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The EBS management model: an effective measure of e-commerce satisfaction in SMEs in the service industry from a management perspective

Mingxuan Wu · Ergun Gide · Rod Jewell

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Abstract While many electronic commerce (e-commerce) systems have been successfully adopted in businesses across a number of different industries, a significant number have failed, especially in small and medium enterprises (SMEs). It is therefore necessary to explore new methods to describe and measure e-commerce success from a business perspective.

Using the fifteen critical success factors (CSFs) obtained from previous works as a foundation, this continuing research explored an EBS Management Model categorised into five components including *Marketing, Management Support & Customer Acceptance, Web Site Effectiveness & Cost, Managing Change*, and *Knowledge & Skills*. Further research is needed to determine the weighting of these CSFs and components as a yardstick so that this EBS Management Model, as an established practical model, can be adopted by business managers for the pursuit of e-commerce success, and assist service industry SMEs in effectively adopting e-commerce systems using a business-focused approach.

Keywords Business satisfaction · e-Commerce · EBS · Management model · Service industry · SMEs

M. Wu (✉) · E. Gide
Central Queensland University, 400 Kent St., Sydney NSW 2000, Australia
e-mail: Robert_wumx@hotmail.com

E. Gide
e-mail: e.gide@syd.cqu.edu.au

R. Jewell
Central Queensland University, 11/29 Alison Rd., Wyong NSW 2259, Australia
e-mail: rodjewell@gmail.com

1 Introduction

While many electronic commerce (e-commerce) systems have been successfully adopted in businesses across a number of different industries, a significant number have failed, especially in small and medium enterprises (SMEs). It is therefore necessary to explore new methods to describe and measure e-commerce success or satisfaction.

However, much current research still focuses on the narrow perspective of e-commerce satisfaction centred on user/end-user/client/customer satisfaction [7, p. 311], for example online store image [2, pp. 1–23], the context model [1, pp. 139–165], revenue model [13], web assessment model [14, pp. 149–172], reputation model [3, pp. 193–216], and framework for the personalisation [12, pp. 173–192]. Gide and Wu [7, p. 312] proposed that the term e-commerce business satisfaction (EBS) would be a better measure of e-commerce success where e-commerce satisfaction was discussed from a business perspective.

Using the fifteen critical success factors (CSFs) obtained from previous works as a foundation, this continuing research explored an EBS Management Model for business managers that describes e-commerce success further in order to establish a practical model that can be adopted for the pursuit of e-commerce success.

2 Research framework and methodologies

2.1 Research framework

A theoretical EBS model based on previous research is shown in Fig. 1 based on the initial items of human resources, information technology, web site, security, management, business relationship, organisational finance, marketing, culture, and ethics and law.

Two focus group studies (one in Australia including nine participants and one in China including participants) were adopted first for identifying a number of problems and issues that industry is facing today (current status of the e-commerce industry). All focus group feedback was reviewed by two English-Chinese language experts.

During the focus group studies, some of the participating academic and industry experts believed that ethics and law factors should not be considered in a cross-cultural study. Therefore, ethics and law factors were removed from the theoretical EBS model. A research framework (Fig. 2) for analysing the EBS measure was thus developed based on human resources, information technology, web site, security, management, business relationship, organisational finance, marketing, and culture.

2.2 Previous research

There is currently no published yardstick for measuring EBS. A theoretical EBS model based on previous research and 73 initial items for e-commerce success was thus developed by [7, p. 234]. Further focus group studies and pilot tests were then conducted to identify the related problems and issues facing the industry today, so the

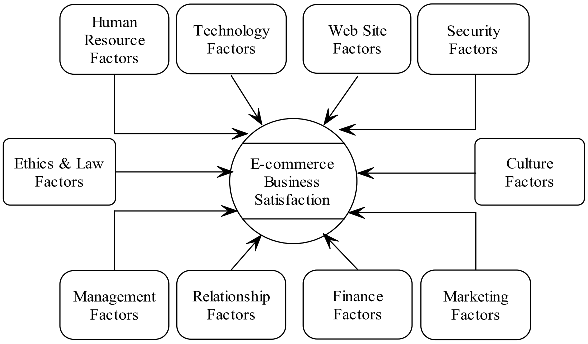


Fig. 1 Theoretical EBS model [7, p. 314]

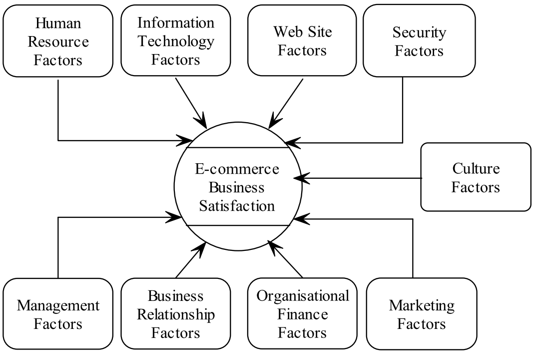


Fig. 2 Research framework

initial theoretical EBS model could be improved. Based on the initial 73 items, a total of 50 items were then adopted for a survey of Australian and Chinese service industry SMEs [19, p. 172]. The data from the survey were analysed using repeated reliability analysis comprising initial reliability analysis, validity analysis, one-sample t-testing, identification of common items, independent-samples t-testing, factor analysis, and detailed reliability analysis. A total of 15 items were finally identified as Common CSFs for EBS. An eyeball diagram was developed to illustrate these common Critical Success Factors (CSFs) and their relationships [19, p. 191].

The fifteen CSFs obtained from the survey data analysis are:

– F1 (CEO IT/e-commerce/e-commerce marketing knowledge),
– F2 (Senior staff IT/e-commerce knowledge),
– F6 (Regular staff training in the appropriate or relevant IT skills),
– F11 (Flexibility of e-commerce systems to change depending on business process),
– F12 (Ability to keep up with the rate of technology change (externally)),
– F22 (The response time effectiveness/performance of an e-commerce site),
– F25 (Trust in the interface design and information displayed in a web site),
– F28 (Support from top management/decision-maker),
– F29 (Support from senior management),
– F32 (Customer pressure/acceptance/interest),
– F41 (Cost associated with keeping up to date or upgrade of e-commerce system),
– F42 (Decision-maker's effective e-commerce marketing plan),

– F44 (Effective e-commerce marketing strategy),
– F45 (Adoption of different e-commerce marketing strategies based on different business requirements/needs), and
– F48 (The consistency of graphics and backgrounds with business culture used in a web site).

3 Data analysis

3.1 Initial reliability analysis

Reliability is the extent to which a question yields the same responses over time, or a scale produces consistent results when repeated measurements are made [18, Chap. 10, p. 1]; [15, p. 341]. A scale measurement must be reliable and valid. SPSS [18, Chap. 10, p. 4] recommends that validity should be assessed first as the measure would not be useful if it did not measure what it was supposed to. Therefore, the majority of researchers assess validity first and then reliability.

However, reliability is a necessary condition for validity as a measure cannot be valid if it is not reliable [18, Chap. 10, p. 4]; [22, p. 232]. According to [23, p. 118], any summated scale should be first analysed for reliability to ensure its appropriateness before proceeding to an assessment of its validity. Thus, this research conducted an initial reliability analysis first.

In practise, the approach for assessing internal consistency is the coefficient alpha, or Cronbach's Alpha, which is the most commonly applied estimate of a survey's reliability [15, p. 344]; [21, p. 322]. Cronbach's Alpha (a.k.a., "*the reliability coefficient*") popularised in a 1951 article by Cronbach based on work in the 1940s by Guttman and others, and is the most common measure of internal consistency of items in a scale [18, Chap. 10, p. 10]; [4, p. 416]; [6, p. 1]; [8, 9]. It provides a summary measure of the inter-correlations that exist among a set of items [4, p. 416]; [11, p. 22]; [15, p. 344]; [9].

In the initial reliability analysis stage, Cronbach's Alpha should be considered as the critical characteristic. Cronbach's Alpha varies from 0 to 1 [15, p. 344], [9]. The higher the correlations among the items, the greater the Cronbach's Alpha values, that implies that high scores on one question are associated with high scores on other questions [18, Chap. 10, p. 10]. If the value of Cronbach's Alpha is low, and if the item pool is sufficiently large, this suggests that some items do not share equally in the common core and should be eliminated [4, p. 416]. Although a recommended level of Cronbach's Alpha is often 0.70 by some researchers (e.g., [18, Chap. 10, p. 10]), several recent researchers [15, p. 344]; [21, p. 322]; [9] state that a value of Cronbach's Alpha greater than 0.6 might be accepted as having satisfactory internal-consistency reliability. Zikmund and Babin [21, p. 322] also indicate that a value is considered to have very good reliability with between 0.80 and 0.95, good reliability (between 0.70 and 0.80), fair reliability (between 0.60 and 0.70), and poor reliability (below 0.60).

If any survey items have been dropped or rejected during this reliability analysis, then it is necessary to re-do the reliability analysis. In the test of reliability, Cronbach's Alpha is 0.837. The results showed strong evidence of meeting the reliability

Table 1 Reliability statistics

Cronbach's alpha	Cronbach's alpha based on standardised items	*N* of items
.837	.843	15

standards of exploratory research (see Table 1 by SPSS) and are considered to have very good reliability.

3.2 Factor analysis

The purpose of conducting factor analysis was to examine the scope for reduction of the number of common items, in order to enable construction later of a robust EBS management model for businesses to successfully adopt an e-commerce system.

The basic rationale of factor analysis is that the variables are correlated because they share one or more common components, and if they did not correlate there would be no need to perform factor analysis, which operates on the correlation matrix of the variables to be factored [18, Chap. 10, p. 7]. Because principal component extraction attempts to account for the maximum amount of variation in the set of variables, it was used in this research for constructing a component matrix, in preference to principal axis factoring that attempts to account for correlations between the variables.

For ease of interpretation, the factors in the correlation matrix were rotated using the varimax procedure, which maximises the variances of the loadings, as it is the method most commonly used. Thus, principal component analysis with varimax rotation method was conducted within the factor analysis. Once items are rejected from the item list, another factor analysis must be conducted on the remaining items [6, p. 4]; [9].

Principal component analysis involves a mathematical procedure that transforms a number of (possibly) correlated variables (items from the survey analysis) into a (smaller) number of uncorrelated variables called principal components as the first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible (DJMW 1999). In practise, principal component analysis can be conducted using SPSS software through factor analysis.

The criteria used for evaluating factor analysis in this research included:

- An evaluation of *the case size requirement* was conducted to check whether the case size compared to the number of principal component variables was appropriate. According to Schwab (2002, p.18) the ratio of the number of cases to variables (items) in a factor analysis should be at least 5:1. The ratio for evaluating the case size requirement (the number of case size/the number of items) is 181:15, or approximately 12:1 which compares favourably with the normally accepted requirement.
- The *determinant* of the correlation matrix was then calculated. This tests for multicollinearity or singlularity, and should be greater than 0.00001. If it is less than this value then one must look through the correlation matrix for variables that correlate

very highly ($R > 0.8$) and consider eliminating one of the variables before proceeding [5, p. 2]. The determinant value was listed at the bottom of the correlation matrix is 0.01, which is greater than the necessary value of 0.00001. Therefore, multicollinearity is not a problem for these data.

– Before continuing with exploratory factor analysis, Sampling adequacy (Kaiser-Meyer-Olkin (KMO)) and Sphericity (Bartletts' Test) should be computed. The KMO measure of sampling adequacy compares the magnitudes of the observed correlation coefficients with the magnitudes of the partial correlation coefficients. The value of KMO should be greater than 0.5 for a sample to be adequate [15, p. 755]; [5, p. 3, p. 6] with superb (above 0.9), great (between 0.8 and 0.9), good (between 0.7 and 0.8), and mediocre (between 0.5 and 0.7). The value of KMO (0.806) in this research is great indicating that the samples are adequate.

Barlett's test of sphericity shows whether the variables in the correlation matrix are correlated or not. A value of $p < 0.001$ shows that correlation between the variables is highly significant and factor analysis is appropriate. Barlett's test gives a significance level of .000 ($p < 0.001$) indicating that it is appropriate to conduct further factor analysis.

– *Communalities* represent the proportion of the variance in the original variables that is accounted for by the factor solution [17, p. 25]. A relatively high communality indicates that a variable has much in common with the other variables taken as a group [21, p. 611]. Generally, the communalities after extraction should probably all be greater than 0.50 [17, p. 3], or the average communality greater than 0.6 (Field 2005, p.7). In Table 2, the initial assumption (middle column) is that all variance is common and the communality is 1.0000 for all items [5, p. 7]. Table 2 shows that all values of extraction are more than 0.5 except the Item F32 (0.482). However, the average communality ($9.726/15 = 0.65$) is greater than 0.6. Moreover, if the Item F32 is deleted, the value of Cronbach's Alpha (0.837) in reliability analysis will be reduced (0.828). Therefore, this criterion is considered to be satisfied. This item should remain.

The following criteria for evaluating a matrix of the factor loading for each variable onto each component are quite good (see Table 3 from SPSS) as:

– fifteen items are grouped into five components with the suppression of loadings not less than 0.4. Items with factor loadings less than 0.4 have not been displayed for clarity [5, p. 8].
– Items were listed in the order of size of their factor loadings [5, p. 8]. Table 3 shows ordering variables by loading size.
– Any components with a variance (represented by the eigenvalue) less than 1.0 were rejected as they contribute less than other factors to the model [18, Chap. 10, p. 9]. Table 4 shows that all eigenvalues are over 1.0 of Components 1, component 2, component 3, component 4, and component 5.
– The components accepted should account for at least 60 % of the cumulative variance [18, Chap. 10, p. 12]; [15, p. 759]. Table 4 shows that cumulative % of variance for the four components account for 64.843 % which satisfies the normally accepted measure.

Table 2 Communalities

Item	Initial	Extraction
F1	1.000	0.709
F2	1.000	0.717
F6	1.000	0.645
F11	1.000	0.611
F12	1.000	0.671
F22	1.000	0.524
F25	1.000	0.504
F28	1.000	0.678
F29	1.000	0.741
F32	1.000	0.482
F41	1.000	0.613
F42	1.000	0.747
F44	1.000	0.724
F45	1.000	0.718
F48	1.000	0.644
Total		9.726

3.3 Detailed reliability analysis

A detailed reliability analysis of the common items accepted after factor analysis was conducted to test for consistency of the results. If any survey items have been dropped or rejected during this reliability analysis, then it is necessary to re-do the factor analysis and detailed reliability liability analysis.

The results showed strong evidence of meeting the reliability standards of exploratory research as follows (see Table 5):

- The values of Cronbach's Alpha must be greater than 0.6 to have satisfactory internal-consistency reliability. As discussed previously, Cronbach's Alpha is 0.837.
- The values in the column labelled "*Corrected Item-Total Correlation*" are essentially the correlations between each item in each row and the total score from the questionnaire [18, Chap. 10, p. 18], [6, p. 3]. A low value for item-total correlation (< 0.3) means that the researcher should consider dropping it [6, p. 3]; [9]. Table 5 shows that all values in the column labelled the "*Corrected Item-Total Correlation*" are above 0.3.
- The values in the column labelled "*Cronbach's Alpha if Item Deleted*" that shows the estimated value of alpha if the given item were removed from the model [6, p. 3]; [9]. If alpha for the item increases, and is higher than the overall alpha, that is an indication that the item may not be necessary for scale construction and can be deleted [18, Chap. 10, p. 18]. Table 4 shows that the values in the column labelled "*Cronbach's Alpha if Item Deleted*" is not increased when any item is deleted. All

Table 3 Rotated component matrix

Item	Component					Cronbach's alpha
	1	2	3	4	5	
F44	0.792					0.743
F45	0.788					
F42	0.67	0.492				
F29		0.818				0.661
F28		0.705				
F32		0.461				
F48			0.771			0.696
F41			0.738			
F22			0.522	0.43		
F25			0.439			
F12				0.805		0.578
F11				0.753		
F1					0.785	0.662
F2					0.782	
F6					0.606	

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalisation; (a) Rotation converged in 7 iterations

values of Cronbach's Alpha are over 0.6 except for Component 4 (0.578) consisting of Items F11 and F12 (see Table 4). However, Table 2 indicates that Cronbach's Alpha (0.837) will decrease (to 0.831 or 0.835) if either Item F11 or F12 is deleted. Therefore, Items F11 and F12 should remain as the value of Cronbach's Alpha is a critical indicator of reliability.

– The values in the column labelled "The squared multiple Correlation" (r^2) indicate the contribution of an item to internal consistency within the dataset [20, p. 10]; [9]. The larger the value of r^2, the more the item is contributing to internal consistency, while the lower the r^2, the more the researcher should consider rejecting it [9]. However, the r^2 of some items may be low even on a scale which has an acceptable Cronbach's Alpha overall [9]. Few researchers appear to use the value of r^2 as an indicator of reliability. This research did not use r^2 as an indicator of reliability.

– The first two columns (Scale Mean if Item Deleted and Scale Variance if Item Deleted) of the next table generally aren't all that useful [10]. Scale mean if item deleted—This is the mean the scale scores would have if the particular item were deleted from the scale [16]. Scale variance if item deleted—This is the variance the scale scores would have if the particular item were deleted from the scale [16]. Table 6 shows the scale mean and scale variance created by SPSS.

Table 4 Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative (%)	Total	% of variance	Cumulative (%)	Total	% of variance	Cumulative (%)
1	4.759	31.730	31.730	4.759	31.730	31.730	2.031	13.537	13.537
2	1.505	10.036	41.766	1.505	10.036	41.766	2.008	13.388	26.925
3	1.256	8.371	50.137	1.256	8.371	50.137	1.943	12.954	39.879
4	1.185	7.899	58.036	1.185	7.899	58.036	1.907	12.712	52.591
5	1.021	6.807	64.843	1.021	6.807	64.843	1.838	12.252	64.843
6	0.851	5.676	70.519						
7	0.751	5.004	75.523						
8	0.635	4.232	79.755						
9	0.603	4.019	83.774						
10	0.523	3.485	87.260						
11	0.471	3.143	90.402						
12	0.465	3.097	93.499						
13	0.404	2.693	96.192						
14	0.319	2.124	98.317						
15	0.253	1.683	100.000						

Extraction Method: Principal Component Analysis

Table 5 Item-total statistics

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
F1	56.08	30.632	0.394	0.407	0.833
F2	56.03	30.510	0.467	0.475	0.827
F6	55.98	31.550	0.383	0.277	0.832
F11	56.11	31.354	0.405	0.311	0.831
F12	56.04	31.571	0.348	0.290	0.835
F22	55.98	30.477	0.538	0.347	0.823
F25	55.82	30.761	0.604	0.402	0.820
F28	55.86	30.631	0.548	0.537	0.822
F29	55.97	31.399	0.493	0.491	0.826
F32	55.98	31.011	0.455	0.322	0.828
F41	56.02	31.622	0.460	0.291	0.828
F42	55.96	30.309	0.569	0.528	0.821
F44	55.98	31.411	0.508	0.468	0.825
F45	55.97	31.743	0.427	0.371	0.830
F48	56.23	31.487	0.405	0.263	0.831

Table 6 (From SPSS) scale statistics

Mean	Variance	Std. deviation	*N* of items
60.00	35.289	5.940	15

4 Results and discussion

4.1 Result—an EBS management model

Based on above analysis, the fifteen CSFs were categorised into five components by strength of relationship:

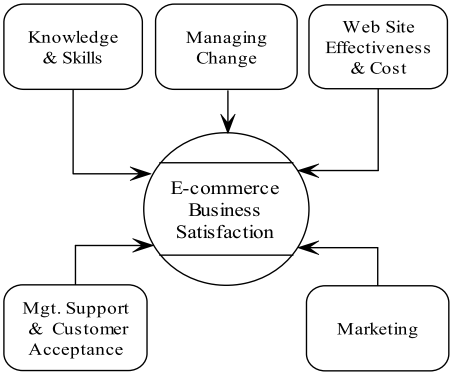
Component 1: For the three items grouped under Component 1, there is a single focus on *Marketing:*

- F44: Effective e-commerce marketing strategy.
- F45: Adoption of different e-commerce marketing strategies based on different business requirements/needs.
- F42: Decision-maker's effective e-commerce marketing plan.

Component 2: For the three items grouped under Component 2, the foci are *Management Support* & *Customer Acceptance*:

- F29: Support from senior management.
- F28: Support from top management/decision-maker.
- F32: Customer pressure/acceptance/interest.

Fig. 3 EBS Management Model



Component 3: For the four items grouped under Component 3, the foci are *Web Site Effectiveness* & *Cost*:

- F48: The consistency of graphics and backgrounds with business culture used in a web site.
- F41: Cost associated with keeping up to date or upgrade of e-commerce system.
- F22: The response time effectiveness/performance of an e-commerce web site.
- F25: Trust in the interface design and information displayed in a web site.

Component 4: For the two items grouped under Component 4, the common factor is *Managing Change*:

- F11: Flexibility of e-commerce systems changes depend on business process.
- F12: The ability to keep up with the rate of technology change (externally).

Component 5: For the three items grouped under Component 5, the common focus is on *Knowledge* & *Skills*:

- F1: CEO's IT/e-commerce/e-commerce marketing knowledge.
- F2: The senior staffs' IT/e-commerce knowledge.
- F6: Staff training with the appropriate or relevant IT skills regularly.

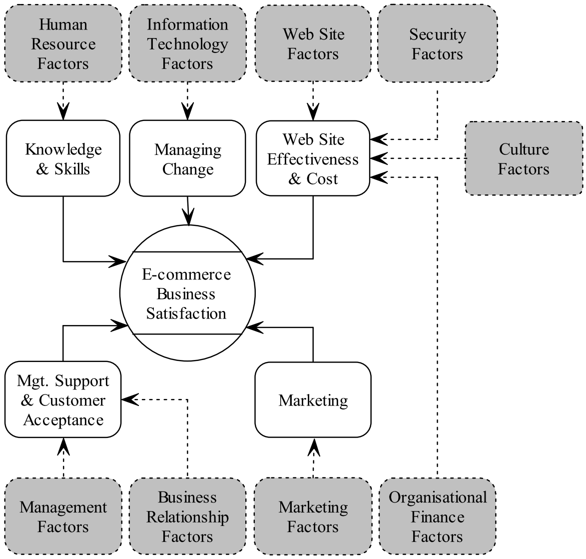
Thus, an EBS model for business managers—EBS Management Model—can be simply developed encompassing the above five components (see Fig. 3).

4.2 Results Validity and Discussion

By superimposing Figs. 2 and 3, close correlation can be seen between the EBS Management Model and the Research Framework (for clarity—the Research Framework are enclosed in dotted borders (see Fig. 4):

– human resource factors compared with the component *Knowledge* & *Skills*,
– information technology factors compared with the component *Managing Change*,
– web site, security, culture, and organisational finance factors compared with the component *Web Site Effectiveness* & *Cost*,
– management and business relationship factors compared with the component *Management*, and

Fig. 4 Correlation between EBS Model and Research Framework



– marketing factors compared with the component *Marketing*.

By superimposing the fifteen common CSFs onto Fig. 4, the strong linkages between the EBS Model for Managers and the Research Framework are further emphasised as shown in Fig. 5. For example, it can be seen that:

– three common factors involved in human resource can be categorised into the component *Knowledge & Skills*,
– two factors involved in information technology can be categorised into the component *Managing Change*,
– one common factor involved in web site, one common factor involved in security, one common factor involved in organisational finance, and one common factor involved in culture can be categorised into the component *Web Site Effectiveness & Cost*,
– two common factors involved in management, one common factor involved in business relationship can be categorised into the component *Management*, and
– three common factors involved in marketing factors can be categorised into the component *Marketing*.

5 Conclusions, limitation and further research

Because a significant number of e-commerce systems have failed across a number of different industries, especially in SMEs, it is necessary to explore new methods to describe and measure e-commerce success from a business perspective.

This research has grouped the fifteen CSFs identified in previous work, into five components: *Marketing, Management Support & Customer Acceptance, Web Site Effectiveness & Cost, Managing Change*, and *Knowledge & Skills*. An EBS Management Model for business managers was then developed. It was also validated visually

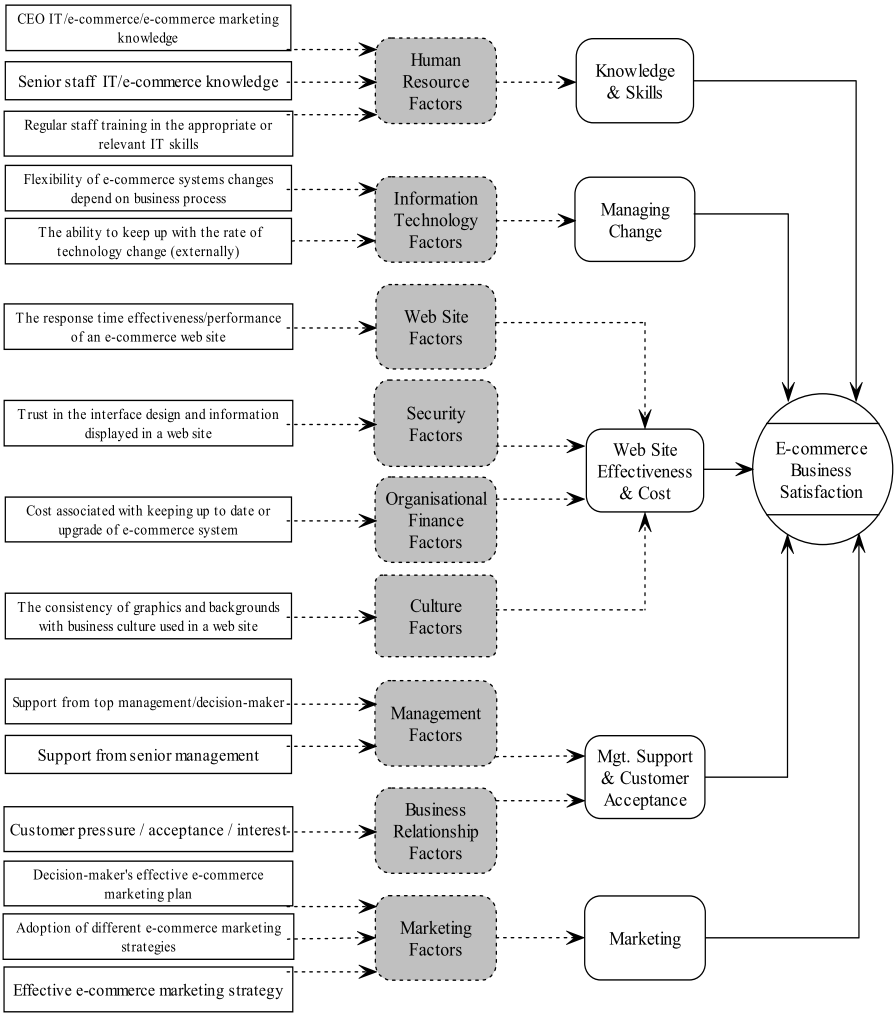


Fig. 5 Linkages between Common CSFs, Research Framework, and EBS Management Model

by superimposing CSFs and the Research Framework so that close correlation can be easily seen.

The major limitation of this research is that this concept was investigated across two very different cultures: Australia (a developed country) and China (a rapidly developing country). Another limitation is that this research focused only on service industry SMEs.

Further research is needed to determine the weighting of the CSFs and components as a yardstick so that this EBS Management Model, as an established practical model, can be adopted by business managers for the pursuit of e-commerce success, and assist service industry SMEs in effectively adopting e-commerce systems using a business-focused approach.

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Mingxuan Wu is currently President of SMEs Online International, and Director of SMEOI Australia Pty Ltd. He is also lecturing information systems and electronic commerce (e-commerce)/electronic business (e-business) courses at CQUniversity Australia Sydney. He holds PhD in E-commerce, Master of E-Commerce, and Bachelor degrees of Economics. His research interests are in e-commerce/e-business, service industry, and health informatics.
Since August 2012, Dr. Wu has been appointed as Distinguished Professor at Jiangxi Institute of Economic Administrators, China. He is also an Adjunct Professor of E-Commerce at Xi'an University of Post and Telecom and a Guest Professor of MIS at Shanxi Medical University in China. In July 2011, Dr. Wu was awarded as 'Top 100 Outstanding Academic Leaders for China's Informatics' by China Informatics Society.

Ergun Gide is currently teaching at CQUniversity in Sydney. Professor Gide holds a BSc with a University Gold Medal for Academic Excellence, an MSc in engineering, an MBA, and a PhD in e-commerce. He was also a Post-doctoral Research Fellow in knowledge-based e-business applications. He has published almost 80 chapters in books, refereed journal articles and conference papers primarily in the field of e-commerce/information systems. Professor Gide is an editorial board member for many international journals in information systems and technology and extensively supervises doctoral research students in the same disciplines. He has personally contributed to many high level international conferences including Harvard University (2010) and Oxford University (2011) just to name a few. His teaching and research interests are in e-commerce system development and implementation, smart e-commerce strategies, e-commerce project management, web-based information systems, e-business solutions, web-based education, e-government and e-services. He also has a wide range of e-commerce consultancy experiences in international educational institutions, manufacturing and service industries both in Australia and overseas. Professor Gide's contribution in his field is highly significant and justified with consistently outstanding student results and achievements. His outstanding contributions to tertiary student learning has been recognised by the following official awards: the *Gold Medal Mort Award for Teaching Excellence*, Sydney Campus, 2006; the CQUniversity *Award for Teaching Excellence* for Australian International Campuses, 2008; the CQUniversity *Vice-Chancellor's 'Teacher of the Year' Award*, 2008 and more recently the *Australian Learning and Teaching Council's* (*ALTC*) "*Citation* for Outstanding Contributions to Student Learning" Award, 2009.

Rod Jewell has a very broad and extensive management and engineering background with over 35 years experience, and more than 25 years at senior levels. This includes considerable project management, construction, and design experience in Australia and the South West Pacific. Rod's experience in the public and private sectors, and the Australian Army, includes program and project management and budgeting, teaching project management and electronic commerce at tertiary level, and being operations manager for a facilities development company. Rod is a skilled facilitator and has briefed and advised senior managers, politicians and senior public servants.
During his tenure as Senior Lecturer at Central Queensland University—Mackay, Dr. Jewell was responsible for development, moderation and coordination of undergraduate and postgraduate programs and courses founded on problem based learning across multiple campuses in Australia and overseas; lecturing and tutoring to undergraduate students at Mackay campus, and research in: electronic commerce, project management, information management and community informatics. He was

also principal supervisor for doctoral students in electronic commerce and operations research.
Tenure included periods as Head of Campus; faculty Sub-Dean; Head of School; and Visiting Research Fellow at State University of Milan (Italy) and Warwick University (UK).
Rod is currently working as Client Project Manager on contract to Gosford City Council, New South Wales—coordinating a program for the upgrade and refurbishment of the majority of Council's 185 sewage pump stations. The work involves planning, budgeting, design, development approvals and construction. The program commenced in 2009 and is planned for majority completion in 2017.