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How different is Sweden from Mexico? A continuous improvement survey comparison.

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Abstract

Continuous improvement techniques are important tools for enabling companies to improve their operations. The implementation of these techniques is however estimated to be quite different around the world. Continuous improvement is a thermometer that companies can use to feel their health in this hectic market. This paper compares two countries, Mexico and Sweden, which are considered to be quite different in culture and industrial structure, in terms of the use of continuous improvement tools and techniques, such as TQM, Kaizen, Six-Sigma, and Lean Manufacturing.

The surveys in the two countries are based on the same scale, sample size, and industrial sector. A definition of each of the key-words was included in the questionnaire. The results indicate both similarities and differences in the strengths and weaknesses of the companies. The companies can work on the results to benchmark themselves and they can reinforce their strengths as well as to reduce their weaknesses.

Keywords: Continuous improvement, practical applications, survey

INTRODUCTION

According to Womack (2002), president and founder of LEI – Lean Enterprise Institute, Inc., there is no "right sequence" to follow in tackling lean and continuous improvement problems. However, the authors respect any feasible sequence choice, but suggest a historical sequence starting from total quality management culture concepts, and tools. Then, follow the kaizen, lean concepts, and the six-sigma approach. Simultaneously, in each step consider some gradual dosage of empowerment. All of these might lead to self-organization.
Based on the above-mentioned sequence, the researchers in Mexico started a research on continuous improvement applications in organizations in the Mexico City area, emphasizing the metal-mechanic sector. The choice of this sector was made because it is a very well represented sector with a range of possibilities of being a general picture of Mexican industry as a whole. During the survey, a scale was used that was created by one of the authors, which was specifically designed for continuous improvement applications.

The findings of the Mexican study, that were presented at the joint conference Euroma-POMS in Como 2003, has now been extended to include Sweden, a country that is estimated to be quite different in terms of industrial tradition, labor legislations etc. This article presents a comparison between these two studies.

CONTINUOUS IMPROVEMENT

The tools examined as continuous improvement applications were total quality management, seven quality control tools, statistical process control, design of experiments, kaizen workshops, lean concepts, six-sigma black belt approach, and empowerment. These tools are briefly described below.

Total Quality Management – TQM

Quality philosophies (Deming, 1982, 1986; Juran, 1964, 1988, 1989; Ishikawa, 1986, 1990; Feigenbaum, 1951; Crosby, 1979) are based on a customer focus. The total quality management process was based on Deming’s principle, Juran’s approach to quality improvement, and Feigenbaum’s company-wide approach to quality control (Stephanou & Spiegel, 1992). Ishikawa (1986, 1990) added some contributions in Japan such as the cause-and-effect diagram and quality control circles. Crosby (1979) introduced the “zero defect” concept. Howe et al. (1995) state that,
despite some successes, TQM has shown that 60-70% of the programs fail to achieve their stated objectives.

**Seven Quality Control Tools**

According to Ishikawa (1986, 1990), the tools are Check sheets, Pareto Diagram, Cause-and-Effect Diagram, Histogram, Scatter Diagram, Run Charts, and Flow charts. These tools are very well known and were used even before the quality movement. Some of them were used before in different areas, such as Pareto Diagram, which was used in the ABC purchasing policy.

**Statistical process control**

The main areas of application of statistical process control (SPC) are for control, for analysis, for adjustment, for inspection (Ishikawa, 1990), and for a useful graphical representation of the data. Periodic samples of the output of a production process are taken, and then compared with the control limits to see whether the process is in control or out of control.

**Design of experiments**

Design of experiments consists of all efforts to use analysis of variation, in many cases applying experimental designs and Taguchi techniques. According to Montgomery (1997), the application of experimental design techniques early in process development can result in (a) improved process yields, (b) reduced variability and closer conformance to nominal or target requirements, (c) reduced development time, and in (d) reduced overall costs. Moreover, it can be used to evaluate and compare basic design configurations and material alternatives.
The National Quality Award criteria

Mexico formally started to deal with continuous improvement by creating its National Quality Award soon after the Americans started the Malcolm Baldrige National Quality Award. Sweden has for a number of years also had its own national quality award, i.e. the Swedish National Quality Award, issued by the Swedish Institute for Quality (SIQ). The criteria are based on any of the following three models: The EFQM Excellence Model, The Malcolm Baldrige National Quality Award, or SIQs own model for improvement.

Kaizen

A Kaizen workshop deals with ongoing improvement involving everyone, from top management to middle manager, from supervisors to workers (Imai, 1986). Kaizen looks for active participation of all department members involved in a process within a non-blame company culture. It is a problem solving process approach used to obtain gradual improvements. Immediate actions are carried out and some follow-up meetings are scheduled for the more time-consuming suggestions.

Lean Concepts

The proponents of lean production emphasize five elements (Jones, 1992) of plant organization in the lean system: (1) the delegation of responsibilities to front-line workers; (2) their organization into work teams; (3) employee involvement in continuous improvement; (4) the use of visual factory controls; and (5) the use of just-in-time to eliminate in-process buffers and eliminate waste.
Six-sigma Approach

Based on the statistical theory, the six-sigma approach was launched by Motorola and popularized by Jack Welsch, GE’s C.E.O. It consists of the application of DMAIC – Design, Measure, Analyze, Implement, and Control – projects supported by a consistent training basis and applications aimed at reducing defects and improving process productivity (Pande et al., 2000).

Empowerment

Empowerment consists in giving responsibility and participation in the decision-making process. Rayner (1994) states that many U.S. corporations are trying to increase the level of workforce participation and involvement in the decision-making process. Employee empowerment aims at the development of the capability of the workforce. In doing so, the organization can be more flexible and ready to adapt to change.

A short definition of each item is provided in the questionnaire (Appendix) to guarantee a perfect understanding of the techniques to be compatible for all subjects.

APPLICATIONS

Companies are using many tools and techniques to improve their performance. This work provides a parameter of continuous improvement in organizations in Mexico as well as in Sweden. Using the results of this work, Management can reflect on its own performance. Managers can also use the scale employed in the survey to have a self-evaluation leading to the identification of strengths, and opportunities for improvement; and to analyze the unsuccessful endeavors from the past. When verifying the results of one technique, and the stress given to it, it is possible to compare this with the allocation of resources to get its results.
Companies can use it in the preparation of their strategic planning in order to have a clear picture of the current situation. Furthermore, they can make projections for the future. After that, they can keep their current records to compare with the data they will collect the following year when they are reviewing the plan. A set of many years can give them information enough to create a dynamic time series.

Consultant professionals will benefit from the analysis of the survey results, or by using the scale in another survey. Therefore, the consultants can establish priorities for their customers.

**SURVEY METHODOLOGY**

The methodologies during the research varied between the studies of the two countries.

The Mexican study was based on the following steps. First, the authors got a random directory from trade associations, and other mailing list sources were contacted. The idea is to gather the most representative responses from the groups. Then, 400 questionnaires was sent to the respondents, which were directors, manager, and engineers. 102 answers were received in a period of 45 days, 17 questionnaires were rejected because they did not attended the research requirements, such as incomplete answers, and repetitions. Later, the data were compiled, and run in the Minitab software.

The Swedish study was performed by means of an e-mail survey. About 560 e-mails were sent to companies, often their PR- or HR-departments, where the recipient was asked to forward the e-mail to the managing director or production manager. The e-mail contained a link to the questionnaire that was placed on the WEB-server of Jönköping University and the data was automatically forwarded into an Access database. About 60 e-mails bounced since the recipient was not still active and a total of 83 answers were complete and could be used in the further analysis. These answers were run in SPSS software.
SURVEY RESULTS

There were 53 companies from the metal-mechanic sector, 31 from all other manufacturing sectors, and 32 from service companies. Owing to the random nature of the survey but with a slight focus on the metal-mechanic sector, this sector represented 26%.

From the Mexican study (Borges & Muñoz, 2003) a total of 56% were large companies (more than 250 employees), 18% were medium sized (101-250), 22% were small sized (11-100), and the remaining 4% were micro companies (0-10 employees). One can assume that there is a tendency that managers of big companies are more inclined to respond to technical questionnaires.

57% of the companies were international companies, and 43% were Mexicans. Although the international companies have almost the same value as the big companies, it is not valid to say that all big companies are international because some international companies have a small or medium subsidiary in Mexico.

The Swedish survey was answered by 13 % large companies, 22 % medium sized, 51 % small sized, and 14 % micro companies. 58% of the Swedish companies act on an international market. The survey presented the results shown in Table 1, and you can infer that the TQM, SPC, QC Tools, Baldrige Customer Focus, and Process criteria were considered successful and standardized for the majority of the companies (more than 30%). Baldrige human resources focus, strategic planning, and Information & analysis criteria were implemented and still waiting results. And there is equilibrium among the remained in all other values.
Table 1 – Survey results in %

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1. Successful and still applying 5. Not Successful and still applying
2. Successful and standardized 6. Not Successful and discontinued
3. Implemented, waiting results 7. Not interested in implementing at this
time
4. To implement in the future

The authors ran the data in the MINITAB software and the following main results were noticed:

*Chi-Square Test – Sweden and Mexico*

1. TQM

   \[ p = 0.047 < 0.05 \]

   It seems that there is evidence that a relationship is present between the TQM use in the two countries.

2. SPC, Kaizen and Six-Sigma: \( p = 0.387, 0.843, \) and 0.948 respectively – with all > 0.05

   This indicates that there is not any evident relationship in the use of the techniques SPC, Kaizen and Six-Sigma in the two countries.

*Logistics Regression between Country and Technique*

There is no significant difference between the countries, that is, the technique does not affect the
two countries $p = 0.504 > 0.05$

Between Techniques:

It seems that there is no significant effect between at least one technique (in this case the three: SPC, TQM, and Lean) with $p$ – values $= 0.000, 0.000$ and $0.038$ respectively.

The interaction between Techniques and Countries does not affect.

The Test all slopes are zero with $p = 0.00$ can tell that the model is significant.

All Goodness of Fitness tests are greater than $0.248$ which is good.

The measures of association resulted in $63.4\%$ agreed (which is close to $70\%$) although there are many variations between the interpretation of the use of the techniques, like SPC, TQM, Lean, and 6-Sigma which have many common tools; therefore, one can say that the results were not that bad.

The authors also made a comparison between how the companies answered two of the most important questions, about TQM and Kaizen, related to the size of the companies. The comparison is shown in Table 2. The results show that the larger companies in both countries have been more positive to implementing TQM. It is remarkable that even the smaller Swedish companies have reached very far in this aspect. The difference related to company size is larger at the Mexican companies. Kaizen seems to be of considerably lower interest to all companies, especially to the smaller Swedish companies. The larger Mexican companies indicate that they are planning to implement Kaizen in the future and some of the companies have already reached quite far in that aspect.

A general observation, when comparing how the companies in the two countries have answered the survey, is that the Mexican companies seem to be more willing to answer that they “have thought about the issue and they will probably implement the tool in the future”. The Swedish companies answer to a higher degree that they either have already reached quite far or that they
are not interested of implementing the tool at all.

Table 2 – Survey results number of companies related to size of companies for TQM and Kaizen, respectively

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CONCLUSIONS

The results from this comparative study between companies in Mexico and Sweden indicate that there are significant differences in the interest and implementation of tools related to continuous improvement and TQM aspects. If we group the answers in three main categories, answers 1-3 (implemented in one stage or another), answers 4-5 (will probably be implemented), and 6-7 (interrupted or not interested), we get the following results:

- Between 44 and 87 % of the Mexican companies answer that they are in a stage where they have implemented the different tools. The Swedish figures vary between 10 % (6-Sigma) and 81 % (Human Resources). The differences in how the companies have answered the survey are significant.
- The countries show approximately the same figures regarding TQM, Customer Focus, Human Resources, Strategic Planning, Information and Analysis, and Process Development.
• The Mexican companies show higher values of implementation regarding Statistical Quality Control and Empowerment.

• The Mexican companies show significantly higher values regarding utilization of Quality Control Tools, Design of Experiments, Kaizen, Lean Manufacturing, and Six-Sigma Tools.

The reason why we get these differences between the surveys in the two countries is unclear. It could of course be due to a real higher implementation rate and higher interest for these issues at the Mexican companies. The closeness to the US and being suppliers to American companies, that demand higher performance, are probably important factors. Another explanation could perhaps be found in differences in culture.

SUGGESTIONS FOR FURTHER RESEARCH

This research show both similarities as well as differences between companies in Mexico and Sweden. Some of the differences could however be more related to culture and how companies believe that the researchers would like them to answer. It would be very interesting to do a series of deeper interviews at a number of companies to determine IF there are differences and HOW these differences show in the operations of the companies. This series of interviews could also be extended to other related areas, such as discussing how the companies work with manufacturing and manufacturing strategies, as well as studying relation between what the companies want to achieve and how this is shown in the design of the activities and production systems (the results of a Swedish study is presented in Winroth, 2004).
REFERENCES


The survey sent to the companies was the following:

Please choose the more appropriate evaluation for each item below.

1. Successful and still applying
2. Successful and standardized
3. Implemented, waiting results
4. To implement in the future
5. Not Successful and still applying
6. Not Successful and discontinued
7. Not interested in implementing at this time

1. Total Quality Management - Training and Motivation to reach the worker’s maximum potential.
Continuous improvement aiming at customer satisfaction.

Use of 7 Quality Control Tools.

3. Quality Control Tools - Use of DOE for process optimization Malcolm Baldrige Award criteria.

4. Design of experiments - Use of DOE for process optimization

5. Customer Focus - Market and customers requirements, expectations and preferences.

6. Human Resources – Training and Motivation to reach the worker’s maximum potential.

7. Strategic Planning - Objectives and Action plans development and deployment.

8. Information and Analysis - Systems management for performance measurement.


10. Kaizen workshops – Kaizen/Lean Concepts & Six Sigma
Frequent use of Kaizen workshops for continuous improvement in all levels.

11. Lean Manufacturing -

Use of Just-in-Time, Lean concepts, Cell manufacturing aiming reduction of waste.

12. Six-Sigma tools -

Use of 6-sigma methodology to improve processes, or products, based on projects.

Empowerment

13. Empowerment -

Operational autonomy for different teams to make decision.

Please check the appropriate answer:

Do you think that it is possible self-organization in your company?

Yes _____ No_____ Didn’t think _____

Is the competition very tough in your market segment?

Yes _____ No _____ Didn’t think _____

Is the trend to become worst in the near future?

Yes _____ No _____ Didn’t think _____

Do you think that cooperation will increase in the market in the near future?

Agree _____ Disagree _____

If you disagree, why?__________________  

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