Training needs in TQM: the Portuguese perspective

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Abstract

A survey to assess training needs in TQM was developed in several European countries, within the framework of a Leonardo's project named IMVOCED. Beyond a comparison of the results in each country, a global analysis was performed to design a TQM programme to be delivered by WBL (Work Based Learning). Differences were found between countries, and the Portuguese results also revealed that different approaches to TQM training should be adopted according to the organisation's dimension. Based on this evidence, two different strategies for TQM training by WBL are proposed and discussed.

Introduction

It is difficult to give one definition of what TQM really is and what is not (Bergquist *et al.*, 2005). However, several definitions of TQM have emerged, and most of them are quite similar and include the same essential features. Tan (1997), for instance, defines TQM as *a team approach strategy that integrates and encompasses the goals of the organisation with its human, capital and financial resources.* Despite all the emerged definitions, some common key factors are always present:

- Continuous improvement
- Total participation and commitment
- Strategic focus and a shared vision
- Customer orientation
- Process management
- Teamwork

Among other important features for successful implementation of TQM, the need for training at all levels within an organization has always been emphasized by the most famous quality gurus and professionals all over the world (*e.g.* Walley and Kowalsky, 1992; Motwani, Frahm and Kathawala, 1994).

Thiagarajan and Zairi (1997), quoting Dumas (1989), affirm that introducing TQM when people do not have the fundamental skills to work in the new system is a prescription for disaster. Therefore, for the success of TQM implementation, the authors argue the entire workforce must acquire new knowledge, skills and abilities.

When designing and implementing training programs, a very important issue to be addressed is the assessment of training needs.

The IMVOCED approach to assess training needs

IMVOCED (Improving Vocational Education) was a three-year research project that is under development, aimed at developing a TQM training programme to be delivered by WBL (Work Based Learning) techniques. Several partners of five countries, namely the UK, Portugal, Finland, Slovakia and Belgium, were involved in the project.

One of the major tasks within the project was to provide further research into training needs in TQM in selected EU markets.

It is commonly agreed that TQM comprehends the so-called "soft" and "hard" elements of quality. In the first category one can consider features such as leadership, commitment, communication and teamwork. The second typically includes the different quality techniques, systems and standards. Therefore, any research carried out to assess the training needs should take into account both the "soft" and "hard" aspects.

The questionnaire was the tool chosen to assess the IMVOCED training issues. An iterative procedure was used to develop the questionnaire. A first draft was produced and sent to all partners asking for their feedback and suggestions for improvement.

After a few rounds, a consensus about the final structure was achieved among the partners.

The questionnaire had a concise statement ("My company would like a WBL based TQM training programme that would…") followed by the expected deliveries (Table 1) from the training programme.

Table 1. Expected Benefits from WBL Training Programme

1	Resources optimisation	13	Provide training on DOE
2	Motivation of employees	14	Provide training advanced tools
3	Leadership skills improvement	15	Improve customer service
4	Communication improvement	16	Measure Cost of Quality
5	Sharing of information	17	Assist Quality audits
6	Development of team work	18	Measure change performance
7	Ease of new staff integration	19	Provide feedback information
8	Use of ISO 9000/2000	20	Evaluate training results
9	Implement EFQM model	21	Set criteria of effectiveness
10	Assist planning	22	Provide Benchmarks
11	Use Quality tools	23	Raise awareness
12	Provide training on SPC	24	Develop a reward system

The respondents were asked to express how important each topic would be for a TQM training programme within their enterprises. The scale of importance ranged from one to five. A native language version of the questionnaire was then sent to a sample of companies in each of the participating countries. Table 2 presents a summary with the number of questionnaires sent and received by each country.

Table 2. Rate of Response per country

Country	Sent Questionnaires	Received Questionnaires	Rate of Response (%)
Belgium	85	30	35
Finland	500	54	11
Portugal	200	77	39
Slovakia	62	35	56
United Kingdom	580	28	5

Portuguese results in the global context

The Portuguese questionnaire was sent to a sample of 200 companies randomly selected from a large database. The sample was quite balanced and included companies that represent a large spectrum of activities and dimension, from SME's to public institutions. The rate of response (39%)

was quite interesting and most of the respondents expressed their willingness to receive further information.

For the purpose of the study a dimension-based segmentation was adopted. The respondents were divided into small (less than 50 employees), medium (between 50 and 250 employees) and large (more than 250 employees) companies. Eventually, a fourth segment composed by the micro companies (until 5 employees) could be considered. However, only one micro company answered the questionnaire and this single case is incorporated in the category of small companies.

As regards the Portuguese sample, the proportion of small, medium and large companies are, respectively, 11,7%, 50,7% and 37,6%. Figure 1 shows the distribution of Portuguese scores without segmentation for the several topics included in the questionnaire. The mean lies between 3.69 and 4.52, where the lowest value corresponds to question number 13 (DOE), followed by questions 12 (SPC), 14 (advanced quality tools) and 18 (measure change performance). The highest mean values correspond to questions number 1 (resources optimisation), 2 (Motivation), 4 (communication), 5 (information sharing), 6 (team work), 15 (customer service), 16 (cost of quality), 20 (training results), 21 (criteria of effectiveness) and 23 (raise employee's awareness).
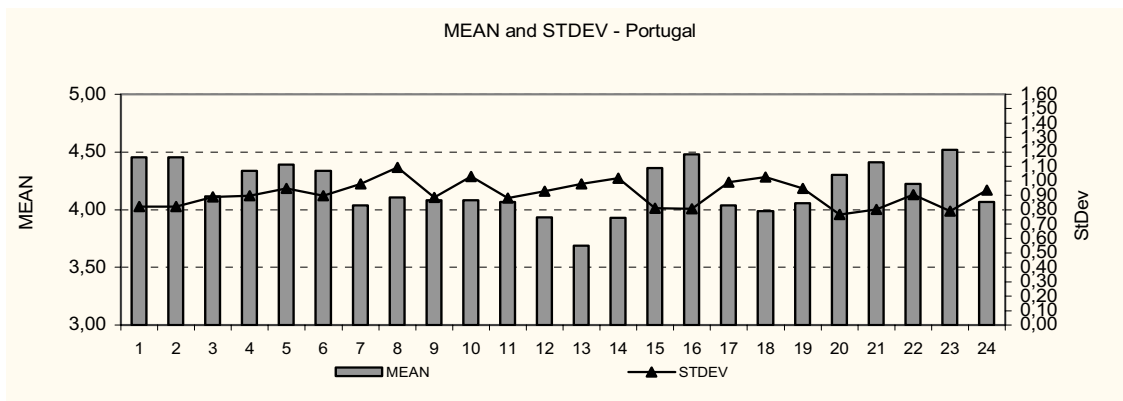

Figure 1. Distribution of Portuguese Scores

Figure 2 shows the distribution of the average scores per question when segmentation is considered.
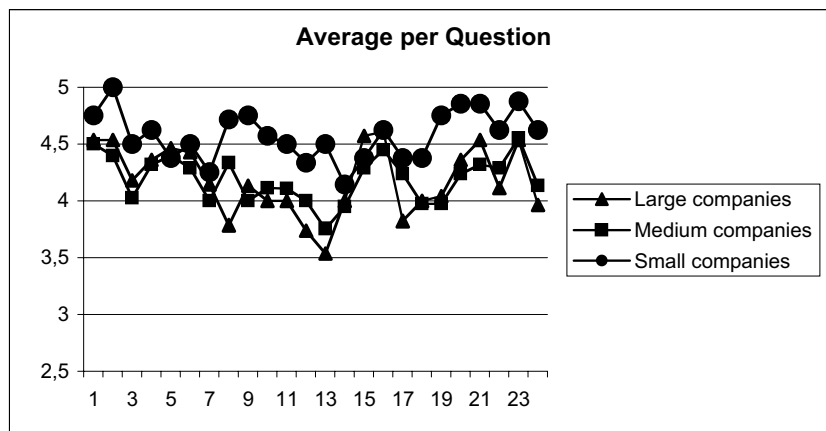

Figure 2. Average per question when segmentation is considered

Somehow, it is clear a common pattern of responses for the three segments. However, it is also evident that small companies generally score higher the several questions. This result is somehow unexpected. In fact, there is a general conviction that small companies are not as aware for quality issues as large companies. Our results do not support this conviction, although a larger sample would be important to reinforce the conclusions. Furthermore, it has to be noted that small companies answering the questionnaire are not fully representative of the Portuguese universe.

The **global analysis** for all countries was carried out on a balanced sample, which included 28 questionnaires per country. This analysis revealed a consensus among the five countries for the following questions:

1. Help the companies optimise resources

2. Motivate employees

3. Leadership

4. Internal communication

5. Raise awareness of the individual employees role in improving competitiveness

The final sample had a dimension of 140 responses, which allowed the use of **Factor Analysis**.

Factor Analysis

Factor Analysis is included among the so-called interdependency techniques (Hair *et al*, . In these kind of techniques there is not a distinction between dependent and independent variables, being all the variables analysed together.

Factor Analysis can be used to reach several objectives. Two of the most common, that can be combined, are those connected with the identification of some underlying structure to the data and the data reduction itself.

First of all, it was important to decide whether Factor Analysis was an appropriate technique to analyse the available data or not. The KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy was computed and a test of sphericity was carried out (Table 3).

Table 3. KMO and Bartlett's test results

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,834
Bartlett's Test of Sphericity	Approx. Chi-Square	1194,057
	df	276
	Sig.	,000

As can be seen, it is rejected the hypothesis that the correlation matrix could be an identity matrix. Moreover, the KMO measure reaches the value of 0,834, far above 0,500, which is the acceptable minimum.

Principal Component Analysis and the Kaiser criterion were used, respectively, for factor extraction and factor retention. After a few trials it was decided to adopt a structure with six factors. The communalities (proportion of the variance, for each variable, that is explained by the common factors) for the variables included in the study ranked between 0,588 and 0,830 as can be seen in Table 4.

Table 4. Communalities

Communalities

	Initial	Extraction
Q1	1,000	,609
Q2	1,000	,652
Q3	1,000	,731
Q4	1,000	,645
Q5	1,000	,704
Q6	1,000	,611
Q7	1,000	,588
Q8	1,000	,708
Q9	1,000	,788
Q10	1,000	,687
Q11	1,000	,809
Q12	1,000	,682
Q13	1,000	,727
Q14	1,000	,770
Q15	1,000	,707
Q16	1,000	,744
Q17	1,000	,740
Q18	1,000	,662
Q19	1,000	,693
Q20	1,000	,684
Q21	1,000	,680
Q22	1,000	,732
Q23	1,000	,830
Q24	1,000	,679

Extraction Method: Principal Component Analysis.

The adopted solution, with six components, explains more than 70% of the total variance, which can be considered quite interesting (Table 5).

Table 5. Proportion of total variance explained per component

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	9,436	39,315	39,315
2	2,325	9,688	49,003
3	1,674	6,974	55,977
4	1,515	6,311	62,288
5	,992	4,132	66,419
6	**,920**	**3,833**	**70,253**
7	,809	3,372	73,625
8	,717	2,987	76,612
9	,648	2,699	79,311
10	,590	2,460	81,772
11	,568	2,367	84,138
12	,534	2,224	86,362
13	,459	1,913	88,275
14	,433	1,806	90,081
15	,380	1,582	91,663
16	,348	1,449	93,112
17	,324	1,351	94,463
18	,278	1,159	95,622
19	,247	1,028	96,650
20	,238	,990	97,641
21	,205	,856	98,497
22	,151	,628	99,125
23	,126	,526	99,651
24	8,382E-02	,349	100,000

Extraction Method: Principal Component Analysis.

The extracted component matrix, before rotation, did not revealed any underlying structure. Therefore, to improve interpretability, the factors were rotated according to the *varimax* algorithm. The obtained solution is presented in Table 6.

Table 6. Component Matrix after rotation

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
Q23	,802	,315	-7,552E-02	9,163E-02	,217	,164
Q2	,770	8,753E-02	,154	,156	1,485E-02	5,792E-02
Q22	,757	,194	9,218E-02	,283	,145	,110
Q21	,622	2,011E-02	,254	,436	,162	,110
Q5	2,865E-02	,756	,300	5,232E-02	1,204E-02	,197
Q4	,249	,704	,205	3,290E-02	,199	6,997E-02
Q6	,222	,651	8,375E-02	,352	8,404E-02	4,582E-03
Q7	,177	,650	,243	-2,465E-03	,238	-,135
Q15	,112	,593	,176	,472	,132	,267
Q11	,242	,133	,850	4,757E-02	8,870E-02	9,736E-03
Q14	-6,230E-02	,321	,782	,202	1,240E-02	,103
Q13	-2,451E-02	,135	,774	,151	,204	,214
Q12	,255	,199	,706	,119	,185	-,173
Q1	,277	5,098E-02	,199	,676	6,987E-02	,167
Q20	,567	,121	7,739E-02	,575	,106	-5,658E-03
Q10	,226	,172	,425	,552	,306	-,166
Q19	,453	,382	,172	,505	-,155	-,181
Q18	,453	,386	,124	,463	,226	,162
Q8	3,692E-02	,188	,182	6,403E-02	,790	-9,929E-02
Q9	7,448E-02	-,103	,168	7,664E-02	,731	,450
Q17	,173	,450	1,194E-02	,350	,617	-7,406E-02
Q24	,426	,252	,292	-6,444E-03	,591	-5,439E-03
Q16	,239	,439	-3,139E-02	,463	,482	,215
Q3	,401	,249	8,446E-02	,120	3,212E-02	,697

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 9 iterations.

The rotation was well succeeded, providing a meaningful structure. The allocation of the questions to components was globally unambiguous, although in few cases a deeper analysis and interpretation was needed. The final structure emerged as follows:

The Factor Analysis led to a structure with 6 factors or components that explained more than 70% of the total variance. Each component comprises one or more variables. The designation of each factor/component was based on the variables allocated to it:

Component 1: Employee's Motivation

2. Motivate employees

21. Set criteria of effectiveness

22. Provide benchmarks for employees to self check progress

23. Raise awareness of the individual employee's role in improving competitiveness

24. Develop a pay for performance reward system

Component 2: Internal and External Communication

4. Improve communications between departments

5. Increase information sharing

6. Develop team working skills

7. Integrate new staff into company systems

15. Provide customer service training exercises

Component 3: Tools and Techniques

11. Provide exercises in use of quality tools (example: Pareto diagrams, Ishikawa, histograms, etc)

12. Provide training on statistical process control

13. Provide training on design of experiments (Taguchi)

14. Provide training on advanced quality techniques (FMEA, QFD, 6-Sigma)

Component 4: Training Impact

1. Help the company optimise resources
10. Assist planning
18. Measure changes in on the job behaviour and performance
19. Provide feedback for trainees and managers
20.Relate results of training programme to organisational objectives

Component 5: Quality Systems

8.Use ISO 9000/2000 as a framework
9. Use EFQM as a framework
16. Measure cost of quality
17. Assist quality audits

Component 6: Leadership

3. Improve leadership skills

As can be seen two of the identified factors are based on "hard" issues of TQM (Tools and Techniques and Quality Systems) while three factors are strongly connected to "soft" issues of TQM (Employee's Motivation, Internal and External Communication and Leadership). The remaining factor (Training Impact) is somehow cross sectional as it represents the necessity of evaluating the success of the training programs.

Average scores for each Factor were computed for the global sample and for each of Portuguese segments. Table 7 presents the obtained results.

Table 7. Average factor scores for Portuguese segments and global sample

		(P) Small Companies	(P) Medium Companies	(P) Large Companies	Global sample for all countries
F1	Employee's Motivation	4,80	4,34	4,34	4,10
F2	Internal and External Communication	4,43	4,26	4,39	4,10
F3	Tools and Techniques	4,37	3,95	3,82	3,51
F4	Training Impact	4,66	4,16	4,19	4,04
F5	Quality Systems	4,62	4,25	4,09	3,83
F6	Leadership	4,50	4,03	4,18	4,15

Figure 3 presents the same results in a radar type graphic, which is quite interesting to analyse.
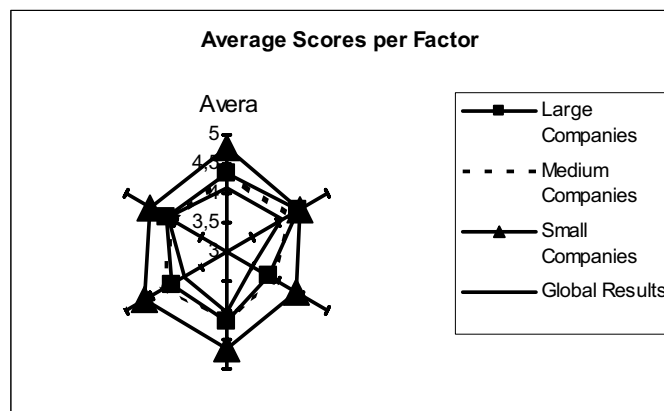

Figure 3. Average factor scores for Portuguese segments and global sample

It becomes clear that the scores for the Portuguese small companies are consistently higher than the rest of the sample for all factors, while medium and large Portuguese companies have a remarkable similar behaviour.

Generally speaking, medium and large Portuguese companies are more exposed to international contacts and practices. Therefore, it is not surprising that a similar behaviour is found between these segments and the global sample. However, it is possible to identify a stronger focus on *hard* TQM issues for Portuguese companies when compared with the global sample. This conclusion is consistent with previous studies (*e.g.* Mathews *et al*., 2000).

Despite these conclusions, it is a fact that several experiences on TQM implementation have been disseminated through articles published in international journals and all of them stress the importance that both hard and soft methods have on the success of theses initiatives. Moreover, the new ISO 9001:2000 standard, according to which companies will be certified, also stresses the importance of having both organisational/relational and technical components in place.

Based on the obtained results, it is worth to discuss alternative training programs for small companies within the framework of IMVOCED. In fact, several authors (*e.g.* Lee (2004) and Hansson (2003)) stress the fact that universal approaches for TQM might not constitute an adequate framework for small companies.

Framework for TQM training

IMVOCED is structured for individual training and this kind of approach is probably the only one suited for individuals working in large and medium companies. Based on the conclusions from the questionnaire, a structure as the one presented on Figure 4 would provide a balanced provision of TQM training.
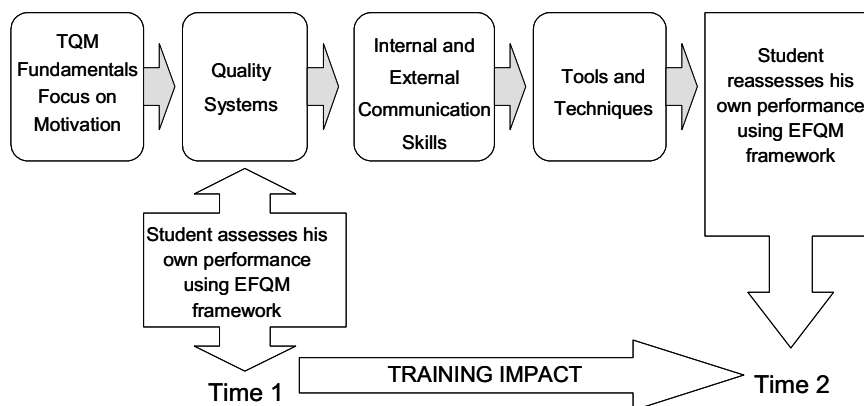

Figure 4. Individual based TQM training

The utilisation of some dimensions from the EFQM model might provide an adequate framework to evaluate training impact. The evaluation would be made on an individual basis, acting the student/worker as the Organisation under assessment.

However, a different model can be discussed for the small companies. The observed results from the questionnaire reveal that a stronger motivation for TQM training is present in this segment. Therefore it might be interesting to design training programs for small companies that could be widened to whole organisation. This would not imply that necessarily all collaborators would be ready for scholar credits. A balance could be found between individuals seeking for scholar credits and the global training program. For instance, individual and specific academic works would be appropriate for those seeking academic recognition. Figure 5 presents the structure to be adopted.
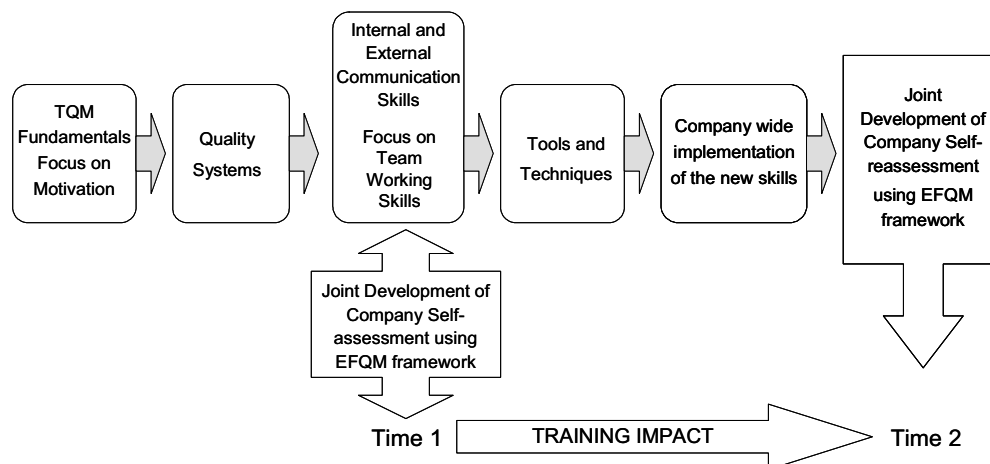
Figure 5. Organisational based TQM training

Like in the individual program presented before, EFQM model could be the framework to assess the training impact. However, in this type of approach, self-assessment would be focused on the whole organisation. Furthermore, the assessments would be the primary vehicles to stimulate communication and to develop team working skills.

Conclusions

It is interesting to stress that smaller companies scored consistently higher the several training issues than medium and large companies did. This evidence puts small companies as a primary target for TQM training.

The six components model produced by Factor Analysis could explain approximately 70% of the total data variation and therefore constitutes an excellent framework to the development of TQM training programmes.

Based on this model, it was possible to see that a stronger focus on the hard issues of TQM is clear within the Portuguese companies when compared with the global sample of the five countries. Furthermore, it was concluded that different approaches for TQM training provision should be adopted, according to the organisation's size.

Individual based TQM training is probably the best solution for people working in large and medium companies. However, as regards small companies, organisational based TQM training could/should be adopted, and coordination between individuals seeking for scholar credits and the global training programme might enhance synergies between the two approaches.

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