda is anything that does not have value or does not add value. The steps to effective waste elimination are:

1. Make waste visible.
2. Be conscious of the waste.
3. Be accountable for the waste.
4. Measure the waste.
5. Eliminate or reduce the waste

In other words, before one can stop waste, he should be able to see it, recognize it as waste, identify who is responsible, and finally appreciate its size and magnitude. Waste that is not seen cannot be eliminated. When something is denied as waste, it also cannot be stopped. When one refuses to accept responsibility for the waste, then he will not eliminate it. Finally, when the waste is not measured, people may think it is small or trivial and therefore will not be motivated to stop it. As the saying goes "What is not measured, is not improved". A lean system declares war on wastes or "Muda". These wastes are classified into 7 types:

### 1. Over-production waste

Its causes are volume incentives (sales pay, purchasing), high capacity equipment, and line imbalance; poor scheduling/shifting, poor production planning, cost accounting practices that encourage build-up of inventory. The just-in-time, pull system, and Kanban rules prevent over-production wastes. Also, lean systems favour smaller equipment over large ones to avoid overproduction due to high but unnecessary capacity utilization.

### 2. Processing waste

Its causes are unclear customer specifications, frequent engineering changes, excessive quality (refinements), inadequate value analysis/value engineering, and unclear work instructions. To reduce it identify value-adding and non-value adding activities in the process using techniques such as value stream analysis and the waterfall diagram

### 3. Transport waste

Its causes are poor route planning, distant suppliers, complex material flows, poor layout, disorganized workplace, line imbalance. One way to cut transport waste is co-location, wherein customers are served by nearby suppliers, usually less than one-hour driving distance away. Departments working with each other or serving each other are also put near each other to cut transport waste.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

#### 4. Waiting-time waste

Its causes are unsynchronized processes; line imbalance, inflexible work force, over-staffing, unscheduled machine downtime, long set-up, material shortage or delay, manpower shortage or delay.

#### 5. Inventory waste

Its causes are over-production imbalanced line, big batch sizes, long lead times, local optimization (turf mentality), large minimum order quantities, high rework rate, JIT-incapable suppliers, lack of material requisition and issuance standards

#### 6. Motion waste

Its causes are poor lay-out and housekeeping, disorganized work place and storage locations, unclear, non-standardized work instructions, unclear process and materials flow. Motion waste happens when unnecessary body movements are made when performing a task. Workers commit this form of waste by searching for tools or documents when their workplace is cluttered or disorganized. Motion waste often delays the start of work and disrupts workflow.

#### 7. Defects

Its causes are unclear customer specifications, incapable processes, lack of process control, unskilled personnel, departmental rather than total quality, and incapable suppliers. Quality is doing the right thing right the first time. It is about prevention and planning, not correction and inspection. Bad quality or defects do not only result in customer dissatisfaction and damage to company image, but also in wastes due to additional costs and time to recall, rework, repair, and replace the defective items. Continuous quality improvement and preventive measures are the most effective means to cut defect wastes [5].

### 7. ANALYZE

Once the data collection and waste elimination process is complete, then the next step is to analyse the data. The purpose of this step is to present useful information that helps in modifying the process and thus solving the focused problem. The tools of Quality management such as flow charts, Pareto charts, cause-and-effect diagrams, scatter diagrams and SPC charts are utilized in analysis. Purpose of this step is to pinpoint the root causes of the problem and then eliminate the problem. This Lean Six Sigma phase has very less amount of interaction among team members so it is less vulnerable to the differences in national culture. But still statistical problem solving can have a little influence of the national culture. In India highly uncertainty avoidance culture must be preferred because it will help the tolerance limit of statistical processes at very low values. This will lead to increase in quality. Also there must be a collective orientation so that analysis is to done at group level.

### 8. IMPROVE

This phase has its focus on manipulating the Xs to enhance the performance considerably. But here the question is who is going to lead the process of improvement. Here again collectivist orientation is preferred because it is the domain of the groups to take responsibility of improving the process. Due to high power distance culture in India, the owner of the process usually drives the improvement process. This must be avoided. To follow cultures with a high level of uncertainty, the steps would be taken very cautiously to avoid the risks of getting into failures.

### 9. CONTROL

The last process in the Lean Six Sigma project is the control phase. In this step the national culture affects the time horizon as well as the responsibility for sustainability. For instance the societies with short term orientations have their expectations up to a period of quarter of fiscal year, but for long term oriented societies this period may extend up to a whole year or more. In cultures with high power distance success of the project is wholly attributed to the owner/manager of the project whereas for low power distance societies the appreciation is for the whole team. Hence, the appreciation must be dedicated to whole team. It will motivate the employees to work hard further.

## III. CONCLUSION

The advantages of newmodel (SMDMVWAIC) as compared to traditional Lean Six Sigma roadmap (DMAIC) are as follows:

- It is more clear and Lean tools appear very well. But in DMAIC cycle Lean tools don't appear very well.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

- The project selection criteria is included in new model whereas traditional method doesn't consist any criteria to determine project selection.
- Market based demand analysis is performed to follow pull principle of manufacturing.
- Various factors affected by Indian culture are pointed out and remedies are also mentioned.
- Traditional method doesn't consist any project preparation period whereas in new model preparation period is included in selection phase.

Thus, the paper explains the following problem statement "How can firms in India successfully apply Lean Six Sigma to achieve an environment of continuous improvement in process?"

## SCOPE FOR FUTURE RESEARCH

The proposed conceptual model should be statistically tested to determine if the relationships are indeed significant. For this empirical research is required to do. As implementation is the crucial step for success of any lean Six Sigma programs, the proposed conceptual model should be examined by applying it to various case studies.

## ACKNOWLEDGEMENT

We want to express our deep sense of gratitude and overwhelming thanks to Prof. U. N. Shete, HOD of Mechanical Department for his intimate motivation to publish our paper in international journals. We would also like to thank specially Mr. Hanmant Dongale an UG student in our college for his technical help and support for producing this research paper.

## REFERENCES

- [1] Darshak, A. D., Mulchand, B. P., "Impact of Six Sigma in a developing economy: analysis on benefits drawn by Indian industries" Journal of Industrial Engineering and Management, Vol.2, Issue 3, 2009.
- [2] Dr. Zoe Radnor, Paul Walley, Andrew Stephens, Giovanni Bucci "Evaluation of the Lean Approach to Business Management and Its Use in the Public Sector" Scottish Executive Social Research 2006
- [3] Hofstede, G. "Cultural constraints in management theories" Academy of Management Executive, Volume 7, Issue 1, 1993
- [4] Mirko, S., Pavletic, D., "The Lean and Six Sigma Sinergy" International Journal for Quality Research, UDK- 658.5 / 006.83
- [5] Prof. Rene T. Domingo "Identifying and Eliminating the Seven Wastes or Muda" Asian Institute of Management
- [6] Reijns, T. J. F., "The advantages and limitations of Lean Six Sigma in process (re)design" Bachelor's Thesis Organization & Strategy – Lean Management, June 2010.
- [7] Mote, V. L., Samuel Paul, Gupta, G. S., "Managerial Economics – Concept" & Tata McGraw Hill.