Modeling Management Information Systems' Success: a study in the domain of Further Education and Training

Mariette Visser
Human Sciences Research Council (HSRC)
Private Bag X41, Pretoria, 0001
+27 72 607 5009
mmvisser@hsrc.ac.za

Judy van Biljon
University of South Africa (UNISA)
PO Box 392, Pretoria, 0003
+27 82 253 4327
vbiljja@unisa.ac.za

Marlien Herselman
Council for Scientific and Industrial Research (CSIR)
PO Box 395, Pretoria, 0001
+27 82 809 4319
mherselman@csir.co.za

ABSTRACT
Capacity in and enhancement of critical, scarce and intermediate skills are seen as a national priority in South Africa. The Department of Higher Education and Training (DHET) in South Africa has prioritized the success of the Further Education and Training (FET) sector to meet this need for capacity development in critical, scarce and intermediate skills. Management information systems (MIS) are pivotal in the efficient and effective running of FET colleges. Therefore, the evaluation of MIS success is an essential spoke in the wheel of FET college success. The problem is that no MIS success evaluation model for FET colleges could be found. In this paper, we describe the development and testing of an evaluation model and tool for MIS success. Information system's evaluation theory and an analysis of FET policy documents were used to propose an initial success evaluation model and tool (questionnaire) for an educational environment (FET colleges) in South Africa. Using a quantitative approach the tool was applied in a survey at one public FET college to evaluate the success of the MIS deployed at the college. Findings from the survey lead to the refinement of the model which is also articulated in this paper and reflected as the SA-FETMIS model. The paper is novel in proposing an IS theory based model and tool which can be used to evaluate MIS success at FET colleges and similar education contexts. The paper should be of interest to researchers in the field of Information Systems success evaluation and also to practitioners and managers in the field of Education.

Categories and Subject Descriptors
H.5.3 [**Information Systems**]: Group and Organization Interfaces – *evaluation/methodology.*

General Terms
Management, Measurement, Performance, Design.

Keywords
Information system success; Management Information Systems; Information Systems success evaluation; FET college; Construct measurement; D&M IS success model.

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1. INTRODUCTION
The public FET college sector in South Africa has endured extensive changes over the past two decades. New policies have been implemented and legislation promulgated to create a framework for transformation in this sector. In 2001 a new institutional landscape was proposed that lead to the merging of 152 Technical Colleges (as these types of institution were called) into 50 multi-campus FET colleges. In the national plan of 2008 for FET colleges, the National Department of Education has committed to the establishment of a standardized business MIS in all public FET colleges that will enable colleges to monitor and account for all their administrative business processes, which include: student, academic, and financial administration, human resource management and development, and asset management [8, 9]. The planned integrated MIS has been implemented at eleven public FET colleges thus far. The implementation of the college mergers has been accompanied by challenges related to the substantive integration of college business systems and processes [2]. In a recent audit of programmes at public FET colleges it was found that very few colleges had taken steps to integrate their administrative, management, IT and communication systems [4]. The challenge is, therefore, to establish administration systems, information technology infrastructure and MISs to ensure the full merger of all information functions at the various sites and align their delivery towards the new FET college mission and mandate [8]. The monitoring and evaluation of key success indicators is not only essential for the management of a specific FET college, but is also of critical importance for the DHET to evaluate its own successes. The problem is that no documented evaluation model or tool to evaluate the success of MIS at public FET colleges in South Africa could be found.

This study constructs a conceptual model that informs the design of an IS success evaluation tool by using the knowledge and trends in the field of information systems success evaluation and taking into account the requirements of South African policy with regard to the administration and functioning of public FET colleges. The study is organized as follows. In section 2 a brief review of information systems' evaluation models is presented. An initial MIS evaluation model for FET colleges is proposed as a point of departure. In section 3 the research design is discussed and in section 4 results and findings of the study are presented. The final, refined conceptual model of the study is also provided in section 4, and concluding remarks are presented in section 5.

2. LITERATURE REVIEW

2.1 Success evaluation models

Specialized literature defines evaluation as a type of research that applies social science procedures to assess the conceptualization, design, implementation and utility of social intervention programmes [20]. It is generally accepted in the literature that evaluation studies have three main purposes: to judge merit or worth, to improve programmes and to generate knowledge [16].

The most commonly used theories on which IS success evaluation models are based are: the theory of reasoned action; the theory of planned behavior; the theory of beliefs and attitudes; the behavioral theory of the firm; and the mathematical theory of communications, while the most frequently used models to evaluate IS success are [37]:

- the DeLone and McLean IS success model (D&M IS Success Model);
- the Technology Acceptance Model (TAM);
- the Task-Technology Fit model (TTF); and
- the End User Computing Satisfaction model (EUCS).

Many researchers in the field of IS success evaluation have conducted empirical studies based on portions, combinations or extensions of these models [3, 13, 15, 21, 22, 24, 25, 27].

The synthesis of models and their underlying theories is presented in Table 1. As illustrated in Table 1, IS success models are based on either one or a combination of theories. This raised the question: which model, extension, or combination will be suitable for this study? Eight models namely, the Technology Acceptance Model (TAM) with its extensions (TAM2, UTAUT, TAM3), the Wixom and Todd model, the Task-Technology Fit (TTF) model, the original Delone and Mclean (D&M) IS success model, the updated Delone and Mclean (D&M) IS success model, the Model of User Satisfaction, the Re-specified Model of IS success, and the End User Computing Satisfaction model (EUCS) were studied in more detail in order to make an informed decision in this regard.

The Original D&M IS Success Model, the Updated D&M IS Success Model, and the End User Computing Satisfaction Model were selected as most appropriate and integrated to develop the proposed conceptual model for this study. The motivation for this decision is presented in section 2.2.

2.2 Motivation for the selected base model for this study

A number of studies have been conducted to validate the D&M model. Seddon and Kiew [28] examined the relationships among four of the constructs and found significant support. Rai, Lang and Welker [25] compared the original D&M model [6] to the re-specified D&M IS success model created by Seddon [27] and found that the original model stood up reasonably well to the validation attempt and outperformed the Seddon model. Sedera, Gable and Chan [29] also tested several success models, including the D&M and Seddon models, against empirical data and determined that the D&M model provided the best fit for measuring enterprise systems success [23]. McGill, Hobbs and Klobas [19] examined the full D&M IS success model and found that the model provided strong support for the relationships between perceived system quality and user satisfaction, perceived information quality and user satisfaction, user satisfaction and intended use, and user satisfaction and perceived individual impact. Thus, the overwhelming evidence in the international literature on the strength of the D&M IS success model lead to the decision to base the model for this study on D&M's IS success model.

In addition, evidence of the application of the updated D&M IS success model in South African research was found. Twine and Brown [31] conducted interpretive research by using categories within the updated D&M IS success model as a lens to investigate the effectiveness of web conferencing systems.

A further justification for the use of the D&M IS Success model is the recommendation of Roseman and Vessey [26]. In their study of the role of applicability checks in the relevance of IS research, they allude to this model as being highly relevant for practical application.

Only the three models namely the Original D&M IS Success Model, the Updated D&M IS Success Model, and the End User Computing Satisfaction Model which were selected as most appropriate and integrated to develop the proposed conceptual model for this study will be described in sections 2.3 to 2.5.

Table 1. Most commonly utilized information systems success evaluation models and their underlying theoretical frameworks

Year: Theory	Theory developed by	Theory	Name of the model based on theory	Model abbreviation	Model developed by:	Year: Model
1934	LaPiere, R.T. – Evidence in the literature of the link between attitudes and behaviors [17]	Led to the formulation of the theories of reasoned action and planned behavior				
1975	Fishbein and Ajzen [12]	Theory of Reasoned Action, Theory of Planned Behavior	Technology Acceptance Model [5]	TAM	Davis F.D., Bagozzi R.P., Warshaw P.R.	1989
			Technology Acceptance Model 2 [33]	TAM2	Venkatesh, V., Davis, F.D.	2000
			Unified Theory of Acceptance and Use of Technology [34]	UTAUT	Venkatesh, V., Morris, M.G., Davis, F.D., Davis, G.B.	2003

			Technology Acceptance Model 3 [32]	TAM3	Venkatesh, V., Bala, H.	2008
			Task Technology Fit Model [14]	TTF Model	Goodhue, D.L., Thompson, R.L.	1995
			TAM/TTF Model with Computer Self-Efficacy [10]	Combined TAM/TTF Model	Dishaw, M.T., Strong, D.M., Bandy, D.B.	2002
1963	Cyert and March	Behavioral Theory of the Firm	Development of a Tool for Measuring and Analyzing Computer User Satisfaction [1]	CUS	Bailey, J.E., Pearson, S.W.	1983
			The Measurement of End-User Computing Satisfaction [11]	EUCS	Doll, W.J., Torkzadeh, G.	1988
1963		Integration of the concept theories; 'Beliefs and attitudes about the system' with 'Beliefs and attitudes about using the system'	Integration of the User satisfaction literature and the Technology Acceptance Model [36]	Integration of User Satisfaction (US) and TAM	Wixom, B.H., Todd, P.A.	2005
1949	Shannon and Weaver [30]	Mathematical Theory of Communications	Expanded Shannon & Weaver's theory by extending 'effectiveness level' into three categories	Expanded Mathematical Theory of Communications	Mason, R.O.	1978
1978	Mason [18]	Expanded Mathematical Theory of Communications	Delone and McLean IS Success Model [6]	D&M IS Success Model	Delone, W.H., McLean, E.R	1992
			Extension of the Delone and McLean IS Success Model combined with the Technology Acceptance Model [28]	Extended D&M IS Success Model combined with TAM	Seddon, P.B., Kiew, M. Y	1996
			Re-specification and extension of the DeLone and McLean Model of IS Success [27]	Partial behavior model of IS Use	Seddon, P. B.	1997
			Updated Delone and McLean IS Success Model [7]	Updated D&M IS Success Model	Delone, W.H., McLean, E.R	2003

2.3 Original D&M IS success model

The original DeLone and McLean taxonomy was based on Richard Mason's modification of Shannon and Weaver's [30] mathematical theory of communications which identified three levels of information:

- the technical level (accuracy and efficiency of the system that produces it)
- the semantic level (its ability to transfer the intended message)
- the effectiveness level (its impact on the receiver) [30].

Mason adapted this theory for IS and expanded the effectiveness level into three categories: receipt of information, influence on the recipient, and influence on the system [18].

DeLone and McLean identified categories for IS success by mapping an aspect of IS success (found in literature reviews of seven sources which included a 100 empirical studies) to each of Mason's effectiveness levels [6]. This analysis yielded six variables of success: *system quality, information quality, use, user satisfaction, individual impact,* and *organizational impact*.

System quality was equivalent to the technical level of communication, while *information quality* was equivalent to the semantic level of communication. The other four variables were mapped to Mason's sub-categories of the effectiveness level. *Use* related to Mason's receipt of information; *user satisfaction* and *individual impact* were associated with the information's influence on the recipient and *organizational impact* was the influence of the information on the system. A diagram illustrating the development of the original D&M IS success model from the theory of communication is given in Figure 1.

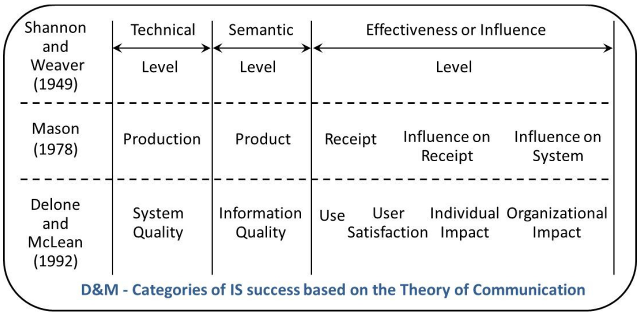

Figure 1. Categories of IS success adapted from D&M [6]

DeLone and McLean developed their initial taxonomy using established theories of communication adapted to IS. These theories suggested that the flow of information was linear; however, they proposed that, for IS, these different measures of success were independent, but that there was interdependency among them [6]. Figure 2 shows the original D&M IS success model.

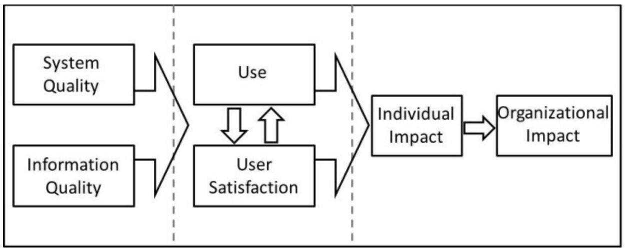

Figure 2. D&M Initial IS success Model [6]

2.4 Updated D&M IS success model

Based on further research the original D&M IS success model was updated to the model shown in Figure 3. A key addition of the updated model was to include *service quality* as an aspect of IS success [31]. This reflects the changing nature of IS which also needed to assess service quality when evaluating IS success. DeLone and McLean recommended assigning different weights to system quality, information quality and service quality, depending on the context and application of the model [31]. DeLone and McLean [7] also note that since the impacts of IS have evolved beyond the immediate user, additional IS impact measures, such as work group impacts, inter-organizational and industry impacts, consumer impacts and societal impacts should be considered. Accordingly, they grouped all the impact measures into a single impact or benefit category called *net benefits*.

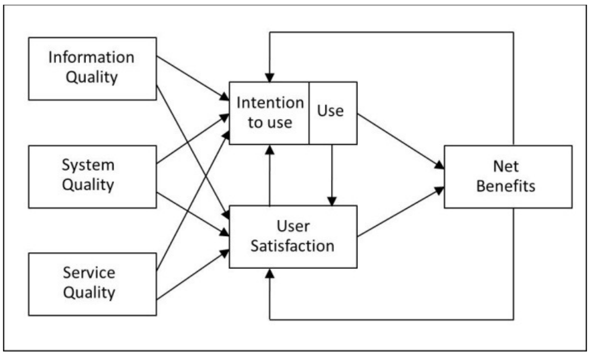

Figure 3. D&M updated IS success Model [7]

2.5 EUCS Model

Doll and Torkzadeh [25] investigated end-user computing satisfaction by contrasting traditional versus end-user computing environments and developed an instrument which merges ease of use and information product items to measure the satisfaction of users who interact with a specific application. Figure 4 provides an illustration of the model, a list of questions used and the identified underlying factors or components of end-user computing satisfaction acquired by factor analysis (*Content*, *Accuracy*, *Format*, *Ease of use*, and *Timeliness*).

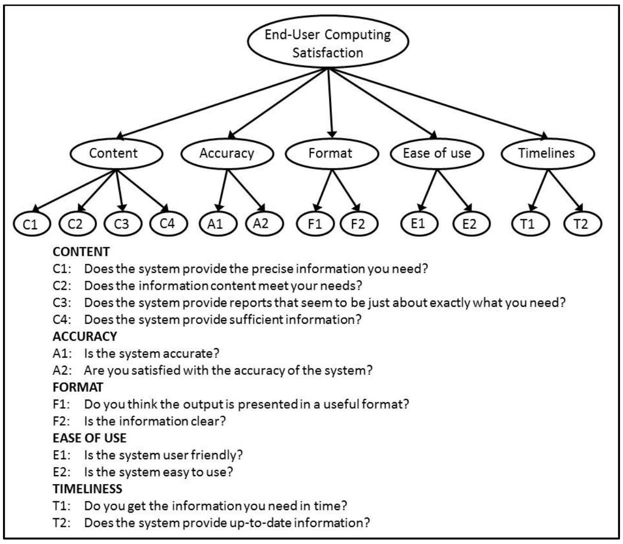

Figure 4. A Model for measuring End-user Computing Satisfaction [11]

2.6 Initial model proposed for this study

The conceptual model for this study was constructed by extending the original D&M IS success model to include an additional construct, *service quality*, which is part of the updated D&M IS success model. Since all users of the system, which was intended to be evaluated, are obligated to use the system, the construct of *intention to use* was omitted. It was furthermore decided to extend the user satisfaction construct in the original D&M IS success model by incorporating the End User Computing Satisfaction Model.

The proposed theoretical model for this study, as depicted in Figure 5, comprises a combination of three models: the original D&M IS Success Model, the updated D&M IS Success Model and the End-User Computing Satisfaction Model. The proposed theoretical model was used to develop the evaluation tool (survey questionnaire) for evaluating the MIS of the selected public FET college [35].

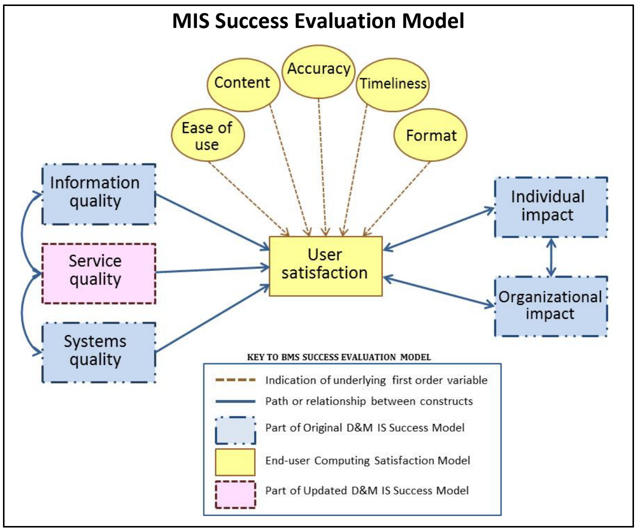

Figure 5. Proposed MIS Success Evaluation Model

In order to design and develop an evaluation tool (survey questionnaire), effectiveness criteria to measure each of the six main evaluation constructs namely: *information quality*, *service quality*, *systems quality*, *user satisfaction*, *individual impact* and *organizational impact* were investigated as described in section 3.2. The developed model and tool were empirically tested on one public FET college in SA and the results of the testing are presented in section 4.

3. RESEARCH DESIGN

A pragmatic, interpretive and post-positivist philosophical paradigm was implemented. After the literature analysis on IS success evaluation and FET policy documents, the quantitative data was gathered through a survey strategy by using a purposive designed questionnaire. The section in the questionnaire on success evaluation of the MIS, comprising forty-two questions, is composed of questions that were selected and adapted from standardized IS success evaluation questionnaires found in the literature, which have previously been empirically tested [35]. The business management information system at the selected public FET college is the application context.

3.1 Population and sampling

Two sampling frames were involved in the study, namely the population of all public FET colleges (50 in total) and the population of MIS users at the selected public FET college. A non-probability sampling technique was employed on the first sampling frame for the selection of the public FET college. One public FET college was purposively sampled to represent a benchmark for the FET sector. It was decided to select one of the top performing public FET colleges for application of the proposed evaluation model. Another condition for selection was that the FET college should be one of the eleven public FET colleges in which the new integrated MIS of DHET has been implemented, since all public FET colleges will eventually use this MIS system. Hence, the selected college, *FET College X*, (called *FET College X* according to confidentiality agreement) has been purposefully selected on those criteria and also since this specific college was proposed by the head of the FET unit at the DHET.

One of the eventual aims of the new integrated MIS is that all college staff should have access to and use the system on a daily basis for academic, administrative and management purposes. At the time of the survey, 163 staff members at FET College X were already using the MIS as part of their daily activities. The average system usage duration per staff member has reportedly been between one and two years. The entire population of the second sampling frame, the total number of MIS users (N=163 participants) at the selected public FET college participated in the survey, hence a 100% response rate was achieved.

3.2 Questionnaire design

The final questionnaire consists of four sections that respectively cover questions on: identification and consent, employment information, MIS evaluation, and personal information. The section in the questionnaire which investigates the evaluation of the MIS was developed by adapting and selecting questions from four standardized empirically tested questionnaires found in the literature [11, 13, 15, 21]. That section consists of forty-two items that were presented in a frequency-of-use Likert rating scale format in terms of which participants had to rate each item on a scale of 1 to 5, where 1 equals almost never; 2 equals some of the time; 3 equals about half of the time; 4 equals most of the time; and 5 equals almost always. The developed questionnaire is available at [35]. Each MIS success evaluation construct was generated by calculating the mean of the underlying items for each participant. The proposed conceptual model should therefore be studied in conjunction with the effectiveness measures included in the evaluation tool (questionnaire).

4. RESULTS AND FINDINGS

This section presents the results of the survey by firstly giving a brief description of the biographical characteristics of the MIS users; secondly by motivating changes to the initial conceptual model and thirdly by providing summary results on the measurements of the different IS success evaluation constructs.

4.1 Profile of MIS users

The gender distribution of the respondents was almost equal with 58% (or 94 participants) being female and 42% (or 69 participants) male. Fifty-two percent of the participants were lecturing staff, 37% support staff and 11% management staff. The mean age of all participants was 35, with just over half the participants being younger than 35 years (56%). The average ages of support, lecturing and management staff was 31, 36 and 44 years respectively. More than half of the participants (57%) had a diploma or occupational certificate as their highest academic qualification. This is not surprising, since FET colleges focus primarily on offering vocational education. One of the distinct findings of the study was that the majority (81%) of MIS users at public FET College X perceived themselves to have above average to excellent computer proficiency skills.

4.2 Statistical analyses

The data analysis provided evidence for adaptations and extensions to the proposed theoretical model. Before each construct variable was calculated, tests for internal consistency and scale reliability (Cronbach's alpha) and unidimensionality (Principal Component Analysis (PCA)) were done.

Principle component analyses were carried out on all constructs (indicators) to illustrate unidimensionality in the underlying variables, i.e. the items in the questionnaire. The results of the PCA on each success evaluation construct are depicted in Tables 2 to 7 in the Appendix and explained below.

4.2.1 Individual impact (indi)

Tables 2a and 2b illustrate that **one** component, which explains 78,528% of the total variance in the sample, is extracted, showing that the five items used to create *indi* are unidimensional. Furthermore, all items load highly (above 0.8 factor loadings) to this component as depicted in Table 2b.

4.2.2 Information quality (infq)

Tables 3a and 3b show that a PCA extracted **two** components from the eleven items that underlie *infq*; these were named *outpq* (output quality) and *dataq* (data quality). Together, these two components explain 74.478% of the total variance in the sample. The rotated component matrix (Table 3b) depicts high factor loadings – factor loadings less than 0.6 were excluded from the analysis.

4.2.3 System quality (sysq)

Tables 4a and 4b illustrate that the PCA extracted **two** components from the twelve items that underlie *sysq*, which were named: *eof* (ease of functioning) and *eoa* (ease of access). Together these two components explain 65.998% of the total variance in the sample. The rotated component matrix (Table 4b) depicts high factor loadings.

4.2.4 Service quality (serq)

Tables 5a and 5b illustrate that **one** component which explains 79.444% of the total variance in the sample is extracted with PCA, showing that the five items used to create *serq* are unidimensional. Furthermore, all items load highly (above 0.8 factor loadings) to this component.

4.2.5 Organizational impact (orgi)

Tables 6a and 6b illustrate that **one** component which explains 72.329% of the total variance in the sample is extracted, showing that the eight items used to create *orgi* are unidimensional. Furthermore, all items load highly (above 0.8 factor loadings) to this component.

4.2.6 End-user computing satisfaction (eucs)

Tables 7a and 7b show that PCA extracted three components which were named *eou* (ease of use), *con* (content) and *for* (format). This finding, of three underlying components instead of five as proposed in the theoretical model, suggests a very important adaptation to the proposed theoretical model. The proposed theoretical model suggests five first-order variables: *eou* (ease of use), *con* (content), *acc* (accuracy), *tim* (timeliness), and *for* (format) for the construct *end-user computing satisfaction (eucs),* whereas the analysis in Tables 7a and 7b of the data for *FET College X* shows that the thirteen underlying items of *eucs* grouped into three underlying components. Together these three components explain 73.749% of the total variance in the sample.

The scale reliability, as calculated for the success evaluation indicators, is discussed in the next section and then the adjusted and extended theoretical model is presented as the SA-FETMIS success model.

4.2.7 Scale reliability statistic (Cronbach's Alpha) testing

The scale reliability statistic was calculated for all first-, second- and third-order factors (success evaluation indicators) and the results are provided in Table 8 in the Appendix. Evidently, all success evaluation indicators have high internal consistency with all Cronbach's alpha values higher than 0.7. A structural representation of the construction of IS success evaluation indicators is presented in Figure 6. Each construct as depicted in the conceptual model (Figure 6) was evaluated by using the ratings of all the MIS users on a number of items and were calculated as follows:

- Individual impact (*indi*), was created by calculating the mean of five items;
- Information quality (*infq*), was created by calculating the mean of eleven items;
- System quality (*sysq*), was created by calculating the mean of twelve items;
- Service quality (*serq*), was created by calculating the mean of five items;
- Organizational impact (*orgi*), was created by calculating the mean of eight items;
- End-user computing satisfaction (*eucs*), was created by calculating the mean of thirteen items;
- Overall IS success (*bmseval*), was created by calculating the mean of fourty-one items that were used to create *indi*, *infq, sysq, serq, orgi*, and *eucs*.

The following changes to the initial conceptual model were suggested by these tests as illustrated in Tables 2 to 8 and graphically presented in Figure 7:

- the construct *information quality* has two underlying components namely: *data quality* and *output quality*;
- the construct *system quality* has two underlying components namely: *ease of access* and *ease of functioning*;
- the tests furthermore revealed that the construct *user satisfaction* consists of three instead of five underlying components namely: *ease of use, content* and *format.*

The adapted and extended SA-FETMIS success evaluation model is depicted in Figure 7.

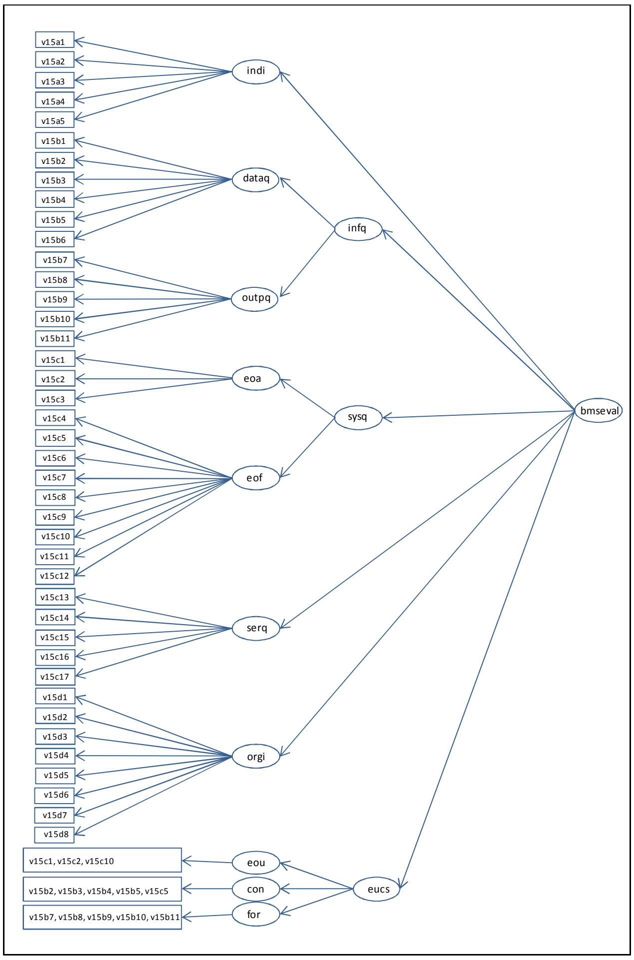

Figure 6. Structural representation of the construction of IS success evaluation indicators for this study

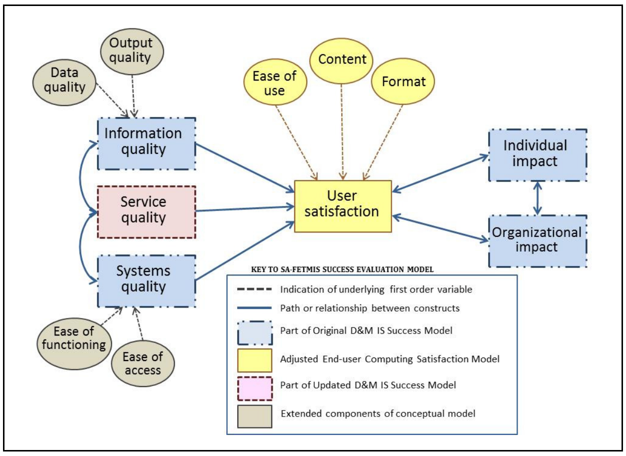

Figure 7. Conceptual model for evaluation of MIS success at public FET College X – The SA-FETMIS success model

5. DISCUSSION AND CONCLUSION

This study investigated the evaluation of MIS success at public FET colleges in SA based on internationally developed models and tools from the literature on IS success evaluation. Quantitative data was captured and analyzed to test the proposed model, including the composition of the constructs as illustrated in this paper. The paper makes two theoretical contributions. Firstly, the comprehensive comparison of information systems success evaluation models from which the initial model was synthesized. Secondly, the SA-FETMIS success model which is supported by the survey tool (as developed and tested in this study) for evaluating MIS success at a public FET college. The changes clearly reflect the FET context as captured from the FET policy documents. For example the construct *information quality* is decomposed into two underlying components namely *data quality* and *output quality* which resonates with the focus on reporting. The construct *system quality* has two underlying components namely *ease of access* and *ease of functioning* which reflects infrastructural issues. Having user satisfaction consist of three instead of five underlying components adds to the parsimony of the model. The practical contribution lies in the usefulness of that model and tool on organizational and managerial levels. Further testing at other FET colleges is needed to refine the SA-FETMIS success model and verify the general applicability of the model in measuring MIS success.

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Appendix

Table 2a. PCA on indi's five underlying items

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	**% of variance**	**Cum %**	**Total**	**% of variance**	**Cum %**
1	3.926	78.528	78.528	3.926	78.528	78.528
2	.455	9.106	87.635			
3	.329	6.587	94.221			
4	.163	3.266	97.487			
5	.126	2.513	100.00			

Note: For all the component matrixes the extraction method was Principal Component Analysis and the rotation method was Varimax with Kaiser Normalization.

Table 2b. Component Matrix[a]

Component		Component	
Item	***indi***	**Item**	***indi***
v15a4	.919	v15a5	.867
v15a2	.905	v15a1	.835
v15a3	.903	a. 1 component extracted.	

Table 3b. Rotated Component Matrix[a]

Component		Component	
Item	***outpq***	**Item**	***dataq***
v15b9	.859	v15b5	.850
v15b8	.857	v15b3	.843
v15b10	.795	v15b2	.774
v15b7	.735	v15b4	.772
v15b11	.721	v15b1	.654
		v15b6	.650

a. Rotation converged in 3 iterations.

Table 4b. Rotated Component Matrix[a]

Component		Component	
Item	***eof***	**Item**	***eoa***
v15c10	.785	v15c2	.865
v15c7	.778	v15c1	.799
v15c9	.752	v15c3	.790
v15c11	.701		
v15c6	.673		
v15c4	.665	a. Rotation converged in 3 iterations.	
v15c5	.653		
v15c8	.575		
v15c12	.567		

Table 3a. PCA on *infq's* eleven underlying items - Total variance explained

Comp.	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cum %	Total	% of variance	Cum %	Total	% of variance	Cum %
1	7.073	64.304	64.304	7.073	64.304	64.304	4.167	37.882	37.882
2	1.119	10.173	74.478	1.119	10.173	74.478	4.025	36.595	74.478
3	.541	4.921	79.399						
4	.421	3.823	83.222						
5	.361	3.281	86.504						
6	.318	2.890	89.394						
7	.280	2.548	91.941						
8	.268	2.432	94.374						
9	.233	2.116	96.490						
10	.206	1.868	98.358						
11	.181	1.642	100.000						

Table 4a. PCA on *sysq's* twelve underlying items - Total Variance Explained

Comp.	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of Variance	Cum %	Total	% of Variance	Cum %	Total	% of Variance	Cum %
1	6.878	57.320	57.320	6.878	57.320	57.320	4.494	37.453	37.453
2	1.041	8.679	65.998	1.041	8.679	65.998	3.425	28.545	65.998
3	.779	6.495	72.493						
4	.707	5.890	78.383						
5	.625	5.208	83.591						
6	.491	4.093	87.685						
7	.414	3.446	91.131						
8	.323	2.689	93.820						
9	.248	2.070	95.890						
10	.218	1.813	97.703						
11	.164	1.366	99.069						
12	.112	.931	100.000						

Table 7a. PCA on *eucs's* thirteen underlying items – Total variance explained

Comp.	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cum %	Total	% of variance	Cum %	Total	% of variance	Cum %
1	7.142	54.940	54.940	7.142	54.940	54.940	3.816	29.352	29.352
2	1.436	11.045	65.986	1.436	11.045	65.986	3.567	27.436	56.788
3	1.009	7.764	73.749	1.009	7.764	73.749	2.205	16.962	73.749
4	.620	4.770	78.519						
5	.528	4.063	82.582						
6	.475	3.653	86.235						
7	.351	2.698	88.933						
8	.335	2.580	91.513						
9	.300	2.307	93.820						
10	.268	2.059	95.879						
11	.229	1.762	97.642						
12	.172	1.321	98.963						
13	.135	1.037	100.000						

Table 5a. PCA on *serq's* five underlying items

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of var	Cum %	Total	% of var	Cum %
1	3.972	79.444	79.444	3.972	79.444	79.444
2	.491	9.814	89.258			
3	.251	5.028	94.286			
4	.157	3.135	97.421			
5	.129	2.579	100.00			

Table 5b. Component matrix[a]

Component		Component	
Item	*serq*	Item	*serq*
v15c17	.918	v15c13	.870
v15c14	.913	v15c16	.854
v15c15	.899	a. 1 component extracted	

Table 6a. PCA on *orgi's* eight underlying items

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of var	Cum %	Total	% of var	Cum %
1	5.786	72.329	72.329	5.786	72.329	72.329
2	.774	9.681	82.010			
3	.416	5.204	87.214			
4	.277	3.467	90.681			
5	.241	3.007	93.688			
6	.197	2.461	96.148			
7	.169	2.107	98.255			
8	.140	1.745	100.00			

Table 6b. Component matrix[a]

Component		Component	
Item	*orgi*	Item	*orgi*
v15d4	.889	v15d5	.849
v15d3	.882	v15d7	.838
v15d2	.863	v15d6	.827
v15d1	.850	v15d8	.803

a. 1 component extracted.

Table 7b. Rotated component matrix[a]

Item	Component		
	format	*content*	*eou*
v15b8	.833		
v15b9	.785		
v15b10	.738		
v15b7	.724		
v15b11	.691		
v15b5		.828	
v15b3		.789	
v15b4		.785	
v15b2		.721	
v15c5		.542	
v15c2			.861
v15c1			.796
v15c10			.643

a. Rotation converged in 6 iterations.

Table 8. Reliability statistic and mean of each success evaluation indicator/construct

Success evaluation indicator/ construct	Number of items	Cronbach's alpha	Level of factor	Mean	Standard deviation	N
serq (Service quality)	5	0.934	1st order	3.76	.8899	148
infq (Information quality)	11	0.943	2nd order	3.71	.8206	159
outpq (Output quality)	5	0.909	1st order	3.75	.8249	158
dataq (Data quality)	6	0.922	1st order	3.67	.9292	159
eucs (End-user computing satisfaction)	13	0.928	2nd order	3.68	.7668	162
for (Format)	5	0.909	1st order	3.75	.8249	158
con (Content)	5	0.898	1st order	3.65	.9181	160
eou (Ease of use)	3	0.765	1st order	3.64	.9102	160
bmseval (Overall MIS evaluation)	41	0.981	3rd order	3.61	.7598	163
orgi (Organizational impact)	8	0.944	1st order	3.59	.9610	156
sysq (System quality)	12	0.929	2nd order	3.58	.8009	161
eoa (Ease of access)	3	0.858	1st order	3.71	.9321	158
eof (Ease of functioning)	9	0.915	1st order	3.52	.8304	160
indi (Individual impact)	5	0.931	1st order	3.44	1.0066	161