Managerial Practices of Quality Costing: An Evidence-Based Framework

1. Background and rationale

Quality is widely acknowledged to be a key competitive weapon in the global marketplace. If it is managed properly, it will not only enhance product differentiation but simultaneously reduce costs. Motivated by the expected benefits from improving quality, many firms around the globe have taken the initiative of obtaining quality labels and certifications. By December 2008 982,832 ISO 9001:2000 certificates had been issued across 176 countries (ISO, 2008). Other firms have gone a step further and embraced the philosophy of TQM. Measuring and reporting quality cost data is a critical step for the successful implementation of quality improvement programs (Duncalf and Dale, 1985). To be most beneficial, these programs should be implemented at the lowest possible cost. This, amongst other things, can be achieved through reducing the costs associated with attaining high quality, which is only possible if such costs are identified, measured and reported. (Schiffauerova and Thomson, 2006)

Quality costing has long been promoted as a critical step for the effective planning and implementation of quality improvement programs. The literature reveals some agreement on what is meant by quality costing and its dimensions. However, as yet, there has been no attempt to propose a systematic operational framework of the processes or practices of quality costing.

The purpose of this paper is to draw together the various practices of quality costing by creating an empirically informed theoretical framework against which discretionary managerial practices can be evaluated. It is appropriate to reiterate that the paper is concerned with a taxonomy of *costing practices* – not of the costs themselves which have already been classified in various ways, such as in the prevention, appraisal and failure model (Feigenbaum, 1974)

2. The "best practices" of quality costing and their classification

Cost of quality reports have been produced for more than 60 years but the literature lacks an agreed definition of quality costing. Previous authors have structured theoretical constructs of what is considered to be "best practice" of quality costing in terms of collecting, measuring, analysing, reporting and using quality cost data. (See for example, Morse *et al.*, 1987; BSI, 1990; Atkinson *et al.*, 1991; Dale and Plunkett, 1991; Tatikonda and Tatikonda, 1996; Bottorff, 1997; Campanella, 1999; Oliver and Qu, 1999; Shah and Mandal, 1999, Prickett and Rapley, 2001; Sower *et al.*, 2007). It is notable that these constructs have not been derived by reference to what actually occurs within 'real-life' organisations.

Drawing on the literature's theoretical representation of "best practice", quality costing is defined for the purposes of this paper as *the selection, collection, measurement, classification, analysis, reporting and use of the quality cost data.* Hence, the practices of quality costing refer to *the practices, policies and procedures which relate to the selection, collection, measurement, classification, analysis, reporting and use of the quality cost data.* A list of 30 "best practices" of quality costing (PQC scale) was extracted from the literature. These practices were classified, *à priori*, into three groups or subscales:

- the first group includes those practices that relate to collecting, measuring and classifying quality cost data (CMC scale);
- the practices in the second group relate to analyzing, reporting and using quality cost data (ARU scale); and
- the third group includes the practices referring to selecting, using and maintaining of quality-related financial metrics (SUM scale).

To improve the generic PQC scale in terms of both content and construct validity it was evaluated by a panel of academic experts, quality consultants and professionals as to the coverage, understandability and clarity of the questions^[1]. Furthermore, the scale was pre-tested by quality managers from four different manufacturing firms that had not been included in the sample. The managers were asked to comment on the content of the questions, their coverage, clarity and layout. Based on the feedback received, the PQC scale was refined. A total of seven items were omitted from the scale as they were unclear to the respondents or overlapped with other items.

Moreover, wording and layout were modified. The final PQC scale was composed of 23 items as shown in Table 1.

Table 1:	The three	a priori	groupings	and thei	r multiple items	

	Item
	Collecting, measuring and classifying data
CMC1	Strategies and methods for measuring and collecting quality cost data are clearly defined.
CMC2	Quality costs data are measured and collected on a continuous basis.
CMC3	The accounting staff participates in determining which quality cost items are collected.
CMC4	The quality cost items collected are categorized under the Prevention, Appraisal, and Failure (PAF) scheme.
CMC5	In our firm, for quality costs, we collect and measure only the cost of inspection and internal failure.
CMC6	There is a high level of cooperation across departments in the collection and measurement of quality cost data.
CMC7	The accounting staff coordinates the process of collecting and measuring quality cost data.
	Analysing, reporting and using data
ARU1	Quality costs reports are prepared on a continuous basis.
ARU2	Graphs and charts are used to present quality cost data.
ARU3	Quality costs data are analyzed across more than one dimension (e.g. process/ product line/department).
ARU4	Quality costs data are analyzed into finer levels of cost components.
ARU5	Quality costs reports are benchmarked against previous periods, budgeted data and/or against competitors.
ARU6	Quality costs reports are made available to senior managers only.
ARU7	In our firm, quality costs reports are influential in identifying potential quality problems and improvement opportunities.
ARU8	In our firm, quality costs reports are influential in planning and monitoring quality improvement programmes.
ARU9	The accounting staff coordinates the process of preparing quality costs
	reports.
	Selecting and using metrics
SUM1	In our firm, financial quality metrics are used in addition to operational metrics.
SUM2	Financial quality metrics in place are directly linked to the objectives of the firm's quality improvement effort.
SUM3	The accounting staff is influential in selecting financial quality metrics.
SUM4	In our firm, financial quality metrics in place are regularly reviewed.
SUM5	In our firm, ratio-based financial metrics are used in addition to absolute values.
SUM6	In our firm, financial quality metrics in place cover all functional areas.
SUM7	In our firm, the only use of financial quality metrics is to attract top management attention to quality problems and obtain resources
	management attention to quanty problems and obtain resources.

3. Method and data

A survey questionnaire^[2] was sent to all 88 Jordanian manufacturing firms (JMF) publicly listed at Amman Stock Exchange in December 2007. These firms were requested to have the questionnaire completed by their quality manager or the individual in charge of the quality function, regardless of his title. Companies were asked to indicate the extent to which they agree with 23 statements, based on the quality costing related to the management control systems actually in place in their firms, using a 5-point scale in which 1 represents disagree strongly, and 5 indicates strong agreement.

A total of 65 usable questionnaires were collected back. The Mann-Whitney U test was used to assess non-response bias between respondents and non-respondents with respect to the firms' characteristics such as total assets, sales turnover, number of employees, age and ISO 9001 accreditation status. The results showed that non-response bias was not a problem in the current study. The normality test suggested that the distribution of the responses for the PQC scale and each of the subscales is approximately normal, with the significance levels of the Kolmogorov-Smirnov statistics ranging between .061 and .099.

The reliability coefficient (Cronbach's alpha) for the comprehensive PQC scale was .851 which is considerably above the acceptable level of .6 (Sekran, 1992). The itemtotal correlation statistic for all but one of the multiple line items is greater than the minimum acceptable level of .3 (Kline, 1986); Item CMC1 had an item-total correlation value of .152, below the acceptable level of .3. This suggests that this item is incorrectly included in the PQC scale. If it is dropped then the Cronbach alpha coefficient for the PQC scale improves from .851 to .879. Nevertheless, the final decision to whether drop this item or not was deferred until the factor analysis was performed.

4. Data analysis

4.1 The profile of responding firms

As shown in Table 2, the 65 responding firms belonged to 14 different industrial sectors. The total assets of these firms ranged from US\$3.5 million to US\$592 million with an average of US\$68 million. The average number of employees was 370. In 2007, the sales turnover generated by these firms ranged between US\$35,000 and US\$1.12 million. About 83% of these firms had been operating in the market for more than 10 years. Of the 65 firms that responded, 54% were ISO 9001 certified.

Table 2: Profile of responding firms					
Categories	Number				
Industrial sectors					
Food, beverage & tobacco	14				
Chemical products	7				
Pharmaceutical	7				
Metal fabricated metal manufacturing	7				
Bricks, pottery, glass & cement	5				
Paper printing publishing	4				
Non-metallic mineral products	4				
Electrical appliance component manufacturing	4				
Textile, apparel & footwear	3				
Mining quarrying	3				
Leather & fur goods	3				
Coal petroleum products	2				
Wood furniture products	1				
Machinery equip	1				
Total	65				
Total assets (US\$)					
Small (< 7,000,000)	13				
Medium (7,000,000 - 40,000,000)	36				
Large (> 40,000,000)	16				
Number of employees					
Small (< 50)	4				
Medium (50 – 499)	53				
Large (500 and more)	8				
Sales turnover (US\$)					
Small (< 10,000,000)	40				
Medium (10,000,000 - 60,000,000)	19				
Large (> 60,000,000)	6				

4.2 Factor Analysis

To better identify the critical dimensions for the practices of quality costing, exploratory factor analysis and reliability analysis were used (Meyers *et al.*, 2006). Factor analysis is not a clear-cut technique but involves judgmental decisions that affect the final solution. For example, decisions have to be made as regard to the factorability of data, extraction method, extraction criteria and so on. These issues are detailed in Appendix 1.

4.2.1 Factor analysis on the 23 items of the PQC scale (first run)

The 23 items of the PQC scale were subjected to an exploratory factor analysis using the principal component method with Orthogonal rotation/Varimax procedure^[3]. The factorability of the data was assessed. The value of the overall KMO^[4] was normal at .628 and exceeded the minimum acceptable level of .5. Furthermore, the Bartlett's test of sphericity was significant ($\chi 2(253) = 540.732$, $\rho = .000$). The KMO statistics for the all but one individual items ranged from .522 to .811; Item CMC1 had a KMO statistic of .407 which is far below the minimal acceptable level of .5.

The initial solution showed that communalities ranged from .570 to .877. Furthermore, seven factors with eigen values greater than or equal to 1 were extracted. These factors accounted for 69.7% of the total cumulative variance with Factor I being the dominant and explaining 27.6% of the variance. However, the inspection of the scree plot revealed a break in the curve at the fifth factor.

To assist in the interpretation of the retained factors, a Varimax rotation was performed. The rotated solution is shown in Appendix 2. Inspection of the rotated matrix revealed that all factors except Factor VII had a number of good loadings with three or more items loaded on each factor. Only one item loaded on Factor VII; unsurprisingly, this item was CMC1. Almost 25% of the items were cross-loaded.

At this point it was clear that Item CMC1 is a problematic item. Therefore, a decision was made to drop this item and re-perform the factor analysis on the remaining 22 items.

4.2.2 Factor analysis for the remaining 22 items

The remaining 22 items of the PQC scale were subjected to an exploratory factor analysis using the principal component method with Orthogonal/Varimax procedure. The overall KMO increases from .628 to .684 and the Bartlett's Chi square is significant ($\chi 2(231) = 517.5$, $\rho = .000$). Both tests indicate that the data is suitable for factor analysis. Furthermore, the KMO for the individual items range from .512 to .836; communalities range from .560 to .875. Six factors with eigenvalues greater than or equal to 1 are extracted. These factors account for 67% of the total cumulative variance with the first two factors being the dominant ones explaining 29% and 11% of the variance respectively. The scree plot in Figure 1 shows a clear break in the curve after the sixth factor supporting the result of the Kaiser's criterion to retain six factors only.

Take in Figure 1.

The rotated matrix (Table 2) shows that all factors have a number of good loadings and none of them are loaded on less than three items. The highest loading is .828 (in Factor II) explaining 68.5% of the item variance, whereas the lowest loading is .500 (in Factor V) explaining 25% of the variance. Moreover, the number of cross-loaded items decreases from six on the *à priori* classification to just two (CMC7 and ARU4).

		Cronbach					
Item	1	2	3	4	5	6	alpha
SUM7	.726	016	.020	.079	.201	.132	.768
SUM1	.661	.256	.244	062	196	069	
ARU7	.630	.107	.255	044	.021	.154	
ARU8	.629	.036	.153	.278	.248	.222	
SUM5	094	.828	.104	020	.113	.257	.746
SUM4	.135	.736	033	.275	.087	.029	
SUM2	.248	.734	017	.099	.229	061	
SUM6	.194	.590	111	.234	.213	.275	
SUM3	.131	.039	.745	172	.008	.042	.687
CMC3	078	119	.669	.249	.192	.190	
CMC7	.402	115	.658	.175	.311	037	
ARU9	.255	.213	.551	.156	143	060	
CMC5	061	.122	.185	.775	.175	032	.742
CMC4	.143	.242	240	.725	.040	.045	
CMC6	.241	001	.143	.702	039	.219	
ARU2	.225	.059	.196	.046	.813	.128	.677
ARU3	.112	.203	047	.211	.758	075	
ARU5	.092	.199	.285	205	.529	.271	
ARU4	.077	.406	.266	.152	.500	.281	
ARU1	.017	.233	014	.306	155	.714	.759
CMC2	.302	.209	.194	.077	.093	.712	
ARU6	.283	206	003	107	.238	.636	
Eigenvalue	3.20	2.60	2.51	2.22	2.17	2.02	
Variance explained %	14.53	11.81	11.39	10.09	9.86	9.20	

 Table 3: Factor analysis - rotated component matrix (Second run)

Extraction method: Principal Component analysis, Rotation method: Varimax with Kaiser normalization.

4.2.3 Validating the extracted factors

The Cronbach's alpha coefficient is computed for each derived factor to assess its reliability. The alpha coefficients range from .677 to .768 (Table 2). The item-total correlation statistics for the multiple line items are between .366 and .682. Moreover, the reliability tables produced by SPSS show that for each derived factor, removing any of its items will not improve its reliability. Accordingly, these six factors are judged to be reliable.

The recommendations of Nunnally and Bernstein, (1994) were adopted in this study to evaluate the construct validity of the factors. Each of the six factors was subjected to a factor analysis using the principal component method which results in unifactorial solutions. Accordingly, it can be said that each of the six factors is a valid construct. Furthermore, the KMO values for each factor and for their multiple items are above the minimum acceptable level of .5. In addition, the Bartlett's chi square is significant for all six factors.

5. Findings and discussion

The factor solution suggests that there are six distinct components of the PQC listing. These factors represent latent constructs within PQC; items loading on a specific factor are, in effect, operationalizing such latent constructs. However, the fact that a number of items cluster together does not necessarily mean that they jointly create a valid conceptual meaning. Therefore it is necessary to conduct a conceptual inspection of the factors and their items after the factor structure has been determined. Once the conceptual meaning for each factor is substantiated, extracted factors need to be labelled according to the common theme presented by the items loaded on the factor as well as the loading statistic (Mahoney *et al.*, 1995). The inspection and labelling of the factors extracted in the current study are discussed next.

Factor I is a construct (scale) comprising four^[5] items namely: SUM7, SUM1, ARU7 and ARU8. As can be seen from Table 4, conceptually these items tackle the different *uses of the quality cost data* and reports. Therefore, it was decided to describe or label this factor as: Use of quality cost data (UQCD). This is the dominant factor explaining 14.53% of the total variance with an eigenvalue of 3.20. However, it should be noted that the percentage of total variance explained by Factor I is not attributed to these four items only; the remaining 18 items of the PQC scale contributed to this percentage too.

Factor II is a construct (scale) comprising four^[6] items namely: SUM5, SUM4, SUM2 and SUM6 (Table 4). Conceptually, these items focus on the practices related to selecting and reviewing the *financial quality-related metrics*. Therefore, the factor was labelled as: Selection of financial quality-related metrics (SFQM). All items in the factor originally come from the *à priori* SUM group. Item SUM5 ("Ratio-based financial metrics are used in addition to absolute values") has the highest loading (.828) amongst all groups. Items SUM4 and SUM2 have almost the same loadings, .736 and .734.

Factor	Items	Label
Factor I		Use of quality
SUM7	In our firm, the only use of financial quality metrics is to attract top management attention to quality problems and	cost data (UQCD)
SUM1	obtain resources.	
50111	addition to operational metrics	
ARU7	In our firm, quality costs reports are influential in identifying potential quality problems and improvement opportunities.	
ARU8	In our firm, quality costs reports are influential in planning and monitoring quality improvement programmes.	
Factor II		Selection of
SUM5	In our firm, ratio-based financial metrics are used in addition to absolute values.	financial quality-
SUM4	In our firm, financial quality metrics in place are regularly reviewed.	related metrics
SUM2	Financial quality metrics in place are directly linked to the objectives of the firm's quality improvement effort.	(SFQM)
SUM6	In our firm, financial quality metrics in place cover all functional areas.	
Factor III		Role of
SUM3	The accounting staff is influential in selecting financial quality metrics.	accounting staff in
CMC3	The accounting staff participates in determining which quality cost items are collected.	quality costing
CMC7	The accounting staff coordinates the process of collecting and measuring quality cost data.	(RACC)
ARU9	The accounting staff coordinates the process of preparing quality costs reports.	
Factor IV		Collection
CMC5	In our firm, for quality costs, we collect and measure only the cost of inspection and internal failure.	and classification
CMC4	The quality cost items collected are categorized under the Prevention, Appraisal, and Failure (PAF) scheme.	of quality cost items
CMC6	There is a high level of cooperation across departments in the collection and measurement of quality cost data.	
Factor V		Sophistication
ARU2	Graphs and charts are used to present quality cost data.	ot analysis
ARU3	Quality costs data are analyzed across more than one dimension (e.g. process/ product line/department).	and presentation
ARU5	Quality costs reports are benchmarked against competitors or against previous periods.	of quality cost data
ARU4	Quality costs data are analyzed into finer levels of cost components.	(SOAP)
Factor VI	•	Frequency of
ARU1	Quality costs reports are prepared on a continuous basis.	collection and
CMC2	Quality costs data are measured and collected on a continuous basis.	reporting quality cost
ARU6	Quality costs reports are made available to senior managers only.	data (FOCR)

 Table 4: The empirical factors with their multiple items and suggested labels

Factor III is a construct comprising four items namely: SUM3, CMC3, CMC7 and ARU9. These items tackle the *role played by accounting staff* in the process of collecting and reporting the quality cost data and accordingly the factor was labelled as: Role of accounting staff in quality costing (RACC). Item CMC7 can be described as a cross loaded item with loadings of .402 and .658 on Factors I and III respectively. It was decided to assign this item to Factor III. Statistically, it loads higher on this factor than on Factor I, and conceptually it fits better (is more consistent) with the nature of Factor III than with Factor I.

Factor IV represents a construct comprising three items namely: CMC5, CMC4 and CMC6. It has been labelled as: Collection and classification of quality cost items (CCQI). The common theme for CMC5 and CMC4 is the type of quality costs elements collected. On the other hand, item CMC6 focuses on the level of cooperation across departments in collecting and measuring quality costs items. At first glance the first two items appear to be unrelated to (inconsistent with) the third item. However, deeper consideration explains this relationship. Before collecting quality cost data, the firm has to define its cost categories (classification) and identify, within each category, the types of payments to be coded as quality costs. Some quality cost elements are easy to identify and collect as they are direct and come from one department (Rust, 1995). For example, appraisal costs arise in the quality assurance department and internal failure cost like scrap, rework and spoilage cost come from the operation department (Dale and Plunkett, 1991). However, these cost elements represent a small portion of the total quality costs and are already captured by the existing accounting system. On the other hand, the majority of quality costs are indirect and often fall across departmental boundaries. These cost elements are neither captured effectively nor reported through the traditional accounting system. Without the cooperation and support of the related departments, it is difficult to identify these elements and hence to collect and measure them. In the absence of intelligent leadership and inter-departmental cooperation this can lead firms to simply report the traditional appraisal and internal failure cost elements already produced by the existing system (Atkinson et al., 1991). Therefore, the higher the cooperation and support of other departments, the more types of quality costs elements are collected.

Factor V includes four items namely: ARU2, ARU3, ARU5 and ARU4. Conceptually, these items focus on the way quality cost data are analyzed, benchmarked and presented in the report. Therefore, the factor was labelled as: *Sophistication of analysis and presentation of quality cost data* (SOAP). All items in the factor are originally from the ARU *à priori* group. Item ARU4 has loadings of .500 and .406 on Factor V and Factor II respectively. According to the criteria used in the current study this item belongs to Factor V since it displays a higher statistical loading on that factor. Furthermore, from a conceptual point of view it is more consistent with the common theme of Factor V.

Factor VI had the lowest explanatory power of 9.20% and has been given the label of: Frequency of the collection and reporting of quality cost data (FOCR). It includes three items: CMC2, ARU1 and ARU6. Items CMC2 and ARU1 focus on the timing of collecting and reporting quality cost data. Item ARU6 is concerned with whether or not quality costs reports are circulated to all managers. The focus of the three items appears to be inconsistent but careful examination shows that they are related. The argument is based on recognition that top management is responsible for allocating the resources for the different activities and projects in the firm. Furthermore, top management speaks in the language of money. Therefore, quality improvement teams use the quality cost data and reports, mainly to describe for management the cost and benefit of proposed improvement with an aim of obtaining the required resources. In such situation, the quality costs report needs to be circulated to top management only. Therefore, it is expected that where quality cost data is collected and reported on a continuous basis, it is unlikely to be circulated across the whole firm. Looked at the other way round, if quality cost data are collected only periodically then they are more likely to be widely disseminated.

6. Conclusion, implications and limitations

As discussed earlier, the literature lacks an agreed definition of what is meant by quality costing and its dimensions. What the literature does provide is a number of "best practices" in terms of identifying, collecting, measuring, analysing, reporting and using quality cost data. Bringing these references together has allowed us to develop of an authoritative list of discretionary managerial practices of quality costing. This PQC scale is in effect an operational definition of quality costing. The items of this scale were classified into three \dot{a} priori groups, namely: CMC, ARU and SUM. However, the exploratory factor analysis performed on the PQC items produces a more sophisticated model with six empirical groupings as shown in Table IV and Figure 1. Three of the empirical groups can be described as heterogeneous since their items come from two or more \dot{a} priori groups. The inspection of the empirical groups and their items shows them to be conceptually meaningful. None of them contains contrasting items and all of them have a statistically sound structure.

Take in Figure 2.

The findings of the exploratory factor analysis have important implications in relation for the literature and managers. They contribute to the quality costing literature through operationalizing the overall concept of quality costing by means of the PQC scale. Furthermore, the classification of the practices of quality costing that we have established can help managers to better visualise, understand and implement the concept of quality costing. In addition, it can be used as framework against which individual firms' management control systems can be evaluated. By carrying out a self assessment exercise of the practices in their firms, managers can identify areas that may warrant improvement. Finally, the procedure described provides an illustration of pragmatic application of exploratory factor analysis to empirical managerial data, which can be used in other contexts.

However, the findings need to be treated with caution. The operational definition of PQC, in the current study, is based on the "best practices" detailed in an inconsistent literature which lacks precise definition, conceptual or operational, of quality costing. Furthermore, the findings are based on self reported data, collected through a questionnaire in Jordan and thus there is a possibility of source bias or general method variance.

Notes

- 1. As recommended by Nunally and Bernstein (1994).
- 2. A copy of the questionnaire can be provided on request.
- 3. The Orthogonal/Varimax assumes that the factors are not related. To check this assumption the 23 items of the PQC scale were subject to an exploratory factor analysis using the Oblique/Direct Oblimin procedure. The correlation coefficients amongst the extracted factors were examined. All these coefficients were below .22. Therefore it is reasonable to assume that the factors are not related. In this case, both, the oblique and orthogonal rotations yield similar solutions (Field, 2005).
- 4. Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) is a test used to assess the suitability of the data set for factor analysis (Field, 2005). It compares the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. It is calculated for both individual and multiple variables. The value of the KMO statistic ranges from 0 to 1. The higher the value of the KMO statistic, the more suitable is factor analysis for the given data set.
- 5. According to the cut-off point (.4) adopted in the current study, item CMC7 has a loading of .402 on Factor I. However, this item is ascribed to Factor III. This issue is addressed when Factor III is discussed.
- 6. Item ARU4 has loadings above the .4 cut off point on both Factor II and Factor V. This issue is addressed when Factor V is discussed.

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Appendices

Appendix 1.

Issues	Technique/Test	Criteria	Reference					
Factorability of data	1- Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)	Min. acceptable level (.5)	Kinnear and Gray, 2000					
	2- Bartlett's test of sphericity	P < .05	Field, 2005					
Extraction method	Principal Components	 Most commonly used Produces more easily interpretable results 	De Vaus, 2004					
Number of factors to be retained	1- Kaiser's criterion (eigenvalue rule)	Eigenvalue ≥ 1.0 .	Bryman and Cramer, 2005					
	2- Scree plot	Cut-off point: the point where the curve breaks/influxes	Field, 2005					
Rotation method	Orthogonal/Varimax	Solution produced: - Has less cross-loaded items - Clear and easy to interpret	Pallant, 2005					
Ascribing an item to a factor	1- Statistically	Min. loading of 0.4	Stevens, 1992; Hair et al., 2005					
	2- Conceptually	Non contrasting items	Mahoney et al., 1995					

Table A1: Factor analysis criteria employed in the current study

Appendix 2.

	Component							
	1	2	3	4	5	6	7	
SUM1	.825	.199	039	046	.104	047	.113	
ARU7	.663	.038	021	.092	.212	.235	.142	
ARU9	.566	.224	.182	110	.394	074	040	
ARU4	.564	.299	.193	.100	.255	.283	002	
ARU8	.556	084	.178	.321	061	.467	263	
SUM7	.526	028	.274	.344	.082	.293	.308	
SUM5	.036	.914	016	.083	.100	.142	.051	
SUM4	.229	.682	.226	.120	103	030	166	
SUM2	.440	.607	.122	.352	139	098	.017	
ARU1	034	.501	.293	199	.032	.460	.219	
CMC5	055	.129	.783	.137	.239	061	138	
CMC6	.266	001	.723	027	.122	.237	.146	
CMC4	.060	.203	.721	.127	238	024	.171	
ARU3	.014	.143	.176	.820	.018	042	.129	
ARU2	.100	.067	.056	.771	.273	.280	078	
ARU6	.105	.263	209	.454	.430	.274	002	
CMC3	007	029	.198	.217	.747	.096	.122	
SUM3	.233	.043	171	058	.674	.031	062	
CMC7	.462	171	.179	.302	.602	.087	038	
ARU5	.043	048	053	.116	.077	.784	003	
CMC2	.219	.257	.093	.037	.211	.630	.209	
SUM6	.432	.157	.299	.257	169	.434	.030	
CMC1	.132	030	.057	.065	.006	.040	.912	
Eigenvalue	3.27	2.52	2.33	2.18	2.17	2.13	1.44	
Variance explained %	14.23	10.95	10.11	9.46	9.43	9.25	6.27	

 Table A2: Factor analysis-rotated component matrix (First run)

Extraction method: Principal Component analysis, Rotation method: Varimax with Kaiser normalization.