A TOOL FOR MEASURING QUALITY CULTURE

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Abstract – Today's organizations face the challenge of measuring the right things and then using those measurements as a starting point to work with improved quality. It is important to design a measurement tool that corresponds to the initiatives taken when a new management implementation such as adopting quality values is carried out. The failure to generate a shared value base is pointed out as one main cause for the inability to effectively apply Quality Management and Lean within organizations, thus it appears central to measure these values. However, the measuring of values and organizational culture, e.g. the soft side, seems to be missing within both concepts. The managers have great influence on what culture will be predominant in an organization, and how they act and behave affects the attitudes and behaviours of the co-workers within the organization. Therefore, there is a need for a tool that measures not only quality values, but also behaviours that support or obstruct a quality culture. Furthermore, it is of interest how the employees rank both the performance and the importance of quality values and behaviours. The tool should not be a 'certification' but rather a diagnostic tool for continuous improvement.

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Purpose - The purpose of this paper is to describe how a measuring tool which measures Quality Culture can be designed and structured.

Methodology/approach – A project with the aim to measure and develop Quality Culture started in 2015. The overall aim of the project was to create new knowledge and insights about 1) what a quality culture is, 2) what a quality culture consists of, 3) how the quality culture can be measured and 4) how it can be developed. In this paper the work to meet the third aim and the results of that work are presented. During two workshops quality values were discussed and in the third workshop supportive and obstructive behaviours were developed and described for each quality value. This resulted in a survey where employees of the participating organizations ranked performance and importance of the described behaviours. The results were presented and discussed in a fourth workshop.

Findings – A description of how a measurement tool can be designed and structured to measure Quality Culture is presented in this paper.

Keywords – Quality Culture, measuring tool, quality values, behaviour.

Paper type – Case study

Introduction

Today's organizations face the challenge of measuring the right things and then using these measurements as a starting point to work with improved quality (Radnor and Barnes, 2007). It is important to design a measurement tool that corresponds to the initiatives taken when a new management implementation such as adopting quality values is carried out (Kollberg et al., 2007). The failure to generate a shared value base is pointed out as one main cause for not effectively applying Quality Management (QM) and Lean within organizations (Ingelsson et al., 2010), thus it appears central to measure these values. However, the measuring of values and organizational culture, e.g. the soft side, seems to be missing within both concepts (ibid). Ingelsson et al. (2010) showed in a literature study that there are similar problems when implementing Lean and QM.

A prerequisite for a successful implementing of Lean seems to be that there are at least some devoted leaders in the organization, leaders that are committed to the values within Lean and QM and who are willing to live by and act according to these values (Ingelsson et al. 2010).

In the first part of this research project the values of a quality culture were explored in literature and practice in cooperation with seven Swedish organizations (Bäckström et al., 2016). The study concluded that a quality culture can be defined by the following values:
• Customer orientation
• Process orientation
• Committed management
• Participation and cooperation
• Continuous improvements
• Base decisions on facts
• Proactivity
For each value a set of behaviour statements were developed to be used as a way of assessing to what degree a quality culture existed (Bäckström et al., 2016).

In this paper we describe how a survey could be designed to measure quality culture, by means of values and behaviours.

Methodology

A project with the aim to measure and develop the Quality Culture started in 2015. Members and founders of the project were seven Swedish organizations from different lines of business, the Swedish Institute for Quality, Mid Sweden University and Linköping University (Swedish Quality Management Academy, SQMA). The overall aim of the project was to create new knowledge and insights about 1) what a quality culture is, 2) what a quality culture consists of, 3) how the quality culture can be measured and 4) how it can be developed. In this paper the work to meet the third aim and the results of that work are presented.

During two workshops, quality values were discussed and in the third workshop supportive and obstructive behaviours were developed and described for each quality value. The academics developed a survey by using the developed behaviours. The survey was tested and used by employees of the participating organizations which ranked perceived performance and importance of the described behaviours. The survey was web-based and available in a Swedish and an English version, both with the same questions only in different languages. The seven organiza-

tions participating chose what part of the company should take part and sent out web-links to the survey. The answers were not sent to the organizations but directly to the researchers. Each organization sent the survey to between 73 and 310 respondents, in total 1016. Response rates varied between 45 % and 91 %, on average 61 %.

Results and analysis conducted by the researchers of given answers were presented to the organizations in a fourth workshop. Each organization was given heads-up information about their specific strengths and weaknesses in terms of quality values and behaviours, before the workshop, and were asked to present their methods and practices of their strong areas in the workshop. In this way the organizations could share best practises and learn from each other.

Analysis of the survey results were done in a number of ways using the methods presented below. The purposes of the analyses were to see: (i) which values and behaviours were strong or weak in each organization, (ii) if there was internal variation of perceptions within the organizations, (iii) if respondents were consistent in their answers within each quality value, (iv) if there were any correlations between answers about behaviours and/or importance, and (v) if differences between organizations were statistically significant.

Measuring quality culture

Measuring quality culture is not an easy task. In some way the values, as given above, need to be quantified. How could this be done? One way is to find objective 'hard' measurements for each value, e.g. number of customer complaints for (lack of) customer orientation, but these types of measurements are too distant from the culture of the everyday work. Another way would be to ask the employees if the values exist, e.g. "To what degree do you agree that you have customer orientation?" The problem with this approach though, is that most employees have different (or no) mental models of what 'customer orientation' is. We need to describe situations and narratives that are easy to understand. Therefore we need to define behaviours that either support or obstruct the values of a quality culture.

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The principles of leadership can be seen as examples of culture creation and management (Schein, 2004). The managers have great influence on which culture will be predominant in the organization and how the manager acts and behaves influences the attitudes and behaviours of the rest of the employees (ibid).

In the aforementioned study the values and behaviours of a quality culture were developed in cooperation between academics and quality practitioners, see table I below.

Table I. Statements describing behaviours, within six quality values, that either support or obstruct the creation of a Quality Culture (Bäckström et al., 2016).

Quality values	Customer orientation	Process orientation	Committed management (*Proactivity)	Participation and cooperation	Continuous improvements	Base decisions on facts
Supportive behaviour #1

vs. | We cooperate to satisfy the customer's needs. | We adhere to our agreed guidelines and working methods. | Our leaders encourage suggestions for improvements and look at problems as a way to improve. | Development of our activities involves all co-workers based on their competencies. | We evaluate and improve our working methods. | When we have a problem, we find out what the root cause is before we decide on a solution. |
| Obstructive behaviour #1 | In our organization, specially appointed staff solve the customer's problems. | Each person chooses individually how to work. | Our leaders assume that we do things right from the beginning to avoid problems. | Our improvement work is managed by our leaders or specialists. | We solve problems when they arise. | We solve problems as quickly and easily as possible. |
| Supportive behaviour #2

vs. | We find out what needs and expectations the customers have and adapt our products and services. | We cooperate between departments and functions as we develop our business. | Our leaders ask for customer consequences in decision situations. | We work to achieve the organization's overarching objectives. | We work on improvements in a structured fashion. | We gather information and measurement results which we use to develop our business. |
| Obstructive behaviour #2 | We develop products and services that are as good as possible. We offer these to customers. | We focus on developing our business within the group and our own department. | Our leaders ask for efficiency when decisions are made. | We work to achieve our team's objectives. | We adapt our improvement work to the situation. | We develop our business based on the knowledge and experience of our co-workers. |
| Supportive behaviour #3
vs. | | | Our leaders prioritize preventive work.* | | | |
| Obstructive behaviour #3 | | | Our leaders prioritize solutions to problems that have arisen.* | | | |

Note 1: The behaviours of Proactivity were incorporated in the analysis of Committed Management.
Note 2: All behaviours were used in the first part of the survey, on perceived performance. Only the first pair of behaviours (#1) for each quality value were used in the second part of the survey, on importance.

A methodological consideration when measuring quality culture is to get answers from employees that are not coloured or biased towards what are supposed to be 'good answers'. Most employees know or have heard that customers and processes are supposed to be 'good'. Therefore the behaviours given above all have been stated in a 'good' way. There should not be a good and a bad answer to choose from, but rather a good statement supporting a quality culture and a good statement obstructing a quality culture (but supporting something else). That is how the statements were developed in an iterative and cooperative way by academics and practitioners (Bäckström et al. 2016).

Another aspect of asking questions is that stakeholders – both customers and employees – when asked, tend to think 'everything is important'. Gregorio and Cronemyr (2011) presented the development and usage of a Trade-Off Importance Model that reduces the 'everything is important' problem by letting the respondents make trade-offs between scenarios where one scenario is good and bad (in our case supportive and obstructive) while the other scenario is bad and good (in our case obstructive and supportive), in two different aspects. The model

was a synthesis and development of the Kano model (Kano et al., 1984; Berger et al., 1993), SERVQUAL (Parasuraman et al., 1985, 1991), Taguchi's loss function (Taguchi, 1987; Phadke, 1989) and IPA – Importance Performance Analysis (Martilla and James, 1977; Slack, 1994). The Trade-Off Importance Model (Gregorio and Cronemyr, 2011), see figure 1, has been used in the development of the survey in this project and the IPA (Martilla and James, 1977; Slack, 1994), see figure 2, has been used in the analysis of the results from the survey.
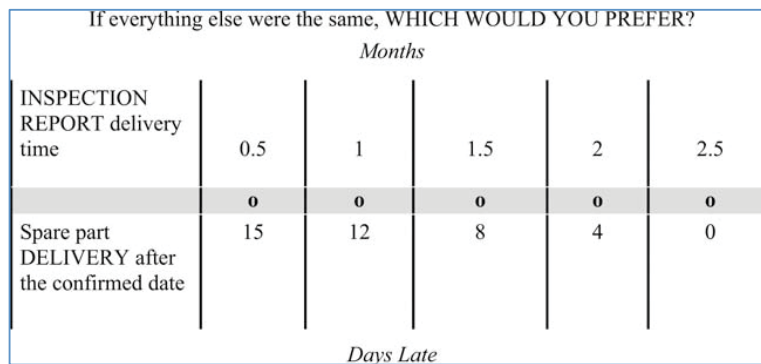

Figure 1. A survey question using the Trade-Off Importance Model from Gregorio and Cronemyr (2011). The top scale is good to bad, the lower scale is bad to good. The respondent has to set an X on the grey line at the desired trade-off.

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When developing the survey in this research project the participants expressed a wish to have a survey that was not 'the same type as all other surveys' with questions of the type 'To which degree do you agree with the following statements?'. Since those surveys sometimes have the 'everything is important' problem, it was decided to use the Trade-Off Importance Model in this project: a type of survey the participants had never used before.
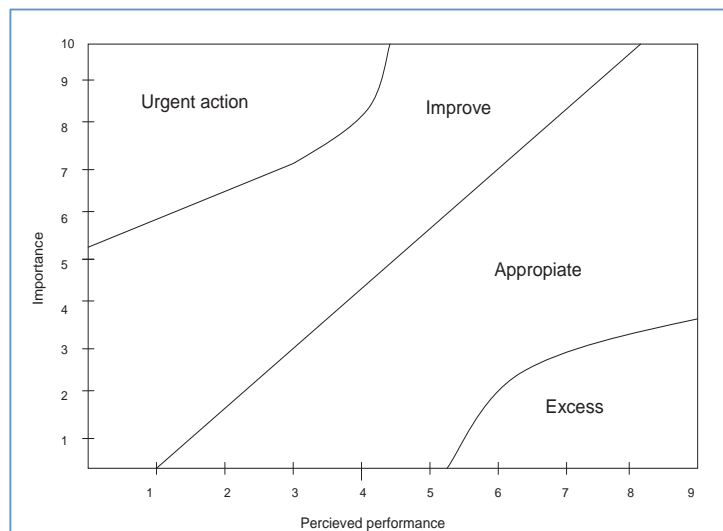

Figure 2. IPA – Importance Performance Analysis (Martilla and James, 1977; Slack, 1994)

A measuring tool

In order to analyse using the IPA, both the perceived performance as well as the importance of the quality values were investigated. But – which is important to stress – the questions did not mention any of the quality values, e.g. Customer orientation etc. Instead the statements on different behaviours were used. The rating of the quality values was calculated from the respondents' ratings of the stated behaviours. Furthermore, all behaviours were randomly mixed in the questions, both (1) the order of the values and (2) varying the order of the behaviours; supportive/obstructive (and opposite) the quality values.

The survey started with explanations on the survey and the research project. The respondents were also asked some contextual information like position, age, time in company etc. Finally there were some open questions about possible problems or suggestions to the organization or to the researchers. All answers were anonymous.

Survey Part 1: Perceived performance of behaviours

The first part of the survey consisted of 13 questions, corresponding to the 13 pairs of supportive and obstructive behaviours presented in table I. Sometimes the supportive behaviour statement was given to the left and the obstructive to the right, and sometimes it was the opposite. Below is an example from the English survey showing the first question in the survey, see figure 3.

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Figure 3. The first question in the survey; first part with questions about perceived performances.

As can be seen, the first pair of behaviours in the Committed Management value are presented (but the respondents do not know which value is being investigated; it does not say 'Committed Management'). The respondent must choose which behaviour occurs most often at his/her own workplace. There are eight different answer alternatives. Seven for different grades of the two behaviours and one if neither of the behaviours occurs.

In this case the supportive behaviour is to the left and the obstructive behaviour is to the right, but of course the respondent is not told about such 'supportive' and 'obstructive' categories. When responses are analysed this is taken into account. An answer in the far left box would give seven points to the value Committed Management, while an answer to the far right (of the scale) would only give one point to Committed Management. An answer in the box outside the scale would give '-1' but would be treated as 'no answer' and would not be used in the following analysis.

Survey Part 2: Importance

The second part of the survey consisted of 15 questions. In this case only the first pair (#1) of behaviours from each quality value were used, i.e. six pairs of behaviour statements were used (*not* all 13 pairs). See note 2 under table I.

In this part hypothetical scenarios are presented to the respondents which they have to choose from. In this case the Trade-Off Importance Model is used, see description above.

In the left scenario one supportive behaviour of an (untold) quality value is combined with an obstructive behaviour of another (untold) quality value. To the right, behaviours of the same values are presented but supportive/obstructive have switched places. So 'good/bad' on one end of the scale and 'bad/good' on the other. The respondent may not think in terms of good or bad, but rather which behaviour to prefer. He/she just has to choose one box from one to seven which he/she would prefer, given that one has to choose.

Since each question combines a pair of behaviours from one quality value with a pair of behaviours from another quality value and, given there are six quality values, the number of questions becomes 15. [n=6; $(n^{2-n)/2=15}$]

As in the first part, supportive and obstructive behaviour statements were given randomly to the left and to the right. Below is an example from the English survey showing the first question in the survey's second part, see figure 4.

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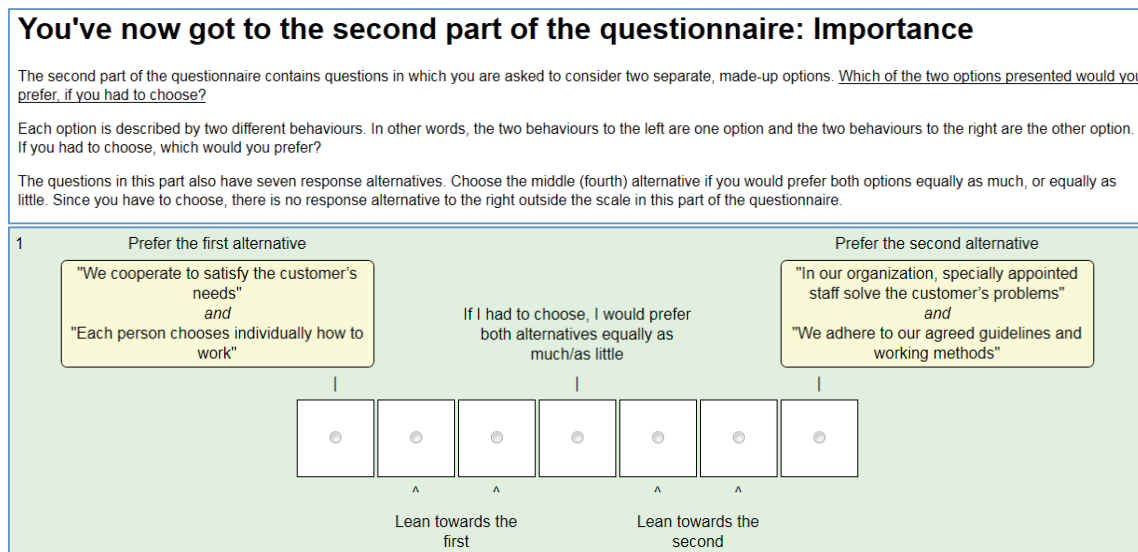
Figure 4. The first question in the second part of the survey; questions about importance.

Here, the first pair of behaviours from Customer orientation have been combined with the first pair of behaviours from Process orientation, even though – once again – the values are not mentioned. The respondent must choose which scenario of behaviours he/she would prefer, if one has to choose. In this case the supportive behaviour of Customer orientation is to the left and the obstructive behaviour is to the right while it is the opposite for Process orientation. When responses are analysed, this is taken into account. An answer in the far left box would give seven points to the value Customer orientation and only one point to Process orientation, while an answer to the far right would give the opposite points. If a respondent consistently answers that behaviours of a certain (untold) value are preferable, that respondent will give higher points to that specific value than the other values.

Analysis of results

Below a summary of the different types of analysis are presented. Only sample results are given. At present analysis is ongoing. A thorough presentation of research results will be given in a subsequent paper.

Analysis of means in perceived performance and importance

• What values and behaviours were strong or weak in each organization?

Each respondent answered all 13+15 questions. For each respondent the average points of the questions for each quality value was calculated, i.e. one average for each value in part 1 about perceived performance and one average for each value in part 2 about importance. Then averages of all the organization's respondents' averages were calculated. Since each answer could be a number between 1 and 7, naturally one could expect the averages of averages to be close to 4.0 points. That is not a problem (we look at variation below). We still want to see which quality values have a little higher or lower values than others. Therefore the overall averages were ranked in order from smallest to greatest and given numbers in the size order to get 'more spread in values'. These rank numbers should only be used for internal evaluation of strengths and weaknesses using the IPA model.

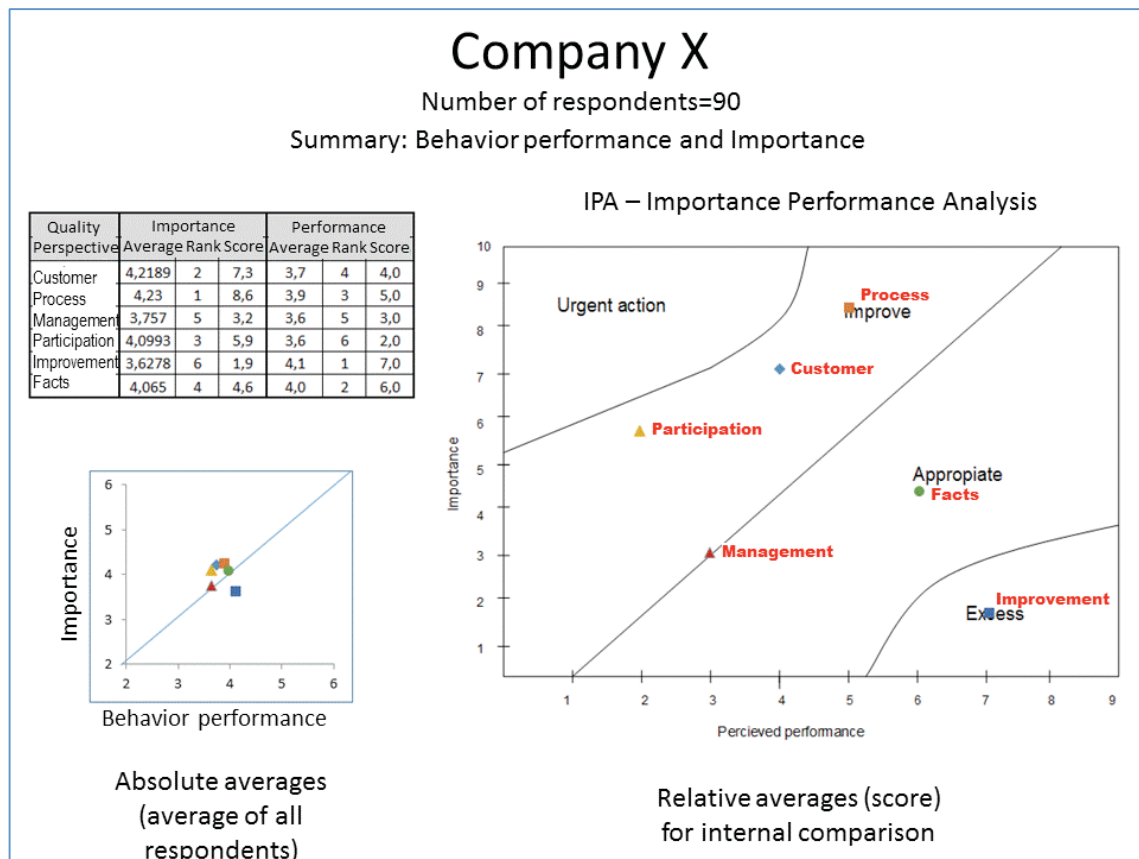An example of an IPA evaluation is given in figure 5.

Figure 5. A sample evaluation of responses from 'Company X'. Absolute values to the left and Relative values in the IPA to the right.

As seen all averages are close to 4.0 ranging between 3.6 and 4.1 for performance and between 3.6 and 4.2 for importance. That might look like very small differences but it requires a quite significant difference in responses to move the average away from 4.0. So the ranking of the averages is important and interesting. By ranking and introducing 'more spread', the strengths and weaknesses of the organization can be analysed *internally with the IPA. This organization was strong on Continuous Improvement but needed to improve in the values Process Orientation, Customer Orientation and Participation and Cooperation. Hence Company X was asked to present in a workshop to the other six participating organizations how they worked with Continuous Improvement, sharing best practice.*

Analysis of variation within organizations

• Were there internal variations in perceptions within the organizations?

The averages of averages presented above do not show the variation in perceptions within the organizations. Hence box plots (as well as histograms and dot plots not shown here) of the internal variation were done, see figure 6. The variation could be analysed based on contextual values, e.g. gender, age, position etc. The significance of differences between the quality values was analysed using ANOVA (not shown in the graph).
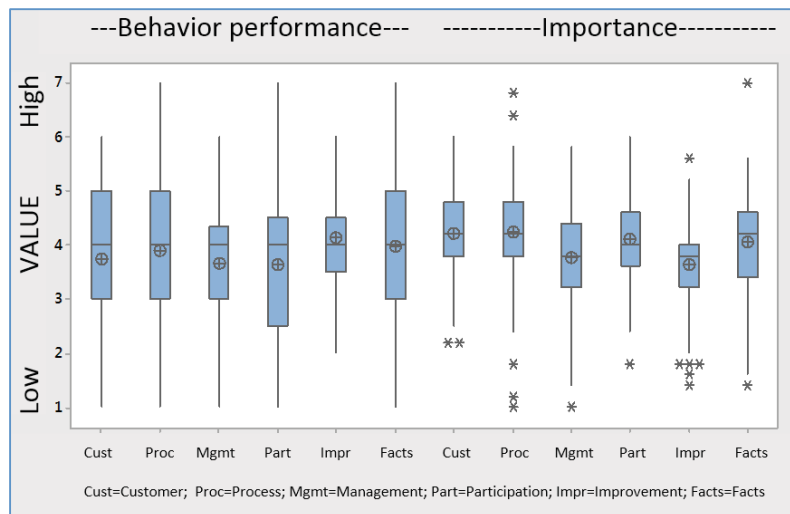
Figure 6. A box plot for the respondents' averages in 'Company X', for each quality value, both perceived behaviour performance and importance. Notice, middle line indicates median, + indicates average. * are outliers outside +/-3σ.

As seen, Continuous Improvement has the highest average, as well as the smallest variation of the perceived performances, and also the smallest average and variation for importance. This means the respondents in Company X grade the behaviours and importance related to that quality value in a similar way.

Analysis of variation between organizations

• Were there significant differences between organizations?

Seven different organizations participated in the research project. Employees from these organizations answered the survey. Strengths and weaknesses in the organizations could be discussed by comparing practices between organizations.

The comparison between organizations for the quality value of Customer orientation is given in figure 7.
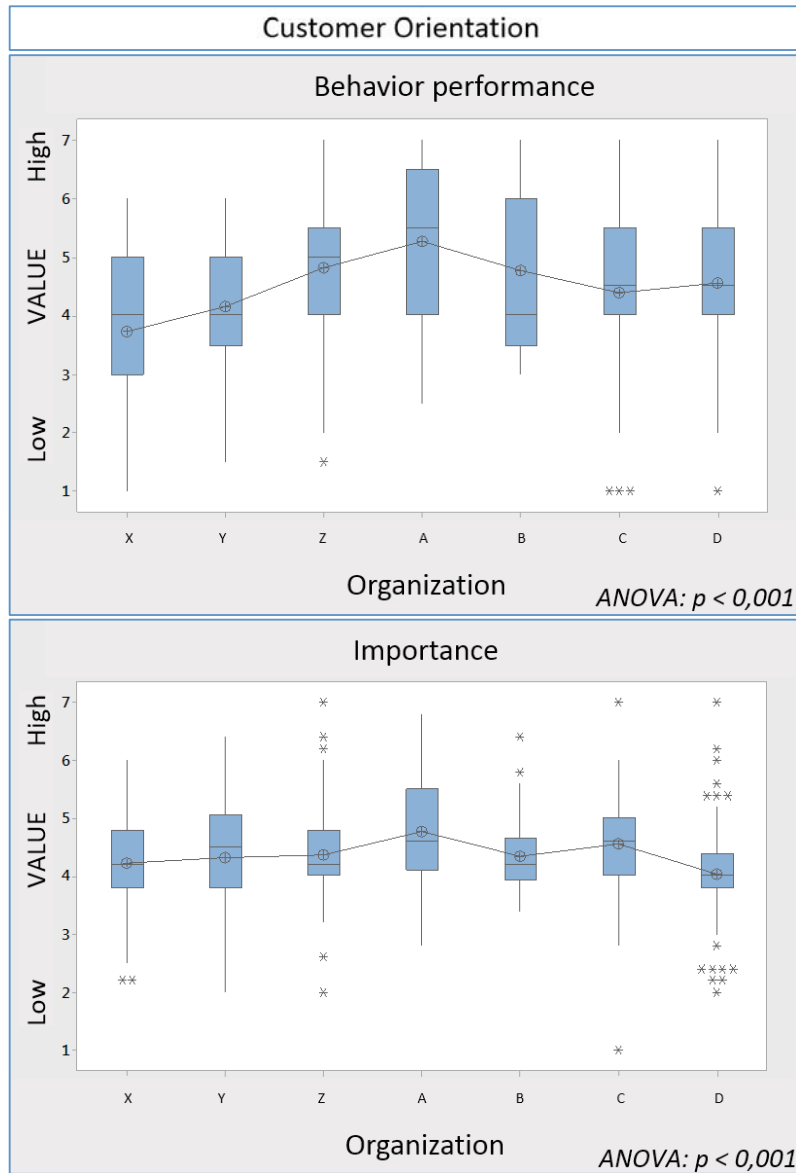
Figure 7. Two box plots for the respondents' averages in all seven organizations, for the quality value Customer orientation. Top: perceived behaviour performance; Bottom: importance. Both have significant differences between organizations as seen by the ANOVA output.

Analysis of consistency in answers

Were respondents consistent in their answers within each quality value?

Even though there naturally will be variation between employees' perceptions and opinions, one would prefer that one respondent's answers about behaviours within the same quality value not to have a big variation. Small variation means the selected behaviours are indicating the same thing, i.e. the (untold) quality value.

In this project the ranges in answers have been analysed in the same way as the averages, see

figure 8. The range is the difference between max and min points given by a respondent to behaviours within a specific quality value. E.g. for behaviours within a quality value the answers 4 and 5 give an average=4.5 and a range=1. Another way is to calculate Cronbach's alpha. It is not included in the figure.
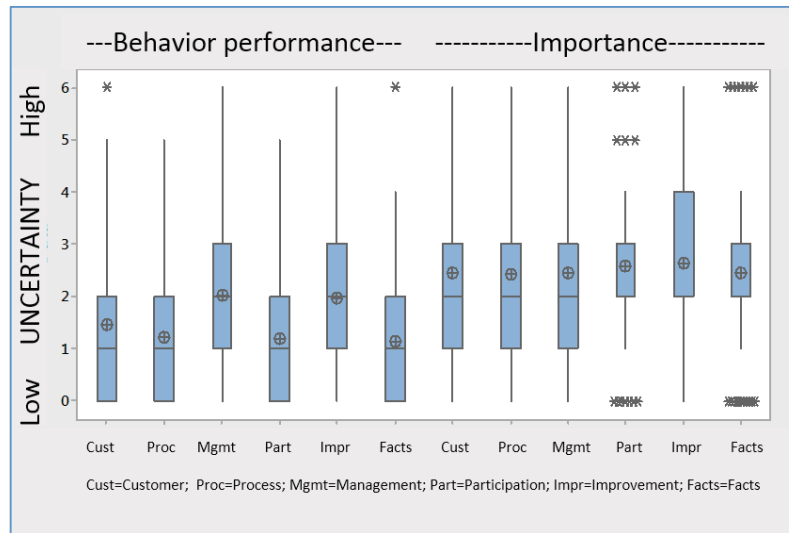

Figure 8. A box plot for the respondents' uncertainty, i.e. ranges in 'Company X', for each quality value, both perceived behaviour performance and importance.

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The respondents' uncertainty expressed as the ranges are lower for the perceived performances than for the importance. Theoretically, a randomly even distribution of answers between 1 and 7 could give ranges between 0 and 6, and would give an average range of 2.2 (and median of 2). Since the respondents' ranges in answers of perceived performances are somewhat lower than 2.2, the uncertainty is said to be low. The ranges of the importance are around 2, indicating higher uncertainty. So there is a higher consistency in answers about behaviour performance than about importance.

Analysis of correlations

• Were there any correlations between answers about behaviours and/or importance?

One more thing that could be investigated are the correlations between the points given to the perceived performances and the importance of the quality values. An example is given in figure 9. Correlation coefficients are given only if significant ($p < 0.05$).

Furthermore, correlations in answers and contextual variables like gender, role, years in organization etc. could be analysed but are not included in the figure.

As known to all quality academics and most practitioners, correlation does not imply causation, so the correlations need to be investigated further.

Behaviour performance (upper triangle) — **SYMMETRICAL**

Customer					
+0.44	Process				
+0.47	+0.48	Management			
+0.42	+0.55	+0.39	Participation		
				Improvement	
+0.40	+0.35	+0.66	+0.26		Facts

Importance (lower triangle)

Customer					
	Process				
-0.34		Management			
+0.23	-0.24	-0.25	Participation		
-0.24	-0.38		-0.22	Improvement	
+0.21	-0.22	-0.22	-0.30	-0.38	Facts

Figure 9. Significant ($p<0.05$) correlation coefficients for responses from 'Company X'.

Discussion and conclusions

In this paper we propose a model and a tool for measuring and analysing a quality culture. This tool can be used to measure the starting point of a quality improvement which Radnor and Barnes, (2007) suggest. Such a model has not been found in the literature by the researchers. The concept of a quality culture has been described by a set of quality values characterizing the quality culture which are central to measure in a Quality Management initiative according to Ingelsson et al., (2010). Furthermore, these values have been described by supportive and obstructive behaviours, and are thus easy to understand. The survey only uses statements about the behaviours, not the values directly. Instead the performance and the importance of the values are derived from the respondents' answers on questions about the behaviours. This way of measuring soft values has been found to be missing within QM (Ingelsson et al., 2010).

The quality values as well as the supportive and obstructive behaviours were developed jointly in several workshops by academics from three universities/institutes and seven major Swedish organizations. In the end there was a consensus in the group that these values and behaviours were good descriptions of a quality culture.

The web-based survey was answered by some 600 employees in the seven organizations. Answers were sent directly to the researchers who did the analysis and presented preliminary results to the participants from the each organization. The analysis of the model and tool itself is still ongoing.

In the first part of the survey the respondent had to choose the behaviour – from one supporting and another one obstructing a quality culture – which occurs most often at his/her own workplace. The second part on importance used the Trade-Off Importance Model presented by Gre-

gorio and Cronemyr (2011). This resulted in having to make a choice between somewhat more complicated scenarios . The main purpose of using this model was to avoid the 'Everything is important' problem. As indicated by correlations, this was accomplished.

The proposed types of analysis that can be performed on the surveyed data include

• Analysis of means in perceived performance and importance – using IPA showing strengths and weaknesses in an organization's quality culture

• Analysis of variation within organizations – using box plots and ANOVA provides an indication of the different performances and opinions with the organization

• Analysis of variation between organizations – using IPA, box plots and ANOVA, leading to best practise sharing between organizations

• Analysis of consistency in answers – using box plots of ranges and Cronbach's alpha as an evaluation of the model itself

• Analysis of correlations – using matrix plots and correlation analysis to see more advanced patterns

Many of these analyses have already been used successfully in this research project while some are still being evaluated. Results will be presented in a subsequent paper.

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The conclusion so far is that the concept of using behaviours as a way to describe, diagnose and develop a quality culture looks very promising.

Acknowledgment

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