UNDERLYING FACTORS OF MANAGEMENT PRACTICES IN CZECH COMPANIES

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Abstract: *The main purpose of the present paper is to identify the factor structure of managerial approaches. Based on a survey performed in 241 Czech companies from various sectors (e.g. mechanical engineering, construction and consumer industry) we identify six factors underlying managerial practices in these companies: Strategic management, Leadership, Partners and customers, Human resources, Process management, and Knowledge and innovation. Therefore, the empirical factor structure is partially different from the theoretical five-dimensional structure assumed in the widespread EFQM model. The present paper thus improves our understanding of the interrelations among various aspects of management in Czech companies. This better understanding can in turn lead to more informed implementation of total quality management in the firms. Understanding the structure of managerial approaches typical for Czech companies can also contribute to smoother transitions when foreign managers are appointed to run Czech firms (because the structure of managerial approaches is culture-dependent, as has been shown by former research).*

Keywords: *Managerial approaches, EFQM, Quality management, Survey, Factor analys*

JEL classification: *C38, L20, M10*

Introduction

In this paper we analyze managerial approaches in 241 Czech companies with factor analysis. Managerial approaches can be measured using the European Foundation of Quality Management (EFQM) model, which recognizes five main dimensions (see EFQM, 2002). EFQM model is an operational framework to implement Total Quality Management (see e.g. Bou-Llusar et al., 2009; Hendrics et al., 1997; Van Der Wiele et al., 2000). The five main areas – the enabler criteria – measured by the EFQM model are Leadership, Strategic management, Human resources, Partnership and other resources, and Processes. However, previous studies indicate that empirically there are often more than five underlying factors (or areas of correlated practices) in companies' management (see e.g. Conca et al., 2004; Quanzi et al., 1998).

We assess the managerial approaches with a 42-item questionnaire. The 42-item questionnaire is inspired by the EFQM model. Technically, each of the items in our questionnaire measures one variable. Hence, each company is described by 42 variables. Subsequently, we study the interrelations among the 42 variables using factor analysis. Factor analysis is a method for exploring complex datasets, i.e., datasets with a large number of variables. Specifically, it can be used to identify the underlying structure of complex datasets by clustering interrelated variables into common factors (see for instance Tabachnick et al., 2007). A factor can be understood as a latent variable (e.g. employees' productivity) that expresses something common or similar to the measured variables (i.e., questionnaire items) contained in it. Factor

analysis has been used in various areas of management and economics (see e.g. Dyer et al., 2005; Půlpánová et al., 2012; Saraph et al., 1989; Žižka, 2011).

With factor analysis we can discover the actual underlying structure of managerial approaches in the 241 companies under study. This latent factor structure can be quite similar to the structure suggested by the EFQM model (the five enabler criteria), but there can be important differences. For example we might discover just four factors, not five, i.e., one of the EFQM areas could be "swamped" by the remaining areas (specifically, one of the areas can share so much variance with one or more of the other areas that it does not emerge as a factor per se in the factor analysis, but is contained in one or more of the remaining factors). Although, what we actually discover is that there are six factors underlying managerial approaches in our sample of companies.

1 Statement of the problem and research background

On the one hand, relationships between certain selected EFQM criteria have been examined in the study of managerial approaches, see e.g. (Burli et al., 2012; Calvo-Mora et al., 2005; Eskildsen et al., 2000; Ghosh et al., 2003; Gomez et al., 2011; Meyer et al., 2001; Pannirselvam et al., 2001; Wilson et al., 2000) for an overview see (Bou-Llusar et al., 2009; Heras-Saizarbitoria et al., 2012). Factor analysis, on the other hand, allows the researcher to take all the interrelations among all measures of management into account.

Using factor analysis on responses to an EFQM model-based questionnaire, (Conca et al., 2004) discovered 10 underlying dimensions of quality management. Similarly, (Saraph et al., 1989) discovered eight factors of quality management, (Badri et al., 1995) found eight factors, (Quanzi et al., 1998) indentified 16 factors, (Burli et al., 2012) found six factors (plus four results factors). For an overview see (Conca et al. 2004; Sila et al., 2003).

The factors identified in past research partially overlap with the criteria of the EFQM model. For example factors 2, 5, 6 and 8 in (Burli, et. al., 2012) are fairly similar to standard EFQM factors Human resources, Strategic management, Leadership and Processes, respectively. Sometimes, however, new aspects of quality management are uncovered with factor analysis. For example the 10 dimensions in (Conca et al., 2004) were Leadership, Quality planning, Communication, Training, Specialist training, Suppliers management, Customer focus, Process management, Continuous improvement, and Learning.

(Dijkstra, 1997) employed factor analysis and found that the five EFQM areas had a common underlying factor. Likewise, (Bassionbi et al., 2008) found one[1] common factor underlying the areas in their modified EFQM model. (Bou-Llusar et al. 2009) arrived at a similar result (i.e., the existence of a common general factor underlying the five enablers) using multidimensional structural equation modeling.

In addition, using factor analysis (Bou-Llusar et al., 2009) confirmed that individual enablers were unidimensional, i.e., the items related to the respective areas (Leadership, Strategic management, Human resources, Partnership and other resources and Processes) had just one underlying factor each (Heras-Saizarbitoria et al., 2012

1 Two factors would have been extracted by Kaiser's criterion.

report the same result). (Bassioni et al., 2008) also report that each criterion in their modified EFQM model has just one underlying factor.

(Jayamaha et al., 2011) computed factor loadings and cross-loadings for quality management assessment items on factors (such as Leadership and Strategic planning) in two variants of a model similar to the EFQM model[2]. They found that the items loaded highly not only on their assigned factors (i.e., a Leadership item correlates highly with a Leadership factor), but that they loaded (somewhat less) highly on the remaining factors also. This result shows that neither variant of the examined quality management model has good measurement validity. In a good model items should correlate highly with their assigned factor (convergent validity) and have relatively low correlations with the remaining factors (discriminant validity, see Gefeb et al., 2005 and Jayamaha et al., 2011 for details). The results obtained by (Jayamaha et al., 2011) imply that either the items or the theoretically assumed factors would need to be modified (to achieve satisfactory validity). (Jayamaha et al., 2008) and (Jayamaha et al., 2009) report results similar to (Jayamaha et al., 2011).

To summarize, no clear picture of the empirical factor structure of EFQM practices emerges from past research. Overall, previous studies tend to cast doubt on the theoretically assumed five-dimensional structure.

In principle, moreover, previous exploratory factor analyses cannot be statistically extrapolated to Czech companies (see Conca et al., 2004). And since there might be cultural differences in quality management practices in different countries (see e.g. Madu et al., 1995; Solis et al., 2000; Vecchi et al., 2009; Vecchi et al., 2011) a mere heuristic extrapolation from previous research performed in different countries could be culturally biased. Therefore, it is necessary to do factor analysis for Czech companies, if we do not want to simply rely on the theoretical assumption that there are five enabler areas (which has been shown to be inaccurate repeatedly, see above).

2 Methods

We performed a survey in a convenience sample of 241 Czech companies of different size (M = 469.3 employees, SD = 1475.6). The companies operate in different sectors (mechanical engineering, electrical engineering, civil engineering, development and production of computer software and hardware, services, and consumer industry). Data were collected with help of trained student interviewers between 2013 and 2015. Breakdown of companies included in the sample, according to sector, is as follows: mechanical engineering (n = 49), civil engineering (n = 33), development and production of computer software and hardware (n = 36), services (n = 58), and consumer industry (n = 41).

Obtaining a more homogenous sample can be seen as one of the tasks for future research, because the factor structure might be sensitive to the size and type of the company (on the other hand, Bou-Llusar et al., 2005 show that mixing service and manufacturing firms in one sample does not confound the results). Note that factor analysis has high requirements with respect to sample size, therefore obtaining a homogenous sample can be quite difficult.

2 Namely the Baldridge Criteria for Performance Excellence model.

Also, if future researchers manage to collect data from a sample representative for the whole country (or any other population of interest), this would provide more generalizable findings. However, it is difficult to obtain a representative sample due to typically low response rates. Even though researchers may initially approach a randomly chosen selection of companies, probably only a fraction of this initial sample would be willing to participate in the study (see e.g. Gutierrez et al., 2010), response rate was 8.4% in their study). This means that the final sample of participating companies is essentially self-selected and most likely no longer representative.

The companies were approached by our trained student collaborators who interviewed the companies' managers. Obtainng information based on respondents' perceptions is common in organizational research (see e.g. Gomez et al., 2011; Nair, 2006; Powell, 1995). A structured interview technique using the 42-item questionnaire was used. The items are available from the first author upon request. They are not reproduced here to spare space (just five examples are given below).

As we mentioned in the introduction the 42-item model is based on the EFQM model, hence it covers the five EFQM areas:

1. Leadership (or People, items LEAD1-LEAD8, Cronbach's $\alpha = 0.92$), e.g. "Managers define and develop the function, vision, culture and values of the organization."
2. Strategic management (or Policy and strategy, items STR1-STR6, Cronbach's $\alpha = 0.91$), e.g. "The current and future needs and expectations of parties involved (including customers) are satisfied."
3. Human resources (items HR1-HR8, Cronbach's $\alpha = 0.89$), e.g. "HR planning is well documented and is in agreement with the strategy and with the organizational and process structure."
4. Partnership and other resources (items PAR1-PAR9, Cronbach's $\alpha = 0.89$), e.g. "Mutual development of the company and its partners is promoted."
5. Processes (items PROC1-PROC11, Cronbach's $\alpha = 0.90$), e.g. "System of quality management is built and/or certified according to the norm ISO 9001. It is implemented and fully functional."

Fulfilling/satisfying the tasks/criteria described by each item was scored on a scale 0-100 (with 0 being the worst possible score and 100 the best). This is in line with the usual practice in management audit and consulting (in fact, the 42-item questionnaire has been used by the first author and his colleagues – auditors and consultants – in a number of companies in the past).

Note that when each of the five areas (e.g. Leadership) is viewed as an individual scale within our questionnaire, we can conclude that each scale has very good reliability, as reflected by high Cronbach's alpha values (given above).

As far as the factor analysis is concerned, we use principal component analysis as the extraction method and direct oblimin as the rotation method. We replace missing data with mean for the respective item (the missing data are not normally distributed, thus it is not recommendable to exclude the cases with missing data from the analysis).

Our research objective is to establish an empirical factor structure of the EFQM model that emerges from managerial practices in a sample of Czech companies. As outlined in the previous section, former research does not provide a clear support for the five-factor structure of the EFQM model, which the authors of this model assume

(EFQM, 2002). Therefore, further empirical investigations into this topic are needed. So far, however, there is also not a clear evidence for a specific alternative of the five-dimensional conceptualization – between one and 16 factors have been identified in the papers we have reviewed in the previous section. Finally, we were also not aware of any related research performed in socio-economic conditions similar to those in the Czech Republic, which could have otherwise given us guidance with respect to what factors might emerge. This set of reasons led us to employ exploratory factor analysis (rather than confirmatory factor analysis, see Long, 1983), which is a method that is commonly used without formulating any a priori predictions or hypotheses. We will, nevertheless, return to the issue of formulating specific hypotheses in future research in our conclusions.

3 Problem solving (results)

Kaiser-Meyer-Olkin measure of sampling adequacy is equal to 0.95 for our data, which verifies our data have excellent factorability (i.e., there is some underlying structure in the data). KMO for individual items is above 0.9 in all cases. The minimum acceptable value of KMO is 0.5, values of 0.8 and above are considered very good.

Using Bartlett's test of sphericity we confirm that our data are adequate to be analyzed using factor analysis, $\chi 2(861) = 5051.6$, $p < 0.001$. Bartlett's test tells us that sufficiently large correlations exist between items, which is necessary for factor analysis to work.

By Kaiser's criterion (i.e., eigenvalue of each factor is above 1) we extract six factors. The factors are listed in Table 1. The total percentage of variance in the data explained by the six factors is 63.4.

Tab 1: Summary of the six factor solution

Factor	Factor interpretation	Eigenvalue before rotation	Percentage of variance explained by unrotated factor	Eigenvalue after rotation
Factor 1	Strategic management	18.44	43.92	11.66
Factor 2	Leadership	2.89	6.89	11.46
Factor 3	Partners and customers	1.48	3.51	6.26
Factor 4	Human resources	1.34	3.20	9.63
Factor 5	Process management: Core processes	1.31	3.11	9.63
Factor 6	Process management: Innovation	1.15	2.74	5.31

Source: own

The total percentage of explained variance is naturally the same for rotated and unrotated factors. Note, however, that in the rotated solution the relative importance of the factors is equalized (compare the eigenvalues before and after rotation in Table 1).

Table 2 gives the item loadings to the rotated factors. More precisely, the pattern matrix is reproduced here. The pattern matrix indicates the unique contribution of an item to each factor (only loadings with magnitude higher than |0.35| are displayed).

Tab 2: Items loading the factors – rotated pattern matrix

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
STR4	0.67					
STR3	0.67					
PAR5	0.64					
PAR4	0.62					
STR6	0.62					
PAR3	0.60					
STR5	0.52					
STR2	0.48					0.38
PAR6	0.40		0.37			
HR1	0.39					
LEAD2		0.83				
LEAD6		0.79				
LEAD7		0.78				
LEAD4		0.76				
LEAD8		0.75				
LEAD1		0.70				
LEAD5		0.69				
LEAD3		0.66				
STR1		0.47				
PAR2			0.68			
PAR1			0.61			
PROC11			0.57			
HR2				-0.58		
HR5				-0.57		
HR7				-0.56		
HR3				-0.52		
PROC8				-0.51		
HR4				-0.47		
HR6		0.38		-0.45		
HR8		0.39		-0.42		
PROC3					0.89	
PROC2					0.75	
PROC1					0.61	
PAR7					0.45	
PROC6					0.41	
PROC7					0.38	
PAR8						
PAR9				-0.35		0.48
PROC9			0.37			0.47
PROC10					0.41	0.45
PROC4						0.44
PROC5					0.39	0.43

Source: own

Each item loads on six factors in total. We call the highest factor loading the "main loading" and the remaining five factor loadings "cross-loadings". The average main factor loading for the 42 items is 0.57 (SD = 0.14), while the cross-loadings are 0.12 on average (SD = 0.10)[3]. The difference between the two means is statistically significant (t-test for independent samples, two-tailed, $t(49.6) = 19.87$, $p < 0.001$), and the effect size is very large, $r = 0.94$. This means that our empirical factor structure has good convergent validity (high main loadings), as well as good discriminant validity (low cross-loadings), unlike the theory-based quality management models studied in (Jayamaha et al., 2008; Jayamaha et al., 2009; Jayamaha et al., 2011) that have poor discriminant validity (high cross-loadings).

3 The descriptives are based on absolute values of factor loadings. Levene's test for equality of variances rejects the null hypothesis that variances are equal in the 42 main factor loadings and in the 210 cross-loadings ($F = 11.98$, $p < 0.001$), therefore equality of variances is not assumed in following the t-test.

4 Discussion

Based on the content of questionnaire items that load highly on a given factor we can interpret what each factor represents. For example Factor 4 captures most of the HR management aspects (seven HR items, one Processes item and one Partnership item load on this factor). Factor 2 quite clearly represents several aspects of leadership (eight Leadership items, one Strategy item and two HR items load on this factor). An almost identical factor was identified in our preliminary work (Veselý et al., 2013), which supports the robustness of the Leadership factor. This is in line with the observation that Leadership is among the most culturally universal factors in quality management (Sila et al., 2003). Our interpretation of the remaining factors is given in Table 1.

We can observe that the initial areas predicted by theory (i.e., the five enabler criteria of the EFQM model) are mapped onto six factors. The six factors represent one of the following:

- a factor similar to one of the factors assumed in theory (namely, factors 2 and 4 represent Leadership and Human resources, respectively);
- a sub-area of the initial five EFQM criteria (there are two distinct Processes factors 5 and 6: Process management and Knowledge and innovation);
- a mixture of sub-areas of the EFQM criteria (factors 1 and 3 represent a mixture of Strategic management and Partnership and of Partnership and Processes, respectively).

We can notice that items from different areas of the EFQM model are sometimes contained in one underlying variable (a factor). This indicates that actions/situations described by these items are in fact closely related and should not be treated as independent and unrelated by companies' managers. In particular, while Leadership and Human resources represent a more or less distinct factors in management of the companies under study (see factors 2 and 4), Processes are an important ingredient in several factors (especially in factors 5 and 6, but also in factors 3 and 4). Also, notice that the Strategic management and Partnership aspects of management are closely linked (see factor 1).

Optimization of synergies between the elements of quality management should be easier when the typical empirical structural properties within the set of those elements are known (to which our study contributes). (Bou-Llusar et al., 2009) argue that understanding the structure of managerial approaches can help us assess the application of quality management in companies. Successful application of quality management leads in turn to better organizational performance and higher employee and customer satisfaction, see e.g. (Bou-Llusar et al., 2005; Duh et al., 2012; Ehrlich, 2006; Eskildsen et al., 2000; Hendricks et al., 1996; Kaynak, 2003).

Our findings can be also useful when foreign companies take over Czech firms and/or when foreign managers are hired to run Czech companies. In those cases the new managers can benefit from knowing the structure of managerial approaches typical for Czech companies, which may be different from the structure typical for companies in their country (see e.g. Madu et al., 1995; Solis et al., 2000).

Given cultural differences in quality management practices (see e.g. Vecchi et al., 2009; Vecchi et al., 2011), it could be interesting to use comparable samples of companies (e.g. with respect to size, sector and turn-over) from different countries to

see in what respects the structure of managerial approaches varies as a function of cultural differences. Future research can also focus on sector-specific differences in the structure of managerial approaches.

There is one intricate challenge for future research, namely to uncover and explain causal links among various aspects of company management. When we, for example, take a look at factor 1, we can see that companies with good Strategic management also perform well when it comes to the Partnership aspects of management. However, because in survey-based studies variables (such as items related to Strategic management) cannot be varied exogenously, we are unable to tell whether an increased performance in Strategic management causes an increase in Partnership, or the other way round. Or, alternatively, whether the increase is caused by another (unobserved) variable. Understanding the actual causal links can be obviously vital for efficiently implementing a system of management (see e.g. Bou-Llusar et al., 2005).

Experimental research – that is used to identify causal relations – is common in modern economics (see e.g. Camerer, 2011; Falk et al., 2009; Smith, 1982). However, it seems that an experimental study of managerial approaches would have to be done in the field (not in the lab), which renders possible future experimental research of managerial approaches all the more challenging.

Conclusion

The main purpose of the present paper was to pin down the factor structure of managerial approaches in a sample of Czech companies. We identified six factors of managerial approaches in the selected companies. Hence, the theoretical five-dimensional structure postulated in the EFQM model does not describe the interrelations between the individual quality management elements particularly well. On the other hand, there are also similarities between the empirical and theoretical structure – we identified two distinct empirical factors (Leadership and Human resources) that are almost identical to those assumed in the EFQM model.

Suggestions for further research: It is important to replicate our results in subsequent studies (see Maniadis et al., 2014). In particular, whereas our research was exploratory in nature (i.e., given the variety of results obtained by previous researchers, we did not have strong prior hypotheses concerning the factor structure), subsequent research can use the results presented here to formulate specific hypotheses. Our results can be especially relevant in this respect for replications performed in Central European countries or in other countries with comparable socio-economic conditions. A suitable method to be used in future research is confirmatory factor analysis (see e.g. Long, 1983). This method allows the researcher to compare the fit of different pre-specified alternative models to the empirical data at hand. One could for example compare the fit of our six-factor solution to the fit of the original five-factor model. What can be also interesting is to compare the fit of the different models across different types of companies (e.g., industrial vs. service companies).

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