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Continuous improvement comparison between Danish and Mexican Companies

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Abstract

This article investigates continuous improvement tools that are used in two countries on two continents. For that purpose two surveys were conducted in the metropolitan area of Mexico City and in Denmark using the same scales and having about the same sample size. The continuous improvement tools comprise such concepts as TQM, Kaizen, Six Sigma and Lean Manufacturing. The paper shows the results of the analysis and a comparison of how and to what degree such tools are used in different places, which allow us to address similarities and dissimilarities of the application. The results are discussed from a Mexican and a Danish perspective separately.

Introduction

The purpose of this article is to accompany a presentation at POMS 2004. The presentation is meant to raise discussion about the findings in the study. Therefore, the article only reports the analysis of the data from the surveys and discusses the results. It does not contain a literature review and a firm and final conclusion to the propositions raised in this study.

The notion of Continuous Improvement can have many interpretations. The perhaps most narrow is to state that Continuous Improvement is the English translation of the Japanese notion of “Kaizen” which is in opposition to “Kaikaku”, which means radical improvement (Imai, 1986).
Another interpretation is to state that continuous improvement refers to attempts to improve value creating and delivering processes without radically changing them (or reengineering them, cf. Hammer and Champy, 1993). Then continuous improvement can comprise numerous improvement programs, many of which being used in Japan. Such programs include Total Quality Management (TQM), Kaizen, Lean Manufacturing and Six Sigma. Looking at these programs, there seems to be a difference with regards to maturity with TQM being the oldest and Six Sigma the youngest when it comes to practical application. TQM for example is seldom heard of in Denmark these days, some call it Business Excellence and others just refer to it as Performance management. Also Kaizen as an independent program is rather unheard of these days, however as well as with TQM it is a very important element for successful Lean implementation. Finally, as TQM, Kaizen, Lean and other programs improve companies’ processes, they are worthy opponents for experienced Six Sigma black belts. Therefore, it might be expected that the level of implementation of programs differ amongst companies according to their maturity.

P1: Differences in degree of implementation of different programs can be found empirically in Mexico as well as in Denmark

From a macro-economic point of view, there are many differences between Mexico and Denmark as well as a few similarities. One important similarity is that both Mexico and Denmark are small industrial countries compared to larger neighbouring countries, i.e. Denmark compared to Germany and Mexico compared to US, and have only few leading
large sized international manufacturing companies. Further, both countries were
industrialized late, Denmark as late as in the 1950s and 1960s while Mexico still is in this
process, therefore none of the countries have a long industrial tradition.

Even though some similarities can be identified, the differences are much more
outstanding. Denmark is a highly developed country, with a high standard of living and
high taxes on income as well, while Mexico still is an industrializing country of somewhat
lower average standard of living. In this way, Mexico is a low-cost manufacturing site for
many US companies, while Denmark is a high-cost environment, in which many
companies try to outsource their manufacturing to Eastern Europe or even to China or
other Far East Asian countries. Even though this is the case, the national quality award
was issued earlier in Mexico than in Denmark. In Mexico, the first Mexican National
Quality Award was awarded in 1988 (inspired by the National Malcolm Baldridge Quality
Award), just one year after its introduction in the US. Not until 1993 did Denmark issue a
national quality award (inspired by the European Quality Award). Therefore, even though
it might seem more urgent for Danish companies to adopt quality improving and cost
cutting programs than for Mexican, the case of the Quality Award indicate that this might
not necessarily be the case. It might actually be expected that there are no differences
between the two countries in implementing continuous improvement programs. Hence,
from a macro-economic point of view, there are many differences between Denmark and
Mexico, but at the micro-economic level, these differences might not necessarily exist –
all companies compete on the same international market place following the same set of
international rules.
P2: There is no systematic difference in degree of implementation of continuous improvement programs between Denmark and Mexico.

Methods

This section describes the methods lying behind this article. It is structured in two subsections. First the surveys are described and afterwards the constructs used are described.

Surveys

The research is based on two surveys issued separately in Denmark in autumn 2003 and in Mexico in autumn 2002 with the latter as the reference. The Mexican survey was developed in the following steps. First, the Mexican author got a random directory from trade associations and other mailing list sources were contacted. Then, there were 400 questionnaires sent to the respondents in the Mexico City metropolitan area. The respondents were typically directors or manager of manufacturing. 97 answers were received. Most respondents were in the metal/mechanical industries.

The Danish survey was based on the English version of the Mexican survey and was kept in English to delimit the possible bias coming from multiple translations from English. The survey was sent by e-mail to 276 companies coming from the two NAC-codes: 280000 and 290000 (Metal and mechanical industries), and the typical respondent was director of manufacturing. Besides, 75 questionnaires were sent to companies that the
Danish author was in contact with on other matters, here also the director of manufacturing was asked to respond. In total 89 responses were received.

* Constructs *

The specific programs examined are total quality management, seven quality control tools, statistical process control, design of experiments, kaizen workshops, lean concepts and six-sigma black belt approach. These 7 programs comprise the notion of “continuous improvement” (see Borges and Muñoz, 2003) for a detailed description of the content of these programs.

Besides, five criteria from the Malcolm Baldrige Quality Award were investigated. These were Customer focus (market and customers requirements, expectations and preferences), Human resources (training and motivation to reach the worker’s maximum potential), Strategic planning (objectives and action plans development and deployment), Information and analysis (systems management for performance measurement), Processes (process development management for operation units), finally Empowerment (operational autonomy for different teams to make decisions) was included as well and will also for the sake of simplicity be considered a QA-practice.

Each program and QA-practice was evaluated by selecting one of the following seven options:

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

This can be called an ordinal scale, which means that “the categories must ... be mutually exclusive and exhaustive, but they also indicate the order of magnitude of some variable” (Minium et.al., 1993). In principle, this qualifies data for non-parametric statistical tests.

The two questionnaires appear as appendix 1 (Mexico) and appendix 2 (Denmark).

**Results**

Table 1 show that the sizes of responding companies differ substantially. For both samples, the median company size (measured as number of employees) is relatively small (125 vs. 211 employees), however in the Mexican sample more than 25% of the companies have more than 1500 employees, while only 10 percent of the companies in the Danish sample has more than 500 employees.
### Table 1: Company sizes in samples.

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Mexican sample</th>
<th>Danish sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2565</td>
<td>269</td>
</tr>
<tr>
<td>Median</td>
<td>211</td>
<td>125</td>
</tr>
<tr>
<td>10 percentile</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>25 percentile</td>
<td>93</td>
<td>74</td>
</tr>
<tr>
<td>50 percentile</td>
<td>211</td>
<td>125</td>
</tr>
<tr>
<td>75 percentile</td>
<td>1500</td>
<td>247</td>
</tr>
<tr>
<td>90 percentile</td>
<td>7096</td>
<td>455</td>
</tr>
</tbody>
</table>

Even though the size of the average Mexican respondents is significantly higher than the average Danish respondents, the Danish companies are not smaller than it can be assumed that they are capable of coping with improvement programs and QA-practices.

For sake of simplicity the data have been transformed into a new ordinal scale as shown in table 2. The purpose of developing a new scale is to have four distinct categories, one for successfully implemented programs and QA-practices, one for programs/QA-practices that have been implemented, but have not yet shown results, a category for programs/QA-practices that the respondent plan to implement in the future, and finally a category for programs/QA-practices that are not relevant at this particular point in time.
<table>
<thead>
<tr>
<th>Old category</th>
<th>New category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “Successful and still applying”</td>
<td>1. Successful and still in use</td>
</tr>
<tr>
<td>2. “Successful and standardized”</td>
<td></td>
</tr>
<tr>
<td>3. “Implemented, waiting for results”</td>
<td>2. Implemented, but not successful yet</td>
</tr>
<tr>
<td>5. “Not successful, but still applying”</td>
<td></td>
</tr>
<tr>
<td>4. “To implement in the future”</td>
<td>3. To implement in the future</td>
</tr>
<tr>
<td>6. “Not successful and discontinued”</td>
<td>4. Not relevant at this particular time</td>
</tr>
<tr>
<td>7. “Not interested in implementing at this time”</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Categories from questionnaires transformed to categories for analysis in this article.

With the new scale at hand, table 3 provide the results of the two surveys in Mexico and Denmark.
<table>
<thead>
<tr>
<th></th>
<th>Mexico</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Denmark</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement programs</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total Quality Management</td>
<td>75</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>26,7</td>
<td>25,6</td>
<td>30,2</td>
<td>17,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical Quality Control</td>
<td>81,2</td>
<td>18,7</td>
<td>0</td>
<td>0</td>
<td>44,8</td>
<td>13,8</td>
<td>14,9</td>
<td>26,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seven Quality Control Tools</td>
<td>66</td>
<td>30,9</td>
<td>3,1</td>
<td>0</td>
<td>5,9</td>
<td>7,1</td>
<td>20</td>
<td>67,1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design of Experiments</td>
<td>54,2</td>
<td>40,7</td>
<td>5,2</td>
<td>0</td>
<td>11,9</td>
<td>7,2</td>
<td>19</td>
<td>61,9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaizen workshops</td>
<td>46,4</td>
<td>47,4</td>
<td>6,2</td>
<td>0</td>
<td>14,4</td>
<td>18,1</td>
<td>28,9</td>
<td>38,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lean Manufacturing</td>
<td>55,7</td>
<td>36,1</td>
<td>8,2</td>
<td>0</td>
<td>14,3</td>
<td>28,6</td>
<td>40,5</td>
<td>16,7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Six Sigma tools</td>
<td>37,2</td>
<td>56,7</td>
<td>6,2</td>
<td>0</td>
<td>3,6</td>
<td>9,5</td>
<td>21,4</td>
<td>65,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QA-practice</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Focus</td>
<td>80,5</td>
<td>18,5</td>
<td>1</td>
<td>0</td>
<td>57,8</td>
<td>25,3</td>
<td>10,8</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Resources</td>
<td>70,9</td>
<td>21,9</td>
<td>7,3</td>
<td>0</td>
<td>53,5</td>
<td>24,4</td>
<td>18,6</td>
<td>3,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Planning</td>
<td>74,2</td>
<td>21,7</td>
<td>4,1</td>
<td>0</td>
<td>54,2</td>
<td>30,6</td>
<td>11,8</td>
<td>3,6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information and analysis</td>
<td>70,1</td>
<td>24,7</td>
<td>5,2</td>
<td>0</td>
<td>36,6</td>
<td>30,5</td>
<td>20,7</td>
<td>12,2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processes</td>
<td>69,8</td>
<td>25</td>
<td>5,2</td>
<td>0</td>
<td>33,3</td>
<td>15,5</td>
<td>29,8</td>
<td>21,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empowerment</td>
<td>69</td>
<td>29,9</td>
<td>1</td>
<td>0</td>
<td>25</td>
<td>23,8</td>
<td>20,2</td>
<td>31</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Table 3: Responses from Mexican and Danish survey. The most frequent answers appear in a shaded cell. Refer to table 2 for label of column.

With table 3, the two propositions can be addressed starting with P1.
P1: *Differences in degree of implementation of different programs can be found empirically in Mexico as well as in Denmark*

Strictly speaking this proposition is supported in table 3. However, in the Mexican survey, only Six Sigma and Kaizen workshops differ in the sense that they have not yet shown results. Looking at the numbers in column 1 for Mexico also show that Total Quality Management and Statistical Quality control together with the QA-practices have been implemented successfully by roughly 3 out of 4 companies. Lean Manufacturing and Design of Experiment lack somewhat behind, while only Kaizen workshops and Six Sigma tools have not proven successful yet. Therefore, in the Mexican survey, we can observe that the Quality movement from the 1980s seem to have worked well in Mexico. Now, it seems like the Mexican firms have turned to the other improvement programs as well.

However, it is interesting to note that not one single Mexican respondent have indicated that one single program or QA-practice is not relevant for his/her company, and at maximum 8% of respondents have not yet started implementing a program/QA-practice. The program that most respondents still have not implemented is Lean Manufacturing.

The data show that there are differences amongst the programs/QA-practices in the Mexican survey, but it seems like the Mexican companies not really choose between them, but try to implement all with more or less success. Hence, their “continuous improvement” strategy seems unclear, or perhaps it just is an “anything goes” strategy.
The Danish survey demonstrates a somewhat more modest degree of implementation of programs/QA-practices. First of all, it can be seen that the QA-practices (except empowerment) are successful or at least implemented to a high degree. Especially Customer focus, Human resources and Strategic planning seems to be successful and of relevance for the majority of responding companies. Also Total Quality Management and especially Statistical Quality Control have been implemented with more or less success. Again we find that the Quality movement leaves some marks.

The next major “thing” to do appears to be Lean Manufacturing. This is not surprising given the huge attention Lean Manufacturing and Lean Thinking have these years in Denmark (as well as other Western countries), and also Kaizen workshops seems to be becoming more relevant for companies as well. However, programs like Seven quality control tools, Design of Experiment and Six Sigma are deemed not relevant for about 60% of responding companies. In general, it is interesting to observe the relative little use employee involving programs such as Seven quality tools and Kaizen workshops together with the QA-practice Empowerment have. If for example companies want to implement Lean Manufacturing, the involvement of employees is crucial for its success, and therefore it is interesting to observe that especially Seven quality control tools are not considered of higher importance for the continuous improvement activities in Danish companies.
In any case, P1 fits nicely with the Danish survey, meaning that there are differences in degrees of implementation of different programs and QA-practices. Again, we find scant evidence for difference in maturity of different programs.

Next, P2 is focusing on differences between Mexico and Denmark, and as a starting point it is suggested that

P2: There is no systematic difference in degree of implementation of continuous improvement programs between Denmark and Mexico.

A glance at table 3 will show that the data cannot support this proposition, there seems to be very large differences. These differences will not be investigated statistically even though non-parametric tests would be possible. We think that the data stand out for themselves.

In general, the major difference between Mexico and Denmark is that all programs are implemented in Mexico, it just differs whether they are successful yet or not, while not all programs/QA-practices are considered relevant amongst the Danish respondents.

In order to shed some further light to the differences between Mexico and Denmark, table 4 provides some data about the average frequencies across programs/QA-practices.
Table 4: Averages for programs and QA-practices.

<table>
<thead>
<tr>
<th>Program/criteria</th>
<th>Mexico</th>
<th>Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  %</td>
<td>2  %</td>
</tr>
<tr>
<td>Average for all programs/QA-pract.</td>
<td>65,4</td>
<td>30,6</td>
</tr>
<tr>
<td>Average for programs</td>
<td>59,4</td>
<td>36,5</td>
</tr>
<tr>
<td>Average for QA-practices</td>
<td>72,4</td>
<td>23,6</td>
</tr>
</tbody>
</table>

Table 4 show that the difference between Mexico and Denmark is consistent also when dividing into programs and QA-practices. For Denmark it can be seen that there is a rather large difference between programs and QA-practices with regard to successful use. In general the QA-practices are implemented or will be implemented, while a rather large part of the respondents find that a number of programs not are relevant at this time.

To shed further light to the differences and similarities between Mexican and Danish companies, it is investigated if it is the same programs and QA-practices that are successfully implemented in both countries. Table 5 report this short analysis.
Mexico | Programs (Successful and still in use) | Total quality management, Statistical quality control, Seven quality control tools, Design of experiments, Six Sigma |
| QA-practices (Successful and still in use) | Customer focus, Strategic planning |

Denmark | Programs (Successful and still in use) | Total quality management, Statistical quality control, Seven quality control tools, Design of experiments, Six Sigma |
| QA-practices (Successful and still in use) | Customer focus, Human resources, Strategic planning, Empowerment |

Table 5: Programs and QA-practices with frequencies higher than the average for “Successful and still in use” (based on tables 3 and 4). In italic the programs and QA-practices with frequencies higher than average for “Not relevant at this particular time”.

Table 5 shows that it to some extent are the same programs and QA-practices that have been successful and still are in use. However, one major difference can be seen. Seven quality control tools is extensively used in Mexico, while it is not used very much in Denmark.

To address the second proposition, tables 3 – 5 provide solid indications that there are differences between the implementation and use of programs and QA-practices between
Mexican and Danish companies. Mexican companies implement and use all types of programs and QA-practices, while Danish companies seem to be much more reserved in their approach to improvement programs and QA-practices.

The next section will discuss the findings and provide suggestions for how to interpret the findings.

**Discussion**

In this section, the results found will be discussed. Reasons for the differences will be discussed and implications for the two countries will be addressed. The results are indeed interesting, and somewhat surprising. However, a few technical explanations can be suggested, and they will be discussed below.

First of all, the fact that the questionnaire was issued by different persons in different countries in different languages in different years might account for some of the differences.

Secondly, the huge difference in size of the average responding company between Mexico and Denmark might explain some of the difference. However, if it was assumed that the programs were measured on a 7 point Likert scale, the data do not show any correlation between size and the implementation of programs or QA-practice. Hence, there are no indications that size matters that much.
Furthermore, the questions are essentially perceptual, hence a program that one find “successful and still in use” could be judged “Implemented, but not successful yet” by another respondent. But still, most respondents should not misunderstand “Successful and still in use” with “Not relevant at this particular time”, hence even though perception might reduce the validity somewhat, this should also be within countries not just between countries.

Is it therefore assumed that “technical” explanations are not sufficient to explain the differences, hence other reasons must he sought. This is done by dividing the rest of the discussion into two parts letting each author give his interpretation of the results seen from his country’s perspective.

*The Mexican interpretation*

To sum up, the surveys show that the Mexican way is somewhat different from the Danish way:

- Big companies in the Mexico City metropolitan area are the majority of respondents; therefore, they have more resources capacity to implement the programs, and the criteria.
- Most of companies are international or multinational, with strong American presence in the area. It seems that this American (or multinational) influence has a significant weight in the application of the programs.
- Mexican companies are successfully using Total Quality Management, Statistical Quality Control, Seven Quality Tools, and some Award criteria.
• Mexican companies can pursue better results by applying some techniques such as Lean Manufacturing, Kaizen and Six-Sigma.

Differences in culture might explain some of the difference between Denmark and Mexico with respect to the way to approach and answer a questionnaire. Kras (1989) states that there are many cultural differences between Anglos (in the U.S.A) and Latinos (in Mexico). She centred her comparisons on cultural traits and management styles. One that is important is that Anglos are direct and Latinos are indirect. If this is the case, it seems that the Danish are more like an Anglo than like a Latino; therefore, they face the questionnaire in a more straight way than the Mexicans. Therefore, Mexican respondents might be more inclined to answer in favour of successful implementation of improvement programs and QA-practices than Danish respondents have done.

*The Danish interpretation*

In short, the results from a Danish perspective are:

• Danish companies are quite selective with regards to what programs to implement and use

• Danish companies use the NMBQA-criteria considerably more on average than they use the improvement programs

• Danish companies in general use criteria and programs to a much lesser degree than Mexican companies

• Employee involving programs such as Seven quality control tools, Kaizen and Empowerment do not have a high priority in Danish companies
• Programs such as Seven quality control tools, Design of Experiments and Six Sigma are deemed “not relevant at this particular time” by about 2/3 of the Danish respondents.

The selectivity towards programs that the Danish companies demonstrate might indicate that they are lead by some kind of strategy. This is the positive interpretation. From this standpoint the fact that the Mexican companies seem to implement everything could be a too much, and might not be an efficient use of company resources. Therefore the selectivity that the Danish companies show might be good.

However, the fact that the Danish companies on average are so much behind their Mexican co-respondents is quite alarming. What are likely reasons behind this?

First of all, it is alarming that Mexican companies seem to be much more active in improving their operations than their Danish counterparts. Compared to USA, Mexico is a low wage country, and should thereby have a small advantage compared to companies from USA and a priori be able to compete on price. Danish wages are high and Danish companies are disadvantaged when they have to compete on price. Therefore, one might expect Danish companies to be very keen on improving their operations – and thereby reducing cost. The results do not support this expectation and a study of Danish manufacturers from 2002 do indeed show that in general, price is the most important competitive priority for Danish manufacturing companies (Christiansen and Bruun, 2002).
Therefore, this discussion has the starting point that what is found in table 3 is not satisfying for Danish industry unless decent explanations can be developed. Here, three possible explanations are discussed.

The first explanation is that most Danish companies compete in niches where price and constantly improving operations is not vital. Product features, relationships and other non-manufacturing specific competitive priorities might be of higher importance. Also many companies might not yet compete globally, the survey included many relatively small companies, hence they might still be somewhat protected by the Danish borders. However, as already stated, previous research have shown that price is a very important competitive priority (Christansen and Bruun, 2002), hence a considerable fraction of Danish companies need to have relatively low cost, and therefore, this explanation cannot stand alone.

The second explanation is that Danish companies believe that they are already good, that they have a manufacturing that is at level with the best in the world. If this is the case, there is no need for further improvement. The data cannot shed light to this explanation, but previous studies by IBM Consulting (1994) showed that the not so well performing companies tended to overestimate their own performance, see figure 1.
Based on the already mentioned report, it is the Danish author’s conviction that many Danish companies do not realise their competitive position and therefore overestimate their own competitiveness, which lead to a lack of willingness to engage in improvement programs.

The third explanation is that Danish manufacturing companies to some extent have given up improving their manufacturing in Denmark and instead consider outsourcing or moving manufacturing to a low cost country instead. If this is the reason, it is a very dangerous path to follow, since both outsourcing and especially moving manufacturing abroad actually requires that the present manufacturing system is clearly specified and well running, else huge costs might occur during the transition.
All the above explanations are possible and have some merit, but are not one by one sufficient to understand the Danish responses. Data show that 40% of companies plan to implement Lean Manufacturing in the future, that 30% are going to implement TQM and almost 30% are going to implement Kaizen workshops. This is promising, but if competitors i.e. Mexican companies, already successfully have implemented these improvement programs, Danish companies will still be behind.

Especially, the fact that employee-involving improvement programs such as Seven quality control tools and Kaizen workshops and the QA-practice of empowerment not are used more than it is the case is problematic, since it is claimed that the Danish workforce is well educated. Why not use it then? Or is the Danish workforce not that educated after all?

The practical implications for Denmark should be that it is acknowledged that we do not see a “market pull” for improvement programs (as apparently in Mexico), and that we need to establish a “technology push”, as is demonstrated with Lean Manufacturing. This program has been the hot topic on most practitioners conferences the last year and a half. Companies are indeed willing to invest in Lean and work with consultants on this subject. Therefore, it should be possible to create the same awareness with other programs as well. Who to do this might be academics or some governmental agencies, as well as consultancy firms. But especially governmental agencies should encourage companies to
implement improvement programs, perhaps not so enthusiastically as in Mexico, less will
do.

**Conclusion**

This study has shown that different programs are indeed implemented to different extent in both Mexico and particularly in Denmark. It has shown that there are huge differences between the implementation and use of programs and QA-practices between the two countries, however firm explanations for these differences cannot be given.

**Limitations**

Due to the way the questions were posed, it is not possible to conduct rigorous statistical analysis of the data, hence the results are only indicative. Caution also needs to be taken when comparing the two samples due to possible differences in culture and ways of answering questionnaires. In fact, more contingency variables might have been useful to ensure that the samples indeed can be compared.

**Further research**

The study has indicated some interesting differences between Denmark and Mexico. The study has not been able to give explanations to why these differences are found. To do this, in-depth case studies must be conducted. First of all to uncover why respondents have answered the way they have, i.e. why the typical Mexican respondent find that his/her company work on almost all improvement programs, while the typical Danish respondent find that several of the programs are even not relevant to engage in.
A further road for improvement is a literature review. Other researchers have compared improvement programs across countries, perhaps not between Mexico and Denmark, but studies on differences between Mexico and US do exist. These should be investigated to improve the article.

References


Kras, E. (1989), Management in Two Countries: bridging the gap between U.S. and Mexican managers, Intercultural Press, Yarmouth, ME.
APPENDIX 1 (Mexico)

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 - _____
   (Continuous improvement aiming at customer satisfaction.)
2. Statistical Quality Control - _____
   (Use of Process control charts.)
3. Seven Quality Control Tools - _____
   (Use of 7 Quality Control Tools.)
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.)

9. Processes –
(Process development management for operation units.)

Kaizen/Lean Concepts & Six Sigma

10. Kaizen workshops -
(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? _______________

______________________________
APPENDIX 2 (DENMARK)

Please choose the more appropriate evaluation for each item below and type in coloured box.

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

1. Total Quality Management  
   (Continuous improvement aiming at customer satisfaction)

2. Statistical Quality Control  
   (Use of process control charts)

3. Seven Quality Control Tools  
   (Use of 7 Quality Control Tools)

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)

9. Processes
   (Process development management for operation units)

10. Kaizen workshops
    (Frequent use of Kaizen workshops for continuous improvement at all levels)

11. Lean Manufacturing
    (Use of Just-in-Time, Lean concepts, Cell manufacturing aiming at reduction of waste)

12. Six Sigma tools
    (Use of 6-sigma methodology to improve processes or products based on projects)

13. Empowerment
    (Operational autonomy for different teams to make decisions)
14. Total Productive Maintenance (TPM)  
   (Optimal availability of manufacturing resources)

15. Value Stream Mapping  
   (Mapping the value creating flow)

Answer the following questions with your primary product line in mind.

Nature of manufacturing operations (select one):

Discrete  
Process  
Both  

Primary product mix (select one):

High-volume/high mix  
High-volume/low-mix  
Low-volume/high mix  
Low-volume/low mix  

Do you (select one):

Design to order  
Engineer to order  
Make to order
Assembly to order  
Make to stock  

Is the competition tough in your market segment?
Yes  
No  
Don’t know  

Answer the following questions with your plant in mind

How many employees are at plant?  

How many employees at plant work full time on systematic continuous improvement?  

Answer the following questions with yourself in mind

What is your job title?  

Considering your time spend on work, which proportion [in %] is spend on:

Daily operations  
Fire-fighting  
Systematic continuous improvement activities  