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EFQM EXCELLENCE MODEL AS THE TQM MODEL OF THE CONSTRUCTION INDUSTRY OF SOUTHEASTERN EUROPE

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Abstract. Over the years the European Foundation for Quality Management Excellence model (EFQM) has become a popular performance management tool and representation of Total Quality Management (TQM) in Europe. Although the model has been tested and supported by many questionnaire surveys, EFQM has never been validated on real self-assessment scores obtained from companies. Therefore this study validates the model on scores from 34 construction companies in South Eastern Europe. The analysis shows that: a) there is an enabler excellence construct that is obtained by each enabler criteria; b) there is a result excellence construct that is obtained by each result criteria; and c) the EFQM model is most suitable for Contractor type organizations. Furthermore, we have found that the EFQM weights do not entirely correspond with the construction industry. Therefore we present new weights for the better use in the construction. Although this study proves EFQM to be a good representation of TQM in the construction industry, further improvements are needed. This is especially evident within investor and consultant type organization, where the criteria of Policy and Strategy, Leadership and Processes, People results and Client results showed certain limitations.

Keywords: EFQM excellence model, validation, total quality management, factor analysis, the construction industry.

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Introduction

The European Foundation for Quality Management Excellence model (EFQM) has become a very popular tool for not only assessing organizational performance, i.e. business excellence, but as an operational framework for implementing Total Quality Management (TQM) (Curkovic *et al.* 2000; Yong, Wilkinson 2001; Lee *et al.* 2003; Bassioni *et al.* 2004, 2005). Past studies show that regular use of performance management (PMM) models, i.e. the EFQM Excellence model (EFQM), positively influences business results (Qureshi *et al.* 2009; de Leeuw, van den Berg 2011; Bayo-Moriones, Merino-Díaz de Cerio 2001), especially in encouraging continuous improvement through self-assessment and benchmarking (Niven 2006). However, EFQM has also been criticized for not having a stronger link with strategy of the company and strategic integration process (Junnonen 1998). Despite the popularity of PMM models (of which the most popular ones are: EFQM, the Malcolm Baldridge National Quality Award and the Deming Prize), more than half fail (Bourne *et al.* 2003; Corredor, Go 2011). Regardless of its weak performance, EFQM has still become a renowned and untouched representation of TQM in Europe (Van der Wiele *et al.* 2000; Bayo-Moriones *et al.* 2011). For example, International Project Management Association (IPMA) propagates The Project Excellence Model for assessing project management quality, which actually relies on EFQM and TQM principles (Westerveld 2003).

TQM has traditionally been connected with issues arising from construction, e.g. an extremely complex combined process, production flow, various structures, high quality requirements and long construction cycle (Tchidi *et al.* 2012). The reason for this may be found in the industry's contrasts with manufacturing, where TQM first originated (Ahmad, Sein 1997; Stockdale 1998). However, unlike TQM, EFQM is a prescriptive model, well defined and easily understood by construction companies (Watson, Seng 2002). Still, the model has never been validated on the EFQM self-assessment scores (Bou-Llusar *et al.* 2009), except limited to Curkovic *et al.* (2000), but only tested on results obtained from questionnaire surveys, where project management professionals gave their perceptions regarding use of EFQM (Bou-Llusar *et al.* 2009; Tari *et al.* 2007). Furthermore, there is scarcity of studies that validate quality award models in general (McAdam, Leonard 2005). This raises concerns whether EFQM is a valid quality management model for the construction industry.

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Therefore, the objective of this study is to analyse and validate the use of EFQM and attempt to improve methodological rigor in analysing quality in the construction industry. To validate the model we will use data gathered from 34 EFQM self-assessment scores of 34 construction companies in South Eastern Europe (i.e. Bosnia and Herzegovina, and Croatia). Afterwards we will calculate a correlation matrix of EFQM criteria and compare the scores with the original theoretical presumptions of the model. Furthermore we will conduct a factor analysis to test the structure within the two types of EFQM criteria: Enablers and Results, and thus obtain an overall interpretation of the ratio correlations. At the end we will propose new weights for EFQM's use in the construction industry and give recommendations for the model's further improvements.

The paper is structured as follows: in the next section we will present a literature review, covering the relationship between EFQM and TQM, and give a brief overview of the performance management (PMM) discipline. Based on the literature review, in the Section 1, we will explain the research methodology. Section 2 will give the research hypotheses and explain their justification. Section 3 will describe the research methods used to test the hypotheses, and present the results. Section 5 will bring the main findings with a discussion of implications stemming from this research. Last section will give our conclusions and guidelines for further research.

1. Literature review

1.1. EFQM Excellence Model (EFQM)

EFQM was originally developed as a quality management system in 1991 (Hillman 1994) by the European Foundation for Quality Management (now known as just EFQM). The model is based on TQM principles and has recently been advocated by many authors (e.g. de Waal 2008; El-Mashaleh *et al.* 2007; EFQM 2005; Radujkovic *et al.* 2010). The main purpose of EFQM is to assess a company's business excellence by identifying deviations of performance from best practice, and generating a stimulus in the form of improving activities (Beatham *et al.* 2004). EFQM thus assesses performance through nine weighted criteria (Fig. 1) and their respective 32 sub-criteria. The model recognizes the distinction between leading indicators (Enablers) and lagging indicators (Results). The model starts with Leadership (a weight of 100 – see Fig. 1) which afterwards leads to the other 8 criteria. Client results (i.e. satisfying client needs) have the highest impact on the final score (20% or 200 points), which shows strong affiliation of the model to TQM principles. EFQM has become a very popular PMM tool in the construction industry (more than 60% of companies have implemented it (Andersen *et al.* 2000; Robinson *et al.* 2004)).

EFQM is a prescriptive model, based on a static design (just the opposite of many descriptive PMM frameworks, such as: BSC (Kaplan, Norton 1992), Performance Prism (Neely 2002), Performance Measurement Matrix (Kennerley, Neely 2002), etc.) and consists of a pre-set of standards and a well-prescribed methodology of self-assessment. Therefore, companies find EFQM much easier to use than the other descriptive models (Robinson *et al.* 2004). EFQM maintains a relationship with the environment and can signalize which business processes are (or not) aligned with changes in the competitive environment.

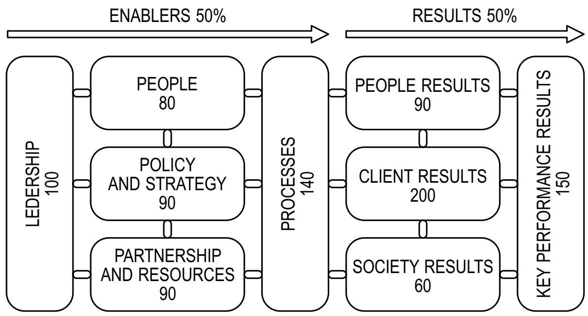

Fig. 1. EFQM Excellence model

The first major research in Europe about EFQM was conducted by Van der Wiele *et al.* (2000) where they reported on research work in Europe. Six European universities cooperated to conduct research into TQM and quality awards. Ritchie and Dale (2000) later found three groups of benefits that come from EFQM and the self-assessment process: 1. Immediate: benefits facilitates benchmarking, continuous improvement, encourages employee involvement and ownership, provides visibility in direction, raises understanding and awareness of quality related issues, develops a common approach to improvement across the company, seen as the marketing strategy, raising the profile of the organizations; 2. Long-term benefits: keeps costs down, improves business results, balances short term and long-term investments, develops a holistic approach to quality, maintains quality image, provides a link between customers and suppliers; Benefits of supporting TQM: focuses employees on quality, provides health check of processes and operations, focuses on processes and not just on the end product, encourages improvement in performance.

The evidence also suggests that the greatest impact on performance occurs about a year from receiving external recognition of implementing a quality award system (e.g. EFQM represents a long term process – the award can only come two years after the firm has totally implemented the system (Corredor, Go 2011)). However, the model has also received a great deal of criticism (Andersen *et al.* 2000; Codling 1995; Lam *et al.* 2004; McCabe 2001; Sharif 2002), mainly for its inability to focus and connect with firm's strategy (Rusjan 2005) and weak causal relationship between consequences and causes in business processes.

1.2. TQM in relation with EFQM

Over the years different definitions of TQM have emerged. The literature review showed no unanimous definition of TQM, where the authors (Sila, Ebrahimpour 2002; EFQM 2005) have different views in defining TQM. Nevertheless experts (Bou-Llusar *et al.* 2009) agree that TQM is a management approach that relies on core concepts and principles that embody the way an organization is expected to operate, which will then consequently lead to a high level of performance. Furthermore, there is a general agreement that there has to be one general framework to put TQM into practice, even though there is presently no such general model in place (Yusof, Aspinwall 2000). We found many different approaches and standardized frameworks of implementing TQM (Deming 1982; Crosby 1979; Gryna, Juran 2001; Askey, Dale 1994; Tummala, Tang 1996; Kartha 2004), among which many authors support the thesis that quality award models (e.g. EFQM) fit the definition of TQM and represent a valid framework for TQM.

However, many of these initiatives have not been empirically tested. Thus the studies that focused on the internal structure of the award models (e.g. the appropriateness of certain sub criteria) did not try to establish whether the results produce high performance, i.e. looking at the bigger picture (Ahire *et al.* 1996; Grandzol, Gershon 1998). Eskildsen and Dahlgaard (2000) suggested a different linkage between the five enabler criteria; Prabhu *et al.* (2000) described three partial linkages of People and People Results, Leadership and Customer Results; Eskildsen *et al.* (2000) found how leadership affects People, Policy and Strategy criteria and Partnership and Resources affect Processes criteria; Reiner (2002) analysed EFQM's sibling in Australia and found direct dependence between the criteria; Bou-Llusar *et al.* (2009) found that EFQM Enablers improve performance in general; Calvo-Mora *et al.* (2005) focused on the inter-relationship among the criteria and found positive linkages among the majority of the criteria. After summing up the past work it is evident that even though EFQM is widely accepted as the European initiative of TQM, there are no studies that address this question empirically (Bou-Llusar *et al.* 2009; Nudurupati *et al.* 2010; Adair *et al.* 2003). Furthermore, over the past number of years the attitude towards TQM has become negative, where people misunderstand the concept and perceive it to be too technical. Thus it has gradually developed it into something different, known as Business Excellence (Ritchie, Dale 2000).

2. Research hypotheses

At the time of EFQM's birth, companies in Europe were paying attention to another management quality system: the ISO 9000 series of standards. Literature also indicates that workers care about the quality of their work and company's performance and that these aspects affect significantly their job satisfaction (Marzuki *et al.* 2012). Although these standards were initially developed as quality assurance systems, they were later changed to converge towards quality management system. Europe has given great importance to these standards, which have now become simply a requirement to do business in some sectors of Europe (Gomez *et al.* 2011). As EFQM is considered synonymous with TQM by many researchers (Adams *et al.* 1999; Forza, Filippini 1998; Rungtusanatham *et al.* 2005; Hendricks, Singhal 1996) and a logical step forward ISO 9000 certification, logical question would be whether EFQM is applicable to certain industries, in this case the construction.

The literature review showed how until now there have been no empirical studies (that relied on real EFQM scores, except Gomez *et al.* (2011)) and that have tested whether EFQM's criteria contribute to performance. Furthermore, all of the papers, except Bou-Llusar *et al.* (2009), study the EFQM model prior to version 2003. Therefore, this research was needed to validate the model's structure and to see whether all the criteria contribute to the same factors or do the Enablers and Results contribute separately. Hence our first hypothesis was: H1. Two categories, i.e. the Enablers and Results, are separately identifiable in the internal structure of the model and are presented as a latent factor that produces complementarities between their components.

Furthermore, the construction industry is a project-oriented industry which relies mostly on three management perspectives: investors (sponsors), consultants (project managers, developers, architects, designers, etc.) and contractors (sub-contractors). To test whether EFQM is applicable for every perspective, we divided our sample on the three perspectives. Therefore, our second hypothesis was: H2. The Excellence model is applicable for every management perspective in the construction industry.

And finally, we were interested in whether the weights correspond with the way that construction companies achieve excellence. If so, the relationship between the latent factor "excellence" and criteria would correspond with the original weights. In past studies, different authors (Eskildsen 1998; Eskildsen *et al.* 2000; Reiner 2002; Bou-Llusar *et al.* 2009; Calvo-Mora *et al.* 2005; Gomez *et al.* 2011) mainly focused on analysing the relationships of the EFQM model and not whether they really represent the performance. We only found Bassioni *et al.* (2008) to question the model's relationships, but again, the study was based on secondary data. Therefore, with our third hypothesis: H3. The original EFQM weights correspond with the way that construction companies achieve excellence; we wanted to see to what extent the model's original weights converge with the weights calculated by the real empirical data.

3. Research methodology

First we ran a literature review of past TQM and EFQM research and consequently defined our hypotheses. Second, the EFQM self-assessment procedure (EFQM 2005) was implemented for the construction industry of South

Eastern Europe (Bosnia and Herzegovina, and Croatia) during a period of 1.5 years. Data was provided by the research team composed of authors of this paper and one consultancy agency that has been cooperating with EFQM in evaluating construction companies. All of the data acquired was kept confidential. There are five different techniques of assessing scores. Although there is a lack of literature on self-assessment methods we chose the Workshop Approach (EFQM 2005) since the method showed as a relatively objective method (Ritchie, Dale 2000). We ran the workshop method throughout five steps: 1. The assessors are explaining the EFQM model; 2. The data is gathered on-site; 3. Representatives of an organization (form upper, middle and lover management levels), together with the research team, are gaining consensus over the scores for each factor; 4. Areas for improvement are being identified; 5. Improvements are being assessed. The companies were chosen from database of Croatian Chamber of Chartered Engineers in Construction (HKIG 2012) industry, which covers all of the 142 medium-sized and large companies that operate in Croatia and Bosnia and Herzegovina. In total we covered 34 medium-sized (41.1%) and large companies (58.9%), which we had grouped in three management categories: investors (20.5%), consultants (29.5%) and contractors (50.0%). After having looked at the construction industry from these three perspectives we were able to identify best practice and understanding how EFQM differs amongst different management perspectives. Third, the data collected were further analysed through reliability (Cronbach's alpha) and validity (Factor Analysis). The factor analysis assumed that all of the EFQM criteria contribute to a latent factor called "excellence". Fourth, we computed the weights of the model criteria by calculating regression coefficients between the criteria and the latent factor. Fifth, by focusing on the correlation coefficients among the EFQM criteria, we tested whether the present model fits the construction industry.

4. Research methods and results

Tables 1 and 2 show the main descriptive statistics, for the variables. It can be seen that highest variance (standard deviation) was noticed within Client results. Furthermore, since the data were collected from three different kinds of organizations/perspectives (investors, consultants and contractors), results are also shown for every perspective (Table 1). Again the same high variance of Client results can be noticed across the three perspectives (Table 1). In general, the investors had the highest score (Table 1, score 422.3), the contractors followed with the score of 367.7; while the consultants had the lowest score of 362.2 of the total performance score (1000 points).

After having obtained these results, an analysis of variance (ANOVA) was conducted to evaluate if these differences were statistically significant. Table 1 shows the results. As can be seen, statistically significant differences were not found for any of the data. To test the criteria of different excellence models and TQM frameworks, checking the validity and reliability of the variables (the criteria) has become an integral part of research in quality management studies (Wilson, Collier 2000; Brewerton, Millward 2001), whereas reliability is a necessary measure, but not a sufficient condition to validity (Cooper, Emory 1995).The data were analysed using SPSS 12.0 software. Reliability addresses the consistency of the results and is mostly measured by Cronbach's alpha (Bassioni *et al.* 2005). We used Cronbach's alpha and set the reliability threshold (α) at 0.6 for new scales (Flynn *et al.* 1994). Cronbach's alpha calculates the proportion of the variability in the scores that is the result of differences among the companies. The alphas were computed separately for each of the groups. Results in Table 3 show that all of the groups had favourable scores.

For testing construct validity (structure detection) we implemented Factor analysis, which shows the extent to which the items (the criteria) of a construct (the groups) measure the same construct (Flynn *et al.* 1994),

Table 1. Descriptives of the three perspectives and ANOVA to evaluate differences among the investors, consultants and contractors

EFQM criteria	Investors				Consultants				Contractors				ANOVA – F statistics		
	N	Max	StDev	Mean	N	Max	StDev	Mean	N	Max	StDev	Mean	Inv/Cons	Inv/Contr	Cons/Contr
Lead.	8	73	22.043	41.286	9	64	16.342	34.545	17	73	19.916	32.435	0.384	0.672	0.525
Strat.	8	63	24.602	34.714	9	65	21.787	31.091	17	67	22.344	33.694	0.699	0.682	0.977
Peop.	8	60	15.327	38.286	9	72	16.211	35.000	17	66	17.760	30.697	0.931	0.767	0.803
Partn.	8	62	10.874	50.286	9	84	15.958	52.364	17	73	16.754	43.679	0.360	0.288	0.911
Process.	8	116	38.598	79.857	9	117	29.716	71.273	17	116	35.729	68.048	0.443	0.725	0.558
Client_r	8	158	56.668	67.571	9	125	38.777	50.091	17	134	43.511	42.119	0.276	0.348	0.729
People_r	8	59	18.933	21.143	9	45	12.498	16.000	17	59	21.072	21.473	0.235	0.848	0.093
Society_r	8	49	18.247	18.571	9	42	9.330	8.636	17	37	11.987	10.352	0.061	0.146	0.418
Key_r	8	121	33.141	71.000	9	113	30.230	63.364	17	121	32.374	72.214	0.759	0.850	0.855
Mean of the total score				422.3				362.2				367.7			

Table 2. Descriptives – all of the perspectives

	N	StDev	Mean	Max (out of 1000)
Leadership	43	18.263	32.974	73
Strategy	43	21.646	32.351	63
People	43	16.961	32.534	60
Partnership & Resources	43	16.496	46.614	62
Processes	43	32.808	69.242	116
Clients	43	45.337	48.288	158
People	43	18.566	18.998	59
Society	43	12.819	10.952	49
Key performance results	43	31.041	68.773	121

Table 3. Cronbach's alpha and 95 per cent confidence limits for each construct

Cronbach's Alpha	N of Items	95% Confidence Interval	
		Lower Bound	Upper Bound
.893	9 (Enablers and Results)	.829	.939
.887	5 (Enablers)	.813	.937
.699	4 (Results)	.491	.836

i.e. they do not measure multiple constructs (Cooper, Emory 1995). The purpose of the structure detection is to examine the underlying or latent relationships between the variables, in this case, three groups: enablers, results and all criteria together. The extraction method was Principal component analysis. The analysis assumed that some of the variability in the data cannot be explained by the components (called factors, in this case, the criteria). To interpret the results more easily we applied Varimax rotation. The communalities measure the percent of variance in a given variable explained by all the factors jointly and may be interpreted as the reliability of the indicator. If communalities are high (above 0.6) recovery of population factors in sample data is normally very good and almost regardless of: sample size, level of over determination or the presence of modal error (MacCallum *et al.* 2001). If the communality exceeds 1.0, there is a spurious solution (too many or too few factors). Table 4 shows no spurious solutions. Still because the sample size, we double checked the data by calculating the subject to variable ratio (STV). STV for the enablers was 6.8:1 and for the results 8.5:1. This showed the sample size valid (Henson, Roberts 2006; Costello, Osborne 2005) and in accordance with current practice in factor analysis of construction management research (87.09% studies had STV lower than 10:1 (Lingard, Rowlinson 2006)).

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy indicates the proportion of variance in the variables that might be caused by underlying factors. High values (close to 1.0) indicate that a factor analysis may be useful and if the value is less than 0.50, the results will probably not be very useful. Bartlett's test of sphericity indicates that the variables are unrelated and therefore unsuitable for structure detection. Values of significance level less than 0.05 indicate that a factor analysis may be useful. Table 5 shows that all three constructs have a data set useful for factor analysis and suitable for structure detection.

Table 5. KMO and Bartlett's test of the three constructs

		Enablers	Results	All
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.821	.665	.813
Bartlett's Test of Sphericity	Approx. Chi-Square	117.821	44.056	226.559
	df	10.000	6.000	36.000
	Sig.	.000	.000	.000

Table 6 shows the factor analysis conducted on the enablers. As Table 6 suggests, only one factor was extracted (covering almost 75 % of variance) with an Eigen value larger than 1. Communalities in the right-hand column show that enablers contribute highly to one single construct that represents the enabler group.

Table 7 shows the factor analysis conducted on the Results. Just as with the Enablers, only one factor was extracted (covering almost 61.1 % of variance) with an Eigen value larger than 1. Communalities in the right-hand column show that the results have a relatively high (not as much as the enabler group) contribution to one single construct that represents the whole result group.

Table 4. The communalities of the three constructs

Enablers	Initial	Extraction	Results	Initial	Extraction	All	Initial	Extraction
Lead.	.775	.772	Client_r	.454	.457	Lead.	1.000	.803
Strat.	.756	.819	People_r	.465	.431	Strat.	1.000	.878
Peop.	.723	.685	Society_r	.443	.453	Peop.	1.000	.721
Partn.	.565	.592	Key_r	.520	.595	Partn.	1.000	.642
Process.	.626	.552				Process.	1.000	.606
						Client_r	1.000	.785
						People_r	1.000	.705
						Society_r	1.000	.821
						Key_r	1.000	.779

Table 6. Factor analysis of the enabler group

Factor	Initial Eigen values			Extraction Sums of Squared Loadings			Criteria	Factor
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %		1
1	3.724	74.477	74.477	3.420	68.399	68.399	Lead.	.878
2	.579	11.578	86.055				Strat.	.905
3	.371	7.417	93.473				Peop.	.828
4	.182	3.641	97.114				Partn.	.769
5	.144	2.886	100.000				Proces.	.743

Table 7. Factor analysis of the result group

Factor	Initial Eigen values			Extraction Sums of Squared Loadings			Factor	Criteria
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	1	
1	2.445	61.133	61.133	1.935	48.387	48.387	.676	Client_r
2	.886	22.156	83.290				.656	People_r
3	.368	9.200	92.490				.673	Society_r
4	.300	7.510	100.000				.771	Key_r

Table 8 shows the factor analysis conducted on all of the criteria. It can be seen that, contrary to the Enablers and Results, two factors were extracted, with Eigen values of 5.724 and 1.017 for factors 1 and 2 respectively. This shows that all of the criteria together could not contribute together to one single construct, i.e. excellence. Communalities in the right hand column show that Society results (in black shading), Client results (to a lesser degree, grey shading) and Partnership criterion (in bold, Table 8) contribute to the second factor.

To confirm factor analysis we conducted ANOVA. The significance value of the F test, in Table 9, is 0.000 which validates these two groups as separate. Furthermore, Table 9 shows how the Enablers excellence contributes highly to the Results excellence, where 71.8% of the variability of the data is explained by the model. Figure 2 shows a scatter plot of the two excellence factors, which shows the strong and almost linear dependence.

The weights of the criteria have been shown to vary over the years without any real justification and therefore authors (Bassioni *et al.* 2005; Eskildsen, Dahlgaard 2000) have started to criticize the model for not corresponding to the way that companies are working. In order to define new weights, authors used various methods. E.g. Bassioni *et al.* (2004) and Eskildsen *et al.* (2000) used the factor regression coefficient; Cheng and Li (2001) used Analytic Hierarchy Process (AHP), etc. We used the factor regression coefficient to assess impact of each

Table 8. Factor analysis of all the criteria

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Component		Criteria
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	1	2	
1	5.724	63.595	63.595	5.724	63.595	63.595	.891	–.098	Lead.
2	1.017	11.304	74.899	1.017	11.304	74.899	.900	–.262	Strat.
3	.717	7.967	82.866				.845	–.079	Peop.
4	.427	4.741	87.608				**.800**	**.047**	**Partn.**
5	.403	4.473	92.081				.778	–.020	Proces.
6	.310	3.449	95.530				.677	.572	Client_r
7	.203	2.256	97.786				.767	–.342	People_r
8	.123	1.372	99.157				**.609**	**.670**	Society_r
9	.076	.843	100.000				.862	–.191	Key_r

Note: Dark and grey cells note relatively evenly distributed communalities of the two components. The bold values indicate shared variance over two components.

Table 9. ANOVA for the Enablers and Results excellence factors

R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
				R^2 Change	F Change	df1	df2	Sig. F Change
.853	.727	.718	.51148017	.727	85.142	1	32	.000

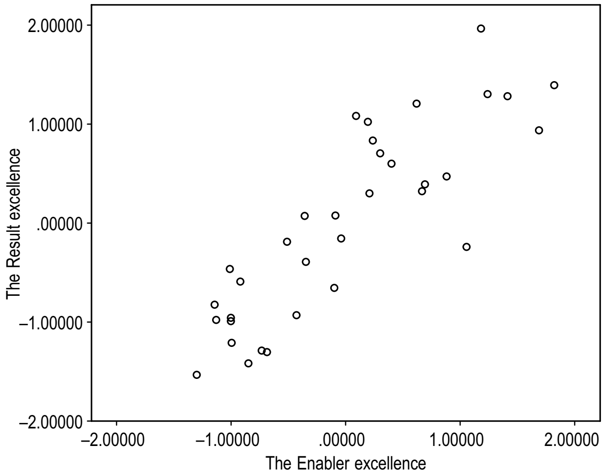

Fig. 2. Scatter plot of the Enablers and Results excellence factors

criterion on the latent factor "excellence". Because the factor analysis, we did this separately for the Enablers and Results.

The regression coefficients are shown in Table 10. Since score coefficients were not suitable for EFQM excellence scoring, we divided each criterion from the enabler group by the total of all coefficients and multiplied it by 500. The same was done for the results.

Table 11 shows the correlations among each of the EFQM criteria. All the correlations were positive and significantly different from zero. The numbers in black shadings show values smaller than 0.5. The correlations were calculated for every perspective and the scores were assigned to the model (this is shown in the following section).

5. Findings and discussion

5.1. There is no latent factor common to all the model's criteria

We found no latent factor "excellence" common to all the model's criteria. Yet we found two categories, the Enablers and Results, which contribute to the latent factor and should be considered separately, i.e. the Enablers and Results, are separately identifiable in the internal structure of the model and are presented as a latent factor that produces complementarities between their components. Therefore we accepted the first hypothesis and thus validated the model's original structure. The structure given in Figure 3, shows how the Enablers contribute to the Enabler excellence, where the arrow points from the Enablers to the Results group. Consequently the Results group leads to the Results excellence. Similar was found by Dijkstra (1997) but on the earlier version of the model (before 2003). Still these findings are contrary to some past studies which put all of the EFQM criteria together in direct relation with one single construct "excellence" (Bassioni *et al.* 2004).

Previous studies (Rahman, Bullock 2005; Rahman 2004; Yong, Wilkinson 2001; Cua *et al.* 2001) also dis-

Table 10. Component score coefficients and criterion weights

	Enablers			Results	
	Score coefficients	Criterion Weights		Score coefficients	Criterion Weights
Leadership	0.911597	107	Clients	0.757445	122
Strategy	0.939236	110	People	0.735359	118
People	0.858961	100	Society	0.753898	121
Partnership & Resources	0.798286	93	Key performance results	0.864068	139
Processes	0.770996	90			
Total	4.279076	500	Total	3.110771	500

Table 11. Example of the correlation matrix for the Investors' perspective

Criteria	Leader.	Strat.	Peop.	Partner.	Proces.	Client_r	People_r	Society_r	Key_r
Leader.	1.000								
Strat.	0.521	1.000							
Peop.	0.754	0.658	1.000						
Partner.	0.460	0.511	0.563	1.000					
Proces.	0.521	0.947	0.794	0.635	1.000				
Client_r	**0.286**	**0.274**	0.707	**0.309**	0.443	1.000			
People_r	0.613	0.551	0.549	**0.389**	0.448	**0.181**	1.000		
Society_ r	**0.365**	**0.040**	0.680	**0.184**	**0.235**	0.935	**0.130**	1.000	
Key_r	0.754	0.884	0.746	0.531	0.830	0.472	0.621	**0.310**	1.000

Note: the numbers in black shadings show lower correlations.

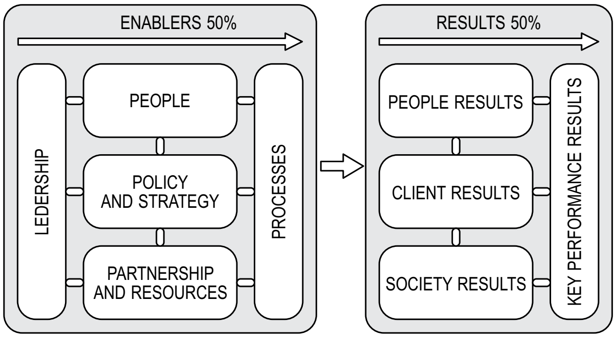

Fig. 3. The excellence model validated by the factor analysis

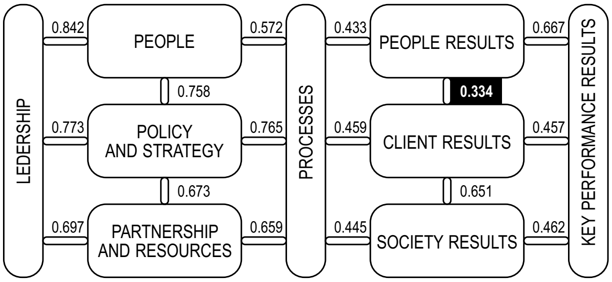

Fig. 4. Correlation coefficients for all the perspectives

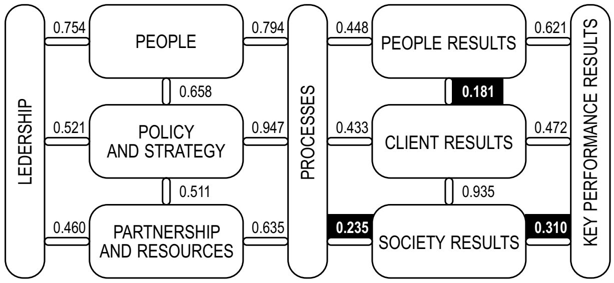

Fig. 5. Correlation coefficients for the investors

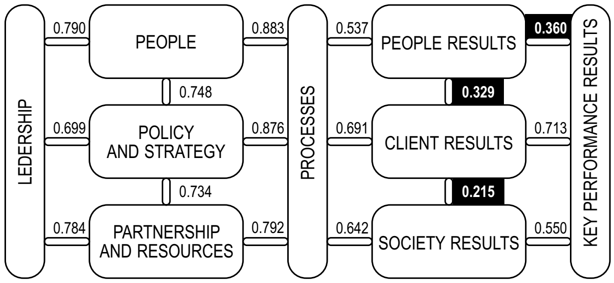

Fig. 6. Correlation coefficients for the consultants
Note: the numbers in black shadings show lower correlations between the criteria.

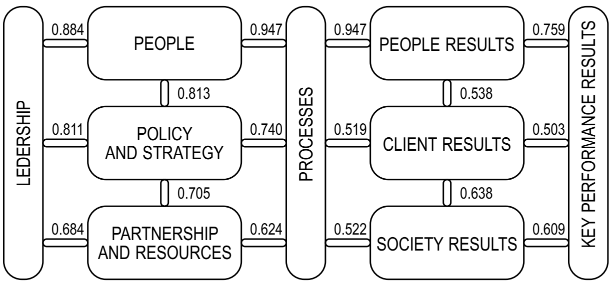

Fig. 7. Correlation coefficients for the contractors

tinguished between social and technical dimensions represented in the enabler and results, which shows how the holistic approach of TQM is represented in EFQM. We found a strong relationship between the Enablers and Results, as the excellence construct is explained by almost 75% variability of the enablers and 61% variability of the results. This confirms the results obtained by Calvo-Mora *et al.* (2005) and Reiner (2002) regarding the internal logic between the EFQM elements. Moreover, this high relationship between the two groups supports the TQM principles and numerous studies (Belohlav 1993; Flynn *et al.* 1994; Train, Williams 2000) which show the importance of adopting a holistic view of the model. This means that there is a difference between the Enablers and Results criteria in the degree to which they contribute to excellence which supports the first hypothesis.

5.2. The Excellence model in its present form is not fully applicable for every management perspective in the construction industry, but only for the contractor perspective

Up to now there have been few studies dealing with validation of EFQM in the construction industry, and none that validated the model on real assessment data. As explained in the methodology part, the South European (SEE) construction industry has a specific business culture. SEE countries have strict law regulation that defines project stakeholders. There are three main management perspectives: investors (sponsors, developers), consultants (project managers, designers, architects, supervision, etc.) and contractors. Therefore these perspectives were analyzed separately. The correlation coefficients from Table were used to validate the relationships of the criteria. Figures 4–7 show the correlation coefficients for every perspective separately.

It can be seen that only the Contractor perspective (Fig. 7) corresponds with the theoretical presumptions of EFQM. When looking at all the perspectives (Fig. 4), a weaker relationship was identified between the Client and People results. The investor perspective (Fig. 5) showed a weaker relationship between Client and People results and between Society, Processes and Key performance results. This was also supported by factor analysis, which showed that, when analyzing all the criteria, the Society criterion does not contribute to an excellence construct. The same was noticed by Gomez *et al.* (2011), but not Reiner (2002) who noticed positive correlation of the People and the Client results. The Society criterion was also reported by other authors by (Bou-Llusar *et al.* 2009; Lee *et al.* 2003; Ghosh *et al.* 2003; Gomez *et al.* 2011) as not being compatible with the Enablers. The consultant perspective (Fig. 6) showed a weaker link among People results, Client results and Society results and between People results and Key Performance results. Again, the Society criterion had a weaker link, which supports the aforementioned notions. Therefore, while the enabler criteria are aligned with EFQM's original structure, the results group raises certain doubts. All these findings rejected the second hypothesis and showed that the EFQM model is not applicable for every management perspective in the construction industry.

5.3. The original EFQM weights do not correspond with the construction industry

Figure 8 shows EFQM model with updated criteria weights (based on the regression coefficients from Table 10), which show how the construction industry obtains excellence. The main benefit of this model is that it provides a model tailored particularly for the construction industry and especially for the contractor perspective. Figure 8 shows that the model puts less emphasis on the Processes and Client results and more emphasis on the Policy and Strategy, People, People results and Society results. These results rejected the third hypothesis and showed that the original EFQM weights are not properly aligned with the construction industry.

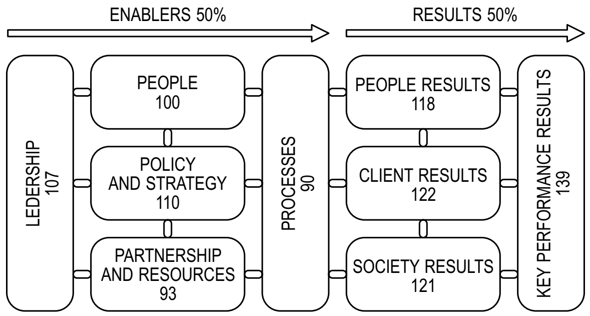

Fig. 8. New weights for the EFQM model's use in the construction industry

Conclusions

This paper explored the internal structure of the EFQM Excellence model and has validated the model's theoretical presumptions. This was done using the real assessment data, obtained from assessing the companies using EFQM self-assessment sheets. This is the first study that uses this kind of data and offers a more precise evaluation of how the EFQM model functions. We have found that effective EFQM implementation requires an approach that manages the Enabler and Result criteria separately. Furthermore, the results show that the original EFQM model, does not work on the principle "one size fits all". This does not mean that the elements of the model cannot be useful to organizations, but certain relationships of the model do not work as the model suggests.

The main findings are: 1. There is an enabler excellence construct that underlines the level of deployment obtained by each enabler criteria; 2. There is a result excellence construct that underlines the level of deployment obtained by each result criteria; 3. The weights, set by the original model, do not entirely correspond with the way the construction industry attains excellence; 4. The EFQM model, in its present form is only suitable for contractor type organizations and thus further improvements are required for Consultants' and Investors' type organizations. This led us to conclude that EFQM is a suitable award model and a framework for implementing TQM in the construction industry.

From the methodological point of view, we adopted a global methodology for testing award models, which has already been proven on similar studies (Bou-Llusar *et al.* 2009; Curkovic *et al.* 2000; Dijkstra 1997). However, this study extends to correlations among the criteria within different management perspectives. Furthermore, our approach is in accordance with Dijkstra (1997), Winn and Cameron (1998), Wilson and Collier (2000) and Bou-Llusar *et al.* (2009), who found a latent factor that underlines the model's criteria and the existence of causal relationship between award criteria.

The results of this study could be very interesting for managers in pursuit of winning a quality award, i.e. the EFQM Excellence Award, because they can serve as a guide for conducting EFQM self-assessment and implementing TQM for the first time. Furthermore, we propose an alternative model for the construction organizations, especially useful for the contractor perspective. Moreover, the analysis of the relationships amongst the model criteria can help organizations in defining priorities for further improvement. Only by understanding the structure of the model and linkages between the elements can allow organizations to benefit fully from the self-assessment process.

However, this study has certain limitations, which need to be addressed. The sample was a convenience sample, made of companies willing to participate in the research (among 142 larger and medium-sized companies, we covered 34 organizations). However, this was the first time that the real assessment data were collected from the construction industry, which provides the importance to this study. Second, since the construction is largely a project-oriented industry, this model might not be successfully applicable to other production-oriented industries. Therefore companies from other industries, besides the construction, are encouraged and welcome to use the new weights, but with the rider that they were designed specifically for the contractors and project oriented companies. Furthermore, companies using these new weights might have issues when benchmarking against the original EFQM model.

The EFQM model is obviously not an ideal model. We agree with Gomez *et al.* (2011) that the problem can come from two sources: the assumptions of the original model or the way the evaluators interpret the model. Therefore the options for further research are wide. First, a natural extension of this study would be to focus on finding the weights for the other two perspectives. Figures 4–7 show that among Investors and Consultants few links are highly correlated, e.g. Client results and Society results for the Investors' perspective. This confirms that there is quite a bit of shared variance within these two perspectives, which shows the need for more validation on a larger sample. Still, the Investors and Consultants can use the model, but with a proviso regarding the areas shaded on the Figures 5 and 6. Second, in order to solve the benchmarking problem regarding the new weights, an analysis of the differences in EFQM between different industries would be necessary. Furthermore, ascertain authors suggested (Prasad, Tata 2003; Rungtusanatham *et al.* 2005; Flynn *et al.* 1994; Bou-Llusar *et al.* 2009), analysing the differences in different approaches between countries in the EFQM model would be necessary.

Finally, we strongly call for further research in this unexplored direction to derive even better total quality management model for the construction.

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