Third International Conference On Construction In The 21st Century (Citc-Iii)
"Advancing Engineering Management And Technology"
15-17 September, 2005, Athens ,Greece

Modelling Sustainable Competitive Advantage in Services Organisations

Dr Nicholas Chileshe
Senior Lecturer, School of Environment and Development
Sheffield Hallam University, Sheffield, UK

Professor Paul Watson
Principal Lecturer, School of Environment and Development
Sheffield Hallam University, Sheffield, UK

Dr Dmitry Maslow
Economics and Management Faculty
Ivanovo State Power University, Ivanovo 153023, Russia

Abstract
For organisations to attain and/or maintain a sustainable competitive advantage they require a competitive orientated management system. The system should address key concepts such as leadership, personnel and development. However, the system also has to fully address the needs of stakeholders. Twenty-five different management function features are correlated with corporate profitability and stakeholder satisfaction. The study used Canonical correlation methods to correlate simultaneously the management function features to the assessment of competitive advantage measures. Through a survey of data collected from 39 employees and 5 managers from the Russian Service Industry, this study empirically refines and validates 5 constructs for management functions. The constructs refined in this study are compared with other major quality measurement instruments. The study reports on the operational framework of Management Functional Assessment Model (MFAM), which can be used to examine the levels of critical factors relating to competitive advantage. The findings indicate that the MFAM is both reliable and valid. Qualitative data was collected based on the following five management function constructs, namely, Forecasting Planning, Organising, Motivation, Control and Co-ordination. Based on a fuzzy scoring system, Construction organisations are able to rate the advancement of identified and validated Management Maturity. The result of the assessment, is a classification of the organisations into five different levels of management maturity in terms of achieving competitive advantage, ranging from Unaware to Achiever, and also identifies the strengths and weaknesses of their quality initiatives. The paper further explores the model's constituent parts and relates them to the process of gathering data on organisational requirements focussed upon attaining/maintaining a competitive advantage.

Keywords: Organisational Excellence, Sustainable Competitive Advantage, Total Quality Management (TQM), European Foundation for Quality Management EFQM.EM, Validation,

INTRODUCTION

The model is based upon previous works including that of Deming, Baldrige and the European Foundation for Quality Management. However, it is original and when deployed provides the link between organisational activities within a framework of corporate profitability and stakeholder satisfaction.

The paper is structured as follows; firstly the major constructs of Competitive Advantage are identified from an extensive literature review which is followed by modifications, refinements and finalisation of the instruments. Data collection through field surveys is conducted with the findings reported. The procedures and the methods used for testing and validating the MFAM are provided reports on the three stage continuous improvement cycle which according to Chen and Paulraj (2004) lies at the heart of instrument development process and addresses the following issues; confirmatory factor analysis, undimensionality, internal consistency and validity. Having empirically validated and tested the proposed measuring instrument, the proposed MFAM can then used to measure the levels of Competitive Advantage, the findings of which are presented in another paper (Chileshe and Watson 2003a).

METHODOLOGY

Data Collection Method

A total of five dimensions of management function practices in the Russian Servive organisations were perceptualised and measured using the five-point Likert scale. (0= no activity demonstrated, 4= activity is deployed permanently and systematically). Components of competitive advantage was measured by the three-point Likert scale (1 = Not at all, 3 = hardly and 5 = greatly) *Statistical Packages for the Social Sciences (SPSS)* package was used for the analysis. Two levels of data analysis are conducted: a macro-level analysis of aggregate, surface characteristics of the respondents and a micro-level level analysis of deeper, fined data methods. As shown in Fig 1.0, the macro-level is concerned with the aggregate measures of the descriptive statistics, where as the micro-level, there is the evaluation of the measurement and structural model of the Management Functional Assessment Model (MFAM) using fine grained methods such as structural equation modelling (SEM)

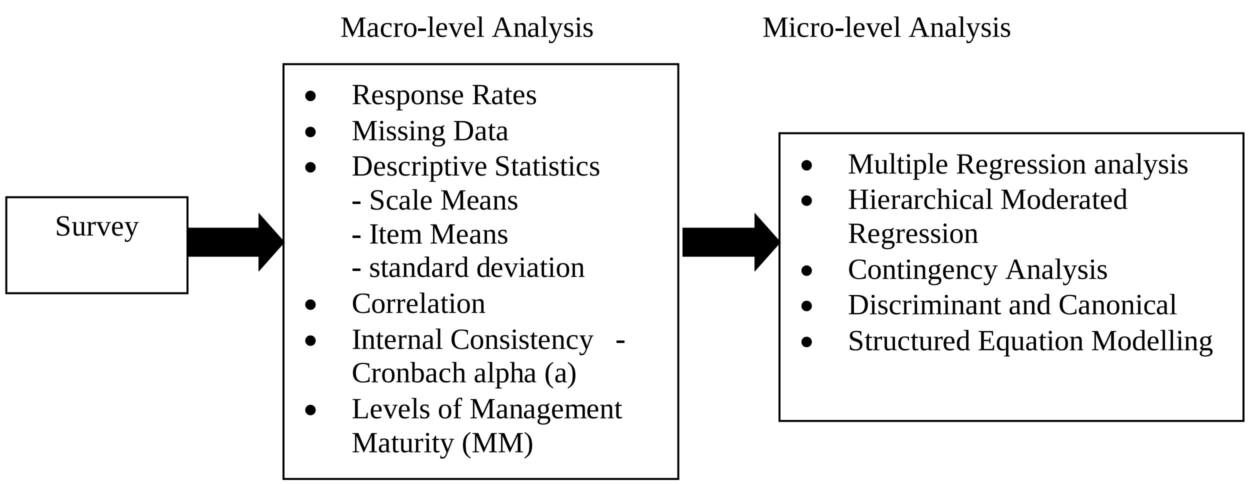


Fig. 1.0. Data analysis map
(Source: Adapted from Boyer et al, 2002)

Data for the Investigation

The second part of the questionnaire was designed to identify the critical success factors and was based on the EFQM, Deming and MBNQA Models. This has 25 variables based on the five deployment constructs: planning, organising, motivation, control, and coordinating. The results of the descriptive statistics such as the mean and standard deviation are given in Table 1.0.

Analysis

SPSS package was used for the analysis. The results of the descriptive statistics such as the mean and standard deviations are presented in table 3. The *relative advancement index* (RAI) derived to summarize the advancement of each implementation construct was computed as

$$RAI = \frac{\sum w}{AxN} \quad \text{……………………………….……………..Equation 1.0}$$

Where: w = weighting as assigned by each respondent in a range 0 to 4, where 0 implies 'no activity demonstrated' and 4 implies 'activity deployed permanently'; A = the highest weight (4); N= the total number in the sample.

Table 1. 0: Descriptive Statistics & Results of Internal Consistency Analysis

Management Functional Assessment Model (MFAM) Construct	Number of items	1. mployee's Evaluation (N = 39)			Managers (N = 5)		Coefficient Cronbach (a) alpha c -
		Mean a	RAI b	SD	Mean	Rank b	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1. Planning = PL	5	2.435	0.487	0.940	3.650	0.730	0.7833
2. Organisation = OR	5	3.050	0.610	1.083	3.125	0.625	0.7978
3. Motivation = MT	5	1.965	0.393	1.150	3.825	0.765	0.6671
4. Control = CT	5	3.070	0.614	1.130	3.125	0.625	0.8527
5. Coordination = CO	5	2.075	0.415	1.386	2.650	0.530	0.8793

a - The mean scores for each construct are on a scale of 0-4.
b- Relative Advancement Index computed from equation 1.0
c – Internal Consistency analysis

The value is used as a measure of central tendency. Column 8 of Table 1.0 presents the cronbach alpha (a). These shows the internal consistency of latent variables, which serve as common factors that are being empirically reflected by indicators. The commonly accepted standard is that coefficient a should have a value of > 0.7 in order for latent variables to be a reliable measure (Nunnally, 1967). Examination of Table 1.0 indicates that all constructs apart from the "Motivation" had values greater than 0.7, therefore the MFAM is a reliable instrument.

Scale Validation and Empirical Assessment Of Mfam

According to Sureshchandar et al (2002), a critical aspect in the evolution of a fundamental theory in any management concept is the development of good measures to obtain valid and reliable estimates of the construct of interest. The various steps involved in the development and validation of the measurement scale are shown by means of the following steps:

Step 1: Expounding the theory and concepts, Step 2: Design of survey instrument, Step 3: Pre-testing of Instrument, Step 4: Modifications to the instrument , Step 5: Data Collection, Step 6 : Confirmatory Factor Analysis and Finally Step 7 – The Proposed MFAM

Issues in applying the instrument development and validation process as outlined in the above steps were used to develop the MFAM instrument that satisfies the requirements of reliability, validity and undimensionality. The steps are brief explained as follows: **Step 1** deals with expounding the theory and concepts that underlie a particular management theory. This involves the review of literature and the identification of the critical dimensions of the TQM constructs. Forza and Filippini (1998) describe this step as the first of the three components of theory. In reality, it can be described as the "what's" in the development of empirical theory and deals with issues of identification and definition of the concepts. These issues have been presented in the earlier sub sections.

Assessment of Measurement of Model Fit

For any model to be accurate, it must represent the data collected as closely as possible. Various methods exist for determining the Goodness of Fit of any model. Notable among them are adjusted Goodness-of-Fit Index, Bentler-Bonnet-Index etc. Goodness of fit is defined by Field (2000) as the degree to which a statistical model represents the data collected. For example, this can fall into three categories, namely Good Fit, Moderate Fit and Poor Fit. Therefore the primary objective of this paper in the model testing and model validation procedure was to determine the goodness of fit of the MFAM. In order to assess their undimensionality and internal consistency, the five scales were subjected to five limited information factor analyses (Anderson and Gerbing, 1998)

Step 2 involved the design of survey instrument by careful selection of the representative items. **Step 3** dealt with the pre-testing of the instrument, either objectively or subjectively by experts in the field. This is defined as content validity which forms part of the confirmatory factor analysis. **Step 4** is addressed by the modifications, refinement and finalisation of the MFAM instrument which is provided for in the subsection dealing with the review of literature and refinements of existing instruments. Finally but not the least, **Step 5** dealt with data collection through a postal survey addressed to 39 Employees and 5 Managers from the Russian Service Industry. The survey methodology undertaken in **Step 5** is explained in the following sub section. The next sub sections presents the results of exploring the data for the descriptive statistics of the five management function factors for the constructions. Table 1.0 reported on the descriptive statistics of the measurement items associated with the five factors. This would followed by the production of the Management Function Pentagonal Profile Chart in **Step 3**. Although not shown in paper, it basically shows a visualisation of the comparison in the achievement of implementation constructs by Managers and Employees surveyed in this study. (Chileshe et al 2003)

Table 1.0 showed the mean score, standard deviation and RAI distribution of the mean scores for each of the five constructs underlying the MFAM model. The level of SCA implementation in the Russian Service organisations is reflected by the overall indicator. The level of SCA advancement can be reflected by the initial score of each construct and the average of the five constructs as the overall indicator. The distribution of the mean score for this indicator and for all five constructs is divided into three bands, high (score of 4 to 5), medium (3 to < 4) and low (1 to < 3), derived from the TQ-SMART. (Chileshe et al 2003)

Table 2.0: Classification of Organisations based on the Advancement/Commitment Matrix

Groupings based on Levels of Sustainable Competitive Advantage	Ratings	Total Score	Ranking of Levels	Co-ordinates
(1)	**(2)**	**(3)**	**(4)**	**(5)**
1. Achievers	HH	81-100	1	(0.8, 0.8)
2. Award Winners	ML	61-80	2	(0.8, 0.5)
3. Improvers	MM	41-60	3	(0.8, 0.2)
4. Uncommitted	LM	21-40	4	(0.5, 0.2)
5. Unaware	LL	0-20	5	(0.2, 0.2)

Structural Equation Modelling (Sem) Approach

The hypothesised overall MFAM model is portrayed in Figure 2.0 in Structural Equation Modelling (SEM) notation. The single headed arrows leading from the second-order of SCA (F_6) to each of its underlying first order factors (F_1, F_6; F_2, F_6; F_3, F_6; F_4, F_6; and F_5, F_6) are regression paths that indicated the prediction of the SCA Forecasting Planning (F1), SCA Organizing (F2), SCA Motivation (F3), SCA Control (F4), and SCA Coordination (F5) from a higher order SCA factor. They also represent second-order factor loadings denoted as q_{11} through q_{61} on Figure 2.0. The results of which are presented in Table 3.0 There is also a residual disturbance term associated with each first-order factor (D_1, D_2, D_3, D_4, and D_5). These represent residual errors in the prediction of the first-order factors from the higher order factor of SCA.

Expressed more formally, the CFA model portrayed in Figure 2.0 hypothesized a priori that:

SCA can be conceptualised in terms of the five factors, each observed variable will have non zero loading for all other factors, error terms (E_1 through E_{25}) associated with each observable variables will be uncorrelated, The five first-order factors will be correlated, and Co-variation among the first-order factors will be explained fully by their regression onto the second-order factor.

Parameter Estimating

2. This generates the unstandardized estimates which could be unanalysed association between factors or measurement errors. The factor loadings are interpreted as unstandardized regression coefficients that estimate the direct effects of the factors on the indicators (Kline, 1985). The above results can be represented in a graphical format as shown in Fig 2.0 in which values used in the second order analysis take the average scores of the variables assigned to each factor. The five factors were initially subjected to validity and reliability tests before a single score could be calculated to represent each construct.

3.

Table 3.0 contains the standardised coefficients for the structural relationships. All but one of the parameters shown in Figure 2.0 were found to be both of the hypothesized sign and statistically significant. Planning (F1) appeared to be strongly linked to SCA (q_{11} = 0.834)

4. Model Testing

5.

6. This involves the demonstration of re-specification, the modification of an initial CFA model with mediocre or poor fit to the data. Several models are tested ranging from the test for a single factor, where SCA is hypothesised as one factor to multifactor model (i.e. the five factor)

Second Order Approach (SOA)

Structural Equation : = G x + S.. Equation 2.0

(5 x 1) = (5 x 1) (1 x 1) + (5 x 1)

First Order Approach (FOA)

Measurement Equation : y = Ly h + e .... Equation 3.0

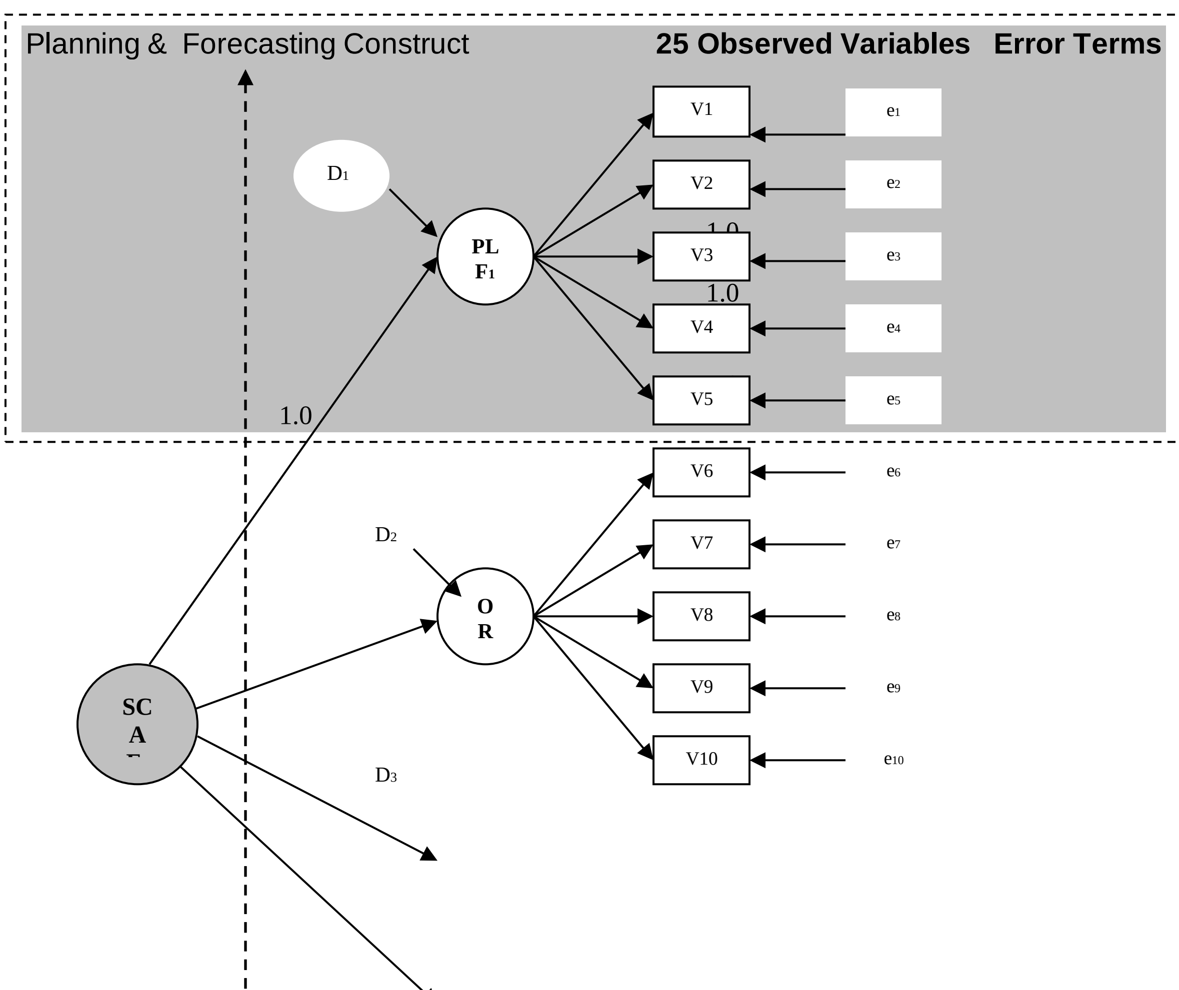
(25 x 1) = (25 x 5) (5 x 1) (25 x 1)

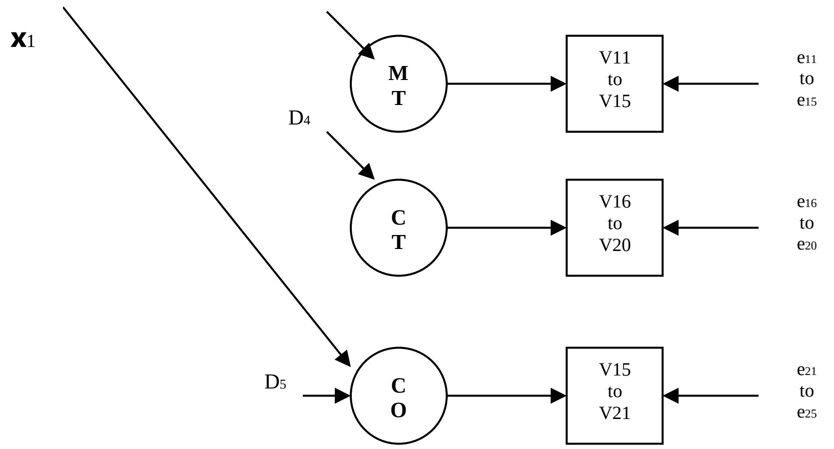
Global Model = Structural Model + Measurement Model

The structural equation links the five quality management factors to the latent factor " Sustainable Competitive Advantage" x. These five factors are shown in Fig 2.0 as Planning (PL), Organisation (OR), Motivation (MT), Control (CT), and Co-ordination (CO). The measurement equation links observed indicators y to their respective hypothesized quality factors h. First order factors are given by Ly while second-order factor loadings are given by G

2. Average Variance Extracted

Discriminant validity is demonstrated if the average variance for each construct (within-construct variance) is greater than the squared correlations between constructs (between-construct variance). Discriminant validity among the five constructs of MFAM was examined using Fornell and Larcker's (1981) techniques. A five factor correlated model representing each of the five elements was used to examine discriminant validity.





(Aggregate Level) (Individual Factor Level)

Higher Order SCA		*Second Order CFA Model*		*First Order CFA Model*
Global Model	**=**	***Structural Model***	**+**	***Measurement Model***

Fig 2.0: Confirmatory Factor Analysis of MFAM Measurement Model

The loading on the first variable (PL) is fixed to 1.0 to scale the latent variable. With this loading fixed, the one factor model has 10 free parameters, including 9 remaining factor loadings and 11 variances (of 5 measurement errors denoted as e-$_1$ through e-$_5$ and latent variable). With 10 observable variables, there are [5(5+1)]/2 =15 observations, thus the degrees of freedom = 15 - 10 = 5. The results of this CFA are tabulated and explained in the next subsection. The modified MFAM model is represented in Fig 2.0 according to the Linear Structural Relationships (LISREL) notation. The ellipses contains the name of the latent variables while the rectangles contain the measure used to explain each construct (Forza and Filipini, 1998). For example the 'Forecasting and Planning (PL)' is represented by latent variable F1 while the measure used to explain this construct are indicated by variables V_1 to V_5 with their associated errors E_1 to E_5.

H_1: The MFAM Model depicted in Figure 2.0 as composed of a measurement and a structural equation model fits the sample data.

The convergent validity analysis was performed in ten stages using the step wise regression method. In the first model only variables belonging to the Forecasting and Planning constructs were included. This was termed as Model 1. Test statistics showed that this model was inconsistent with sample data. The root mean square-residual (RMSR) was very high (RSMR = 0.190). The squared multiple correlation (SMC) was 0.151. Examination of Table 3.0 reveals that when only Planning is used as a predictor, this becomes a simple correlation between forecasting and planning and achieving sustainable competitive advantage SCA (0.388)

Description of Sem Output and Discussion of The Regression Analysis

Inner Coefficients (Structural Parameters): These indicate the strength of relationships between the individual factors. For example between the Planning and Forecasting (F_1) and Organisation (F_2). Outer Coefficients :These relate to the strength of relationships (correlations) among the variable. For example (between V_1 and V_2) . Coefficient of Determination (r_2) and Pearson Correlation Coefficients

Table 3.0: 5 Construct Model Summary of Regression Analysis

Model	Multiple R	R^2	Adjusted R^2	St Error of the Estimate
1	.388[a]	.151	.039	.31470
2	.594[b]	.353	.157	.29479
3	.706[c]	.498	.229	.28186
4	.812[d]	.659	.362	.25650
5	.865[e]	.747	.397	.24938

7. The interpretation of the Model 5 in Table 3.0 is that if the sample was drawn from the population, then the expected variance would be R^2 less the adjusted R^2 value, which would be 0.747-0.397=0.350. This means that the variance from the sample would be 35.0 per cent. The purpose of this analysis was to determine the independent variables (Factors 1-5) which are related to the dependent variables of performance measures. Stage 1 was the basic multiple linear regression using each dependent variable with all independents. In this case all the five SCA constructs were entered as independent variables with each of the fifteen dependent variables (performance measurement variables), the results of which are the t-values and Beta (b) which are not reported in this paper. Stage 2 involves a complete residual analysis which was conducted to determine the prior assumptions of linearity and homoscedascity where valid. The primary method used to test the distribution normality of residuals was the Chi-square (c^2) goodness of fit. The chi-square (c^2) tests conducted on the residuals of each regression indicated the acceptance of normality for the dependent variables. The standardised estimates allow the evaluation of the relative contributions of each predictor (the five deployment constructs of Sustainable Competitive Advantage) to each outcome variables. Finally stage 3 involved the stepwise selection of variables.

Presentation of Findings

The findings can be presented in form of a visualisation of the comparison in the achievement of implementation constructs by Managers (5) and Employees (39) surveyed in this study. It is evident that there was a marked difference in the self-evaluation of achievement of implementation constructs by the two groups of respondents (Managers and Employees). However, the study there was a significant level of achievement of SCA implementation constructs by the Managers. More so, there was little difference in the level of accordance between managing decisions and its perception by employees of Control (CT) and Organisation (OR) constructs. A comparison of the ratings using the fuzzy scores, on the other hand, shows a significant reduction in the levels of achievement. It is also shown that there was a more even difference across all implementation constructs, which would suggest a more cautious and realistic measurement of achievements. This paper validates the MFAM with the data of 39 employees and 5 managers within the Russian Service Industry. Structural analysis was used to examine the underlying relationship among the five constructs.

Discussion

Although the sample of this study (44) was limited, the findings represent a snapshot of the reality of Sustainable Competitive Advantage (SCA) achievement by Employees and Management. However, the use of quantitative approaches normally requires a large number of cases representing the population of interest, in order to determine the statistical significance of results. Thus, while the result cannot be generalised at this stage further research should confirm the findings of this study.

Conclusions

The self-assessment methodology on the MFAM base develops, as well as the Management Functional Assessment Model itself. Now we test model and assessment methodology at the enterprises of Russia and UK. The practical application of model will allow to correct criteria and estimated categories of the MFAM, to grind self-assessment methodology. The modelled MFAM is of practical use to organisations of different sizes, business and public sector, manufacturing and service sectors in the diagnostic assessment. This paper demonstrates that for organisations to attain and / or main a sustainable competitive advantage they require a competitive oriented management system. This system addresses key concepts such as leadership, personnel and development. However, the system has to fully address the needs of stakeholders. This paper has presented the modelling of the 'Management Functional Assessment Model'

References

Anderson, M. and Gerbing, D.W. (1998) Structural Equation Modelling in practice, a review and recommended two-step approach, *Psychological Bulletin*, 103(3), 411-423.

Boyer, K.M. and Pagell, M. (2000) Measurement issues in empirical research: improving measures of operations strategy and advanced manufacturing technology, *Journal of Operations Management*, 18: 361-374.

Chen, I.J., and Paulraj, A. (2004) Towards a theory of supply chain management: the constructs and measurement, *Journal of Operations Management*, 22: 119-150.

Field, A. (2000) *Discovering Statistics using SPSS for Windows*, Sage Publications, London.

Fornell, C. and Larcker, D. (1981) Evaluating Structural Equation Models with unobservable variable and measurement error, *Journal of Marketing Research*, 18: 39-50.

Forza, C. and Filippini, R. (1998) TQM impact on quality conformance and customer satisfaction: a casual model, *International Journal of Production Economics*, 55: 1-20.

Kline, R.B. (1985) Structural Equation Modelling, The Guildford Press: New York, London.

Nunnally, J.C. (1967) *Psychometric theory*, New York: McGraw-Hill.

Sureshchandar, G.S., Rajendran, C. and Anantharaman, R.N. (2002) Determinants of customer-perceived service quality: a confirmatory factor analysis approach, *Journal of Services Marketing*, 16(1), 9-34.

Watson, P.A. and N.Chileshe. (2003a). "Deploying and scoring the European Foundation for Quality Management Excellence Model (Part One)". *2nd International Structural Engineering and Construction Conference (ISEC-02)*, ISBN 90 5809 599 1, Vol 1, pp 1595-1598, Rome, Italy, Sept 23-26.

Watson, P.A. and N.Chileshe. (2003b). "Deploying and scoring the European Foundation for Quality Management Excellence Model (Part Two)". *2nd International Structural Engineering and Construction Conference, Conference (ISEC-02)*, ISBN 90 5809 599 1, Vol 1, pp 1625-1627, Rome, Italy, Sept 23-26.

Watson, P., Chileshe, N. and Maslow, D. (2004a) A New Model for Obtaining Sustainable Competitive Advantage**,** *In***:** Root, D., Massyn, M. and Shakantu, W. *(Eds.***)** *2nd CIDB Postgraduate Conference*, 10-12 October 2004, Cape Town, South Africa, Construction Industry Development**,** 129-141**.**

Watson, P., Maslow, D. and Chileshe, N. (2004b) Deploying Total Quality Management in Russia. *European Quality Journal*, 11(2), 58-69

Watson, P., Chileshe, N. and Maslow, D. (2005a) Functional Management Assessment: A New Model for Management System Improvement. *Quality Innovation Education*, No. 2 Journal

Watson, P., Maslow, D. and Chileshe, N. (2005b) Management Assessment for Competitive Advantage. *iSixSigma Insights*, 6(19), 1-6. ISSN: 1530-7603. Available online on http://www.isixsigma.com/library/content/c050307a.asp

Watson P., Maslow D. and Chileshe N. (2005c) A New Model for Obtaining Sustainable Competitive Advantage // *EFQM Excellence One Newsletter* 2005-02-18 – URL: http://web-1.efqm.org/excellenceone/newsletter/2005_02_18.htm

Watson, P., Chileshe, N. and Maslow, D. (2005d) Addressing Sustainable Competitive Advantage via a Functional Assessment Model. *In:* Lowe, D. *(Ed) First Commercial Management Conference-ICM 2005*, University of Manchester, Manchester, April 7-8 2005.
Zairi, M. (1994) *Measuring Performance for Business Results*, Chapman and Hall, London.