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Measuring KMS success: A respecification of the DeLone and McLean's model

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Abstract

We proposed and empirically assessed a KMS success model. This was derived through an analysis of current practice of knowledge management and review of IS success literature. Five variables (system quality, knowledge or information quality, perceived KMS benefits, user satisfaction, and system use) were used as dependent variables in evaluating KMS success, and their interrelationships were suggested and empirically tested. The results provide an expanded understanding of the factors that measure KMS success and implications of this work are discussed.

Keywords: Knowledge management; Knowledge management system; Information system success; System quality; Knowledge or information quality; Perceived KMS benefits; User satisfaction; System use

1. Introduction

In all types of firms, from professional services to retailing and manufacturing, competitive advantage is garnered through possession of unique knowledge and the organization's ability to leverage it to their advantage. Because knowledge is usually difficult to imitate, transfer, and replicate, such characteristics endow it with strategic importance. Therefore, there is a growing recognition in the business community of the importance of knowledge as a critical resource. Many organizations believe that knowledge resources matter more than conventional ones (material, labor, capital), and thus must be managed explicitly [42].

Recently, IT has advanced dramatically in both capability and affordability, and it is recognized for its ability to capture, store, process, retrieve, and communicate knowledge. Thus, many organizations are developing IS that are designed specifically to facilitate knowledge management; these are termed knowledge management systems (KMS) [1]. However, despite their rapid diffusion across corporations, knowledge management literature has mainly focused on general conceptual principles or case studies of knowledge management initiatives in major organizations [18,28]. There is a general scarcity of models and frameworks developed from empirical surveys that attempted to evaluate KMS success [16]. This raises the important issue of establishing a measurement model that can be used to evaluate KMS success and suggest ways to improve its usage.

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DeLone and McLean's IS success model [8] has received much attention among IS researchers, and it provides a foundation for research in the KMS domain [4,24,25]. This study therefore respecifies DeLone and McLean's model to measure KMS success, and validates its use in empirical surveys about KMS.

2. Background and literature review

2.1. Knowledge management systems

A KMS is a class of IS that manage organizational knowledge: thus it is a system developed to support and enhance the organizational processes of knowledge creation, storage and retrieval, transfer, and application. Two common characteristics of a KMS are *knowledge repositories* and *knowledge maps* [16,35]. The first are databases of useful documents with the system that provides functions for capturing, organizing, storing, searching, and retrieving the knowledge and information. Thus a KMS serves as a repository of knowledge for the firm regardless of time and geographic barriers, improving the capability for the combination and exchange of intellectual capital [45]. The second are searchable indexes or catalogues of expertise held by individual employees. However, because it is impossible to capture and store knowledge itself, the best way to use it is to map it in an organized way [39]. The KMS can then help team members find individuals with particular knowledge to help analyze complex problems, thereby improving the diversity of knowledge in analyzing problems.

Based on the knowledge repositories, a KMS is also an ''integrated, user–machine system for providing information or knowledge to support operations, management, analysis and decision-making.'' It is thus similar to early MIS ideas as defined by Davis and Olson [7]. But, through knowledge maps, the KMS provides a mechanism to manage the tacit or implicit knowledge carried in an individual's mind and not present in the company databases. This characteristic is the main difference between a KMS and an MIS [33]. In addition, one major KMS benefit comes from knowledge creation and sharing on the basis of ''pull'' by users and not the ''push'' of information to them. Thus, the characteristics of a KMS are different from those of an MIS.

2.2. DeLone and McLean's IS success model

Because IS success is a multi-dimensional concept that can be assessed at various levels, the measure for IS success has neither been totally clear nor exactly defined. However, DeLone and McLean in 1992 made a major breakthrough. They conducted a comprehensive review of IS success literature and proposed a model of IS success shown in Fig. 1.

This model identified six interrelated dimensions of IS success. It suggested that the success can be represented by the system quality, the output information quality, consumption (use) of the output, the user's response (user satisfaction), the effect of the IS on the behavior of the user (individual impact), and the effect of the IS on organizational performance (organizational impact). This model provided a scheme for classifying the multitude of IS success measures and suggested the temporal and causal interdependencies between the six dimensions.

The original IS success model needed further validation; therefore, based on a review of the literature, DeLone and McLean proposed an updated model. This is shown in Fig. 2 [9]. The primary differences between the original and updated models included:

(1) the addition of *service quality* to reflect the importance of service and support in successful e-commerce systems,
(2) the addition of *intention to use* to measure user attitude, and
(3) the collapsing of individual impact and organizational impact into a more parsimonious *net benefits* construct.

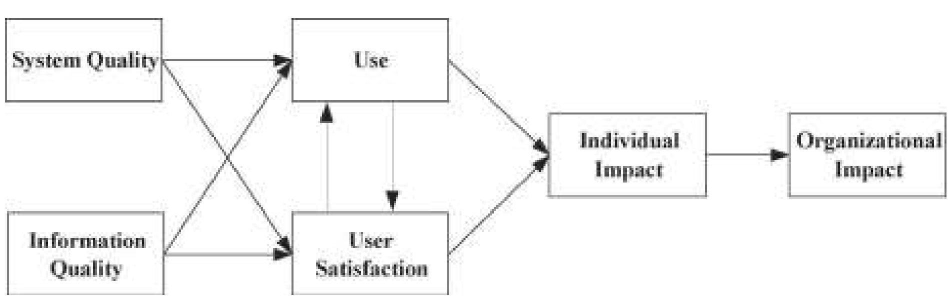

Fig. 1. DeLone and McLean's IS success model (1992).

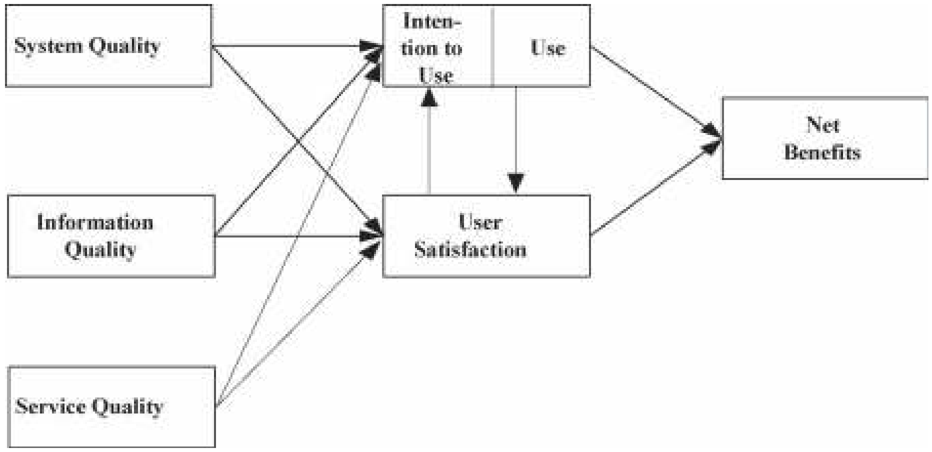

Fig. 2. DeLone and McLean's updated IS success model (2003).

The categories of the updated taxonomy were system, information, and service quality, intention to use, use, user satisfaction, and net benefits [10].

Although DeLone and McLean proposed an updated conceptual IS success model, it clearly needed further validation before it could serve as a basis for the selection of appropriate IS measures. In addition, researchers had to choose several appropriate success measures based on the objectives and the phenomena under investigation, as well as consider possible relationships among the success dimensions when constructing the research model.

2.3. Related validations, comments, and changes to the success model

Many empirical studies supported the left-hand part of the DeLone and McLean model, which assumed that the relationships that ''system quality and information quality'' cause ''system use and user satisfaction'' [22,36]. It has been shown that quality influences attitude and behavior in an IS context. However, there have been many debates on the relationships of the right-hand side of the IS success model.

2.3.1. System use as a measure of IS success

There has been an intense debate about whether system use is a good measure of IS success. Although some authors [37] have suggested that it is better to remove system use as an IS success variable, DeLone and McLean argued that system use was an appropriate measure. They asserted that the source of the problem was a too simplistic definition of *system use*, and that researchers must consider the extent, nature, quality, and appropriateness of it. Simply measuring the amount of time a system is in use is not enough: informed and effective use is an important indication of IS success.

2.3.2. Measure of net benefits

Although it may be more desirable to measure system benefits in terms of numeric costs (e.g. cost savings, expanded markets, incremental additional sales, and time savings), such measures are often not possible because of intangible system impacts and intervening environmental variables that may influence the numbers [30]. Therefore, there has been little consensus on how net benefits should be measured objectively and thus they are usually measured by the *perceptions* of those who use the IS. Therefore, ''perceived system benefits'' or ''perceived usefulness'' has been adopted as an important surrogate of IS success [46].

2.3.3. The relationships among system use, user satisfaction, and net benefits

The right-hand side of the DeLone and McLean's model, which assumed linear causality between system use, user satisfaction, individual impact, and organizational impact, has not been authenticated.

Seddon contended that the model was too encompassing and introduced some confusion because it mixed process and causal explanation of IS success. He further argued that system use must precede impacts and benefits, but that it did not cause them. Accordingly, system use would be a behavior that reflects an expectation of system benefits from using an IS and thus would be a consequence of IS success, rather than a determinant of system net benefits. Some empirical surveys [15] also found that the association between system use and system benefit was not statistically significant. System use is necessary but not sufficient to create system benefits.

User satisfaction results from the feelings and attitudes from aggregating all the benefits that a person hopes to receive from interaction with the IS [23]. In fact, attitude can not influence system benefits — on the contrary, perceived system benefits can influence user satisfaction. Therefore, individual impact and net benefits can cause user satisfaction (rather than *vice versa*).

In addition, some researchers [3] have suggested that user satisfaction causes system use rather than *vice versa*. Thus, the DeLone and McLean's assertion that system use causes user satisfaction seems to be merely a temporal rather than causal relationship.

2.3.4. Independent versus dependent variables as IS success

Many models based on that of DeLone and McLean have been presented. However, they often confuse the independent variable and dependent variables of IS success. "Technological support", "knowledge strategy or process", and "support and service" are three examples of suggested additions but these clearly cause success (rather than being part of it). The variables should be dependent; i.e. surrogate measures for success. DeLone and McLean suggested that the IS success model should include service quality for electronic commerce systems. However, it is not a good measure for KMS success because it determines success rather than being a part.

3. A KMS success model

3.1. The applicability of the IS success model for the KMS domain

Any IS must effectively recognize the primary mechanisms by which users work and build technological solutions. The success measurements, from the socio-technical viewpoint, should capture both technological and human elements [14,38]. An effective KMS typically requires an appropriate combination of both [5]. As with most information systems, KMS success partially depends upon the degree of use [31], which itself may be tied to system quality, information quality, user satisfaction, and usefulness. Thus, the technological dimensions (i.e. system and information quality) and the human dimensions (e.g. user satisfaction, perceived system benefits, and system use) can be a good starting point when considering suitable constructs for measuring KMS success.

System quality depends on the intended operational characteristics. It is concerned with whether there are errors in the system, its ease of use, response time, flexibility, and stability. System quality measures the reliability and predictability of the system independent of the knowledge it contains. These criteria are equally applicable in measuring KMS success.

Information quality has been used as a success measure for traditional IS. In the KMS context, the distinction between knowledge and information depends on context and the user. One processor's knowledge can be another's information; knowledge to a given processor for a certain task at a certain time may be only information for another task or at a different time [20].

User satisfaction is one of the most frequently measured aspects of IS success. In addition, it is hard to deny the success of a system which users say they like; thus, user satisfaction is also a good measurement for KMS success.

System use is also one of the most frequently assessed categories in measuring IS success [43]. However, as Seddon pointed out, system use is a good proxy for IS success when the use is not mandatory. Doll and Torkzadeh, DeLone and McLean argued that system use is an appropriate measure of success in most cases and is a key variable in understanding IS success [12]. The traditional measure for system use is too simplistic to reflect the nature, extent, quality, and appropriateness of system use. A reasonable measure could be determined by assessing whether the full functionality of a system is being used for its intended purposes. System use could thus be an appropriate measure for KMS success, if it captures the richness and nature of KMS use.

Intention to use is a measure of the likelihood a person will employ the application. It is a predictive variable for system use. However, only when system use is difficult to assess, measuring intention to use can be worthwhile [6,27]. Therefore, it was dropped from the KMS success model.

Perceived system benefit is the degree to which a user believes that use of the system results in benefits to the user or the organization, often assuming that this results in an increase in job performance and productivity [40]. However, *perceived system benefits* not only capture user feelings but also capture other dimensions, such as IS effectiveness. Thus, it is desirable to use such a construct as the dependent variable in IS success measurement and we used *perceived KMS benefits* as our measure for KMS success.

3.2. A KMS success model

The resulting KMS success model and its hypotheses are shown in Fig. 3.

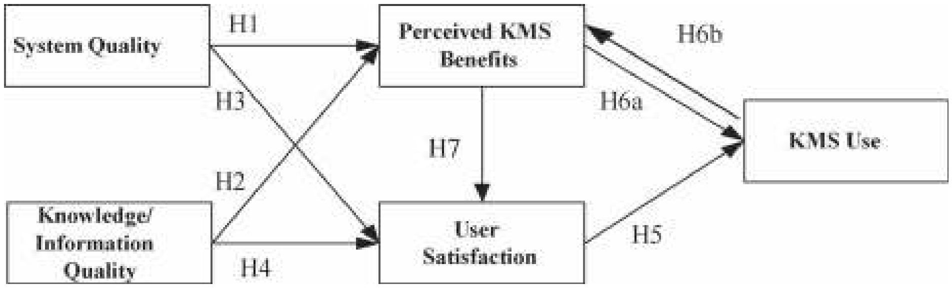

Fig. 3. KMS success model.

Like most IS, the system quality and knowledge or information quality of a KMS are expected to be drivers of user perceived benefits. Therefore, we hypothesized:

H1. The extent of system quality in KMS is positively associated with user perceived benefits.

H2. The extent of knowledge or information quality in KMS is positively associated with user perceived benefits.

Doll and Torkzadeh developed a valid and reliable user satisfaction measure instrument with 12 questions [11]. These were split into five categories: content, accuracy, format, timeliness, and ease of use; the first four relate to quality, while the fifth is a component of system quality. The instrument actually measures two variables that are causes of user satisfaction: system quality and knowledge or information quality. Therefore, we hypothesized:

H3. The extent of system quality in KMS is positively associated with user satisfaction.

H4. The extent of knowledge or information quality in KMS is positively associated with user satisfaction.

Attitude cannot influence system benefits; however, it can determine behavior, while perceived system benefits can influence user satisfaction, possibly increasing both user satisfaction and system use. However, the assertion that system use causes user satisfaction seems to be merely a temporal rather than causal relationship.

Also, an IS does not contribute to performance if it is not used. An IS will contribute to performance only when it is adequately and completely used. The effects of KMS use can improve employees' ability to search for and find knowledgeable individuals, which leads to more accurate and complete analysis of complex problems, and system use is an important driver for KMS benefits and may increase perceived system benefits in a KMS context. Thus, the following hypotheses were proposed:

H5. The extent of user satisfaction in KMS is positively associated with system use.

H6. The user perceived KMS benefits and system use are positively interrelated.

H6a. The extent of user perceived KMS benefits is positively associated with system use.

H6b. The extent of system use is positively associated with user perceived KMS benefits.

H7. The extent of user perceived KMS benefits is positively associated with user satisfaction.

4. Research method

4.1. Construct definitions and measures

All constructs and measures were based on items in existing instruments, KMS literature, and input from KMS experts. They are summarized in the Appendix A. Items in the questionnaire were measured using a seven-point Likert scale ranging from (1) strongly disagree to (7) strongly agree. To ensure the desired balance and randomness of the questionnaire, all items were randomly sequenced in order to reduce the potential ceiling (or floor) effect that can induce bias of the responses.

4.1.1. System quality

The typical measures of this area in traditional IS studies include system stability, acceptable response time, a user-friendly interface, and ease of use [32]. Our study adopted these also.

4.1.2. Knowledge or information quality

For a KMS, knowledge or information quality is a multi-dimensional construct having two components: content quality and context and linkage quality. The first is similar to that of traditional IS environment, and the second is made up of special KMS characteristics. We developed a two-dimensional, 11-item instrument for measuring it.

4.1.3. User satisfaction

Items measuring only user satisfaction were sought: Seddon and Kiew's four-item instrument was used in our study.

4.1.4. Perceived KMS benefits

Most KMS benefits are intangible and indirect being relatively long term. Measure indicators need not be hard and financial, but can be soft and non-financial [21]. Therefore, the KMS benefits were measured by the perceptions of those using it; the five items are shown in Appendix A.

4.1.5. System use

In the KMS context, two common use types are knowledge sharing and knowledge acquisition and utilization (the active and passive uses). Broadly speaking, the former includes usage behaviors about publishing, contributing to discussions, answering, valuing, and commenting, while the latter includes usage behaviors concerning searching for and reading about knowledge or answers [29].

The initial measurement for KMS use consisted of two dimensions and eight items. One is *passive use*, which is knowledge acquisition and utilization. It included four items. The other dimension was *active use*, which also included four items. In order to test the robustness of our measurement model, we ran exploratory factor analysis prior to conducting confirmatory factor analysis (CFA). It was found that passive use and active use collapsed onto one dimension. The three preceding items of the original measure for passive use were dropped because of low factor loading (<0.4) or cross loading. Furthermore, these four items of passive use were highly related. The purpose of perusing and assimilating knowledge in KMS was always for helping solve job problems, while making decisions usually coincided with solving problems. Therefore, eliminating the three preceding items of the original measure for passive use was reasonable. In conclusion, system use was a first-order construct and included five measurement items. Five items were selected and reworded to be suitable for KMS based on Doll and Torkzadeh's work.

4.2. Data collection

Data for our study were collected using a questionnaire survey administered in Taiwan during the year 2004. Top-500 firms were included, but we only selected those who already had been using a KMS. They received initial phone calls explaining the purpose of the research project and inquiring whether the firm would be willing to participate. Fifty firms agreed. A contact person was identified at each firm; this person distributed the self-administered questionnaires to KMS users. Respondents were selected because they had good insight into the resources and the effects of KMS on their organization. We sent out 350 questionnaires and received 204 useful responses. The response rate was thus 58.3%.

We assessed potential nonresponse bias by comparing the early *versus* late respondents. They were compared on several demographic characteristics. The

Table 1
Respondent profile and nonresponse bias analysis

Demographics	Total (%)	Early respondents (%)	Late respondents (%)	*P*-value
Industry				
Manufacture	33.8	32.1	34.9	0.51
Service	34.8	37.2	33.3	
Finance	24.5	26.9	23.0	
Others	6.9	3.8	8.7	
Gender				
Male	66.0	65.4	66.4	0.88
Female	34.0	34.6	33.6	
Age				
18–30	27.9	28.2	27.8	0.59
31–40	47.5	51.3	45.2	
41–50	20.6	19.2	21.4	
51–60	3.4	1.3	4.8	
60 above	0.5	0.0	0.8	
Computer experience (years)	9.8	9.4	9.9	0.52

t-test and χ^2 analysis were used to examine the distributions between these two data sets. The results indicated that there are no statistically significant differences. This suggested that nonresponse bias was not a serious concern. Table 1 shows the demographic profile of the respondents and nonresponse bias.

5. Data analysis and results

We used structural equation modeling for hypotheses testing. A two-phased approach was used, based on Anderson and Gerbing [2]. First, the measurement model was estimated using CFA to test the overall fit of the model, as well as its validity and reliability. Second, the hypotheses were tested between constructs using the structural model.

5.1. Measurement model

The LISREL 8.30 program was used. Because ''knowledge or information quality'' is a second-order construct, CFA was first used to justify its underlying factor structure and assess the reliability and validity of factors and items.

To test the KMS success model and the associated hypotheses, the second-order construct (i.e. knowledge or information quality) was treated as a first-order factor, composites scores of the two first-order factors (i.e. content quality and context and linkage quality) were computed and represented the observed indicators. The composite score was the average score of the measure items on the corresponding first-order factor [19,47].

Therefore, the updated measurement model included 29 items describing five latent constructs: system quality, knowledge or information quality, user satisfaction, perceived KMS benefits, and system use. The goodness-of-fit indexes for the hypothesized measurement model were summarized in Table 2. The ratio of χ^2 to the degrees of freedom, goodness-of-fit (GFI), root mean square residual (RMR), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), and incremental fit index (IFI) were used to evaluate the model. Although it may be the convention that the standard of 0.9 for GFI, AGFI, NFI, and NNFI be used to judge the overall fit of a model, the 0.9 criterion has been criticized as being too stringent for developing theories and/or models [34,44]. Consequently, less restrictive criteria may be appropriate, depending on the level of empirical and theoretical development [41].

Table 2
Fit indices for measure model

Fit indices	Criteria	Initial	Adjusted
χ^2/d.f.	1–2	1.88	1.78
GFI	>.85	0.86	0.87
RMR	<.05	0.06	0.05
AGFI	>.80	0.82	0.83
NFI	>.80	0.90	0.90
NNFI	>.80	0.94	0.95
CFI	Approaching 1; higher	0.95	0.95
IFI	values, higher goodness	0.95	0.96

Since success measures in the KMS area were under development rather than firmly established, the 0.9 standard was felt to be too stringent. Thus, the goodness-of-fit indices suggested by Hadjistavropoulos et al. [17] and Hair et al. were used: GFI $>$ 0.85, AGFI $>$ 0.8, RMR $<$ 0.05, NFI and NNFI $>$ 0.8

All model fit indices exceeded their respective common acceptance levels, demonstrating that the measurement model exhibited a good fit with the data. However, the RMR was somewhat higher than the recommended level of 0.05. Thus, items with factor loading values lower than 0.5 were abandoned from further analysis. One item (US2) was therefore deleted from consideration, leaving a total of 28 items for further analysis. CFA was then conducted with the results shown in Tables 2 and 3. The adjusted measurement model substantially improved all indexes of goodness-of-fit. Therefore, we could proceed to evaluate the psychometric properties of the measurement model in terms of reliability, convergent validity, and discriminant validity.

Composite reliability shows the degree to which the items depend on a common construct; for all the factors in the measurement model it was above 0.6 [13]. The result therefore demonstrates composite reliability. Convergent validity was evaluated by examining the factor loadings; the recommendation of Hair et al. was that those greater than 0.5 were considered to be very significant. All factor loadings of the items in the model were greater than 0.5, demonstrating adequate convergent validity.

Discriminant validity was assessed by developing a confidence interval of $\psi \pm 2\sigma_e$ for each pair of factors and examining whether 1 is included. The ψ notation is the correlation between two factors while the σ_e is the standard error between two factors. If 1 is not included, it provides evidence of discriminant validity [26]. As shown in Table 4, none of the 10 confidence intervals include the value of 1, thereby providing evidences of discriminant validity.

Table 3
Composite reliabilities and factor loadings of the measure model

	Composite reliabilities	SQ	KQ	PKB	SU	US
System quality	0.76					
SQ1		0.77				
SQ2		0.66				
SQ3		0.58				
SQ4		0.64				
Knowledge or information quality	0.83					
KQ1			0.88			
KQ2			0.79			
Perceived KMS benefits	0.88					
PKB1				0.78		
PKB2				0.79		
PKB3				0.82		
PKB4				0.77		
PKB5				0.71		
System use	0.91					
SU1					0.79	
SU2					0.81	
SU3					0.86	
SU4					0.81	
SU5					0.85	
User satisfaction	0.92					
US1						0.84
US3						0.88
US4						0.94

5.2. Structural model

Given an adequate measurement model, the hypotheses can be tested by examining the structural model. Fig. 4 shows the standardized path coefficients, their significance for the structural model, and the coefficients of determinant (R^2) for each endogenous construct. The standardized path coefficient indicates the strengths of the relationships between the independent and dependent variables. The R^2 value represents the amount of variance explained by the independent variables.

As expected, hypotheses H2 and H4 were supported. These implied that increased knowledge or information quality of the KMS would be associated with increased user perceived system benefits and user satisfaction. For system quality, hypothesis H3 was supported, but hypothesis H1 was not. Although system quality had a significantly positive effect on user satisfaction, it had no effect on perceived system benefits.

Hypothesis H6 was partially supported. The perceived KMS benefits had a significantly positive effect on KMS use, but not *vice versa*. We found that knowledge or information quality was the main determinant of user perceived KMS benefits ($\beta = 0.99$). System quality and system use had no significant effect on user perceived KMS benefits. Knowledge or information quality explained 54% of the variance contained in user perceived KMS benefits.

Table 4
Confidence intervals for each pair of factors

	KQ	PKB	SU	US
System quality (SQ)	[0.26, 0.54]	[0.13, 0.37]	[0.03, 0.23]	[0.23, 0.51]
Knowledge or information quality (KQ)	–	[0.39, 0.71]	[0.34, 0.62]	[0.43, 0.75]
Perceived KMS benefits (PKB)		–	[0.32, 0.60]	[0.36, 0.68]
System use (SU)			–	[0.34, 0.62]
User satisfaction (US)				–

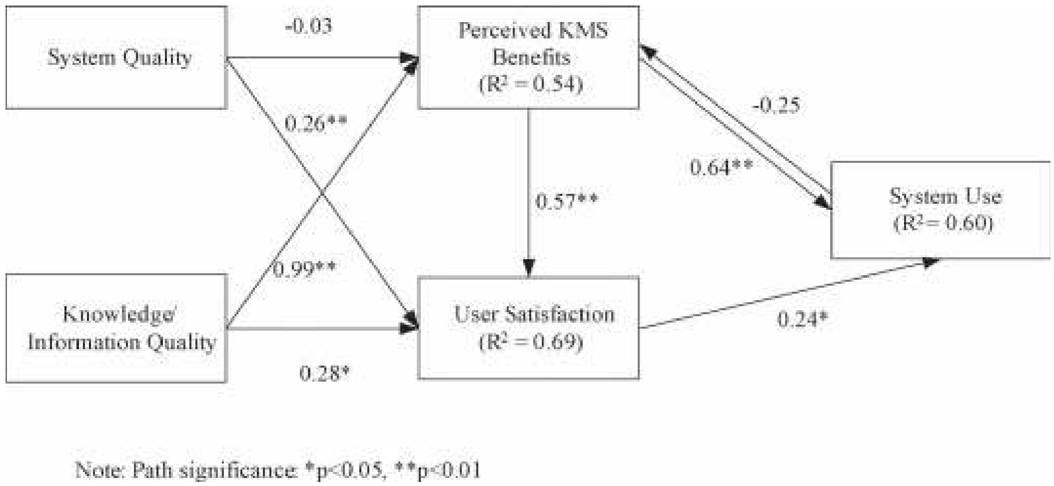

Fig. 4. Hypotheses testing results.

Hypothesis H7 was supported. Because hypotheses H2 and H4 were also supported by the data, user perceived KMS benefits, system quality, and knowledge or information quality all had a significantly positive effect on user satisfaction. Altogether, they accounted for 69% of the variance. However, perceived KMS benefits ($\beta = 0.57$) contributed more to satisfaction than both system quality ($\beta = 0.26$) and knowledge or information quality ($\beta = 0.28$).

Hypothesis H5 was supported and indicated that user satisfaction had a significantly positive effect on system use in a KMS context. Since hypothesis 6a was also supported, it could be suggested that a higher level of user satisfaction and perceived KMS benefits would lead to a higher level of KMS use. They together explained 60% of the variance in system use.

The total effect of a variable on the dependent variable is the result of the direct and indirect impacts of intervening variables. User perceived KMS benefits had the strongest influence on system use and user satisfaction. Compared to system quality, knowledge or information quality of KMS has higher total effect on perceived KMS benefits, user satisfaction, and system use. Knowledge or information quality has a big impact on user perceived benefits and user satisfaction. It also has an important indirect influence on use.

6. Discussion and conclusions

Most empirical studies of the success model have examined information-based IS. It was not clear whether the constructs and relationships embodied in the DeLone and McLean's updated model would be applicable to knowledge-based IS. Our study specified a KMS success model. Using this as a theoretical framework, we introduced ‘‘knowledge/information quality’’ as a KMS success measure. We also developed new measures of ‘‘knowledge/information quality’’ and ‘‘system use’’ in the KMS context.

The empirical results provide considerable support for the model. Five of the seven hypothesized relationships were found to be significant.

6.1. Revalidate the “beliefs–attitude–behavior” relationships

The empirical results of our study indicated that system quality and knowledge or information quality have a significantly positive influence on user satisfaction. In addition, user satisfaction and perceived KMS benefits had a direct effect on KMS use.

In the KMS context, we found that user attitude is affected by beliefs about system quality and knowledge or information quality, which then affected KMS use. Users' beliefs about the KMS quality shape their attitude and this affects their KMS use.

6.2. User satisfaction reflects quality and perceived benefits

The empirical results showed that the system quality, knowledge or information quality, and perceived benefits had a significantly positive influence on user satisfaction. It can be interpreted as a response to the three types of user expectations about a system: they want their KMS to be of high system quality, have high knowledge or information quality, and provide substantial benefits.

6.3. Effects of system and knowledge or information quality

The finding that the system quality of the KMS did not have a significantly direct influence on user perceived benefits was inconsistent with most prior MIS research. A KMS with system quality is necessary but not sufficient to provide benefits. System quality only ensures that the KMS is running normally.

Compared with system quality, knowledge or information quality has a greater influence on user satisfaction and perceived benefits. Users have started to consider IS to be a part of their working life. Thus, system operation is no longer an important issue. Its effect may be important during the initial implementation but subsides over time.

The goals of the KMS are to manage and disseminate organizational knowledge, and then leverage the knowledge value. Thus, it is important for users to acquire and utilize helpful knowledge from the KMS. The user's perception thus depends on the quality of the contents and outputs of the KMS rather than the system performance and its functions.

6.4. The relationships among user satisfaction, user perceived benefits, and system use

We found that perceived KMS benefits had a positive influence on user satisfaction and that perceived KMS benefits and user satisfaction had a direct positive effect on system use but that system use had no significantly positive effect on user perceived KMS benefits. If users conclude that the benefits will outweigh the costs or effort of using a KMS, they will effectively use it, but if it cannot provide benefits to users and help them, it will not contribute to user performance.

6.5. Limitations of the study

The validity of a KMS success model cannot be truly established on the basis of a single study. Thus, we need to exercise caution when generalizing our findings. Validation of measurement requires the assessment of measurement properties over a variety of samples in similar and different contexts. Furthermore, samples from different cultures or nations should be gathered to confirm, evaluate, or refine the model.

In addition, many important exogenous variables, such as managerial factors (e.g. attitudes of top management), facilitating conditions (e.g. reward), environmental factors (e.g. trust, organizational culture), and resource availability may have an influence on KMS success. Our study indicated that user perceived KMS benefits played a significant role in KMS success, but it is necessary to understand the relationship between user perceptions of KMS benefits in order to generalize our findings.

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Appendix A. Construct definition and measures

System quality: How good the KMS is in terms of its operational characteristics
- Q1. KMS is easy to use
- Q2. KMS is user friendly
- Q3. KMS is stable
- Q4. The response time of KMS is acceptable

Knowledge or information quality: How good the KMS is in terms of its output

Content quality
- KQ1. KMS makes it easy for me to create knowledge documents
- KQ2. The words and phrases in contents provided by KMS are consistent
- KQ3. The content representation provided by KMS is logical and fit
- KQ4. The knowledge or information provided by KMS is available at a time suitable for its use
- KQ5. The knowledge or information provided by KMS is important and helpful for my work
- KQ6. The knowledge or information provided by KMS is meaningful, understandable, and practicable
- KQ7. The knowledge classification or index in KMS is clear and unambiguous

Context and linkage quality
- KQ8. KMS provide contextual knowledge or information so that I can truly understand what is being accessed and easily apply it to work
- KQ9. KMS provide complete knowledge portal so that I can link to knowledge or information sources for more detail inquire
- KQ10. KMS provide accurate expert directory (link, yellow pages)
- KQ11. KMS provide helpful expert directory (link, yellow pages) for my work

User satisfaction: The sum of one's feelings of pleasure or displeasure regarding KMS
- US1. I am satisfied that KMS meet my knowledge or information processing needs
- US2. I am satisfied with KMS efficiency
- US3. I am satisfied with KMS effectiveness
- US4. Overall, I am satisfied with KMS

Appendix A (*Continued*)

Perceived KMS benefits: The valuation of the benefits of the KMS by users
- PKB1. KMS helps me acquire new knowledge and innovative ideas
- PKB2. KMS helps me effectively manage and store knowledge that I need
- PKB3. KMS enable me to accomplish tasks more efficiently
- PKB4. My performance on the job is enhanced by KMS
- PKB5. KMS improves the quality of my work life

System use: The extent of the KMS being used
- SU1. I use KMS to help me make decisions
- SU2. I use KMS to help me record my knowledge
- SU3. I use KMS to communicate knowledge and information with colleagues
- SU4. I use KMS to share my general knowledge
- SU5. I use KMS to share my specific knowledge

References

[1] M. Alavi, D.E. Leidner, Knowledge management and knowledge management systems: conceptual foundations and research issues, MIS Quarterly 25(1), 2001, pp. 107–136.

[2] J. Anderson, J. Gerbing, Structural equation modeling in practice: a review and recommended two-step approach, Psychological Bulletin 103(3), 1988, pp. 411–423.

[3] J.J. Baroudi, M.H. Olson, B. Ives, An empirical study on the impact of user involvement on system usage and information satisfaction, Communications of the ACM 29(3), 1986, pp. 232–238.

[4] P.F. Clay, A.R. Dennis, D. Ko, Factors affecting the loyal use of knowledge management systems, in: Proceedings of the 38th Hawaii International Conference on System Sciences, Big Island, Hawaii, 2005.

[5] T.H. Davenport, D.W. DeLong, M.C. Beers, Successful knowledge management projects, Sloan Management Review 39(2), 1998, pp. 43–57.

[6] F.D. Davis, User acceptance of information technology: system characteristics, user perceptions, and behavioral impacts, International Journal of Man–Machine Studies 38, 1993, pp. 475–487.

[7] G.B. Davis, M.H. Olson, Management Information Systems: Conceptual Foundations, Structure, and Development, McGraw-Hill, New York, 1985.

[8] W.H. DeLone, E.R. McLean, Information systems success: the quest for the dependent variable, Information Systems Research 3(1), 1992, pp. 60–95.

[9] W.H. DeLone, E.R. McLean, The DeLone and McLean model of information system success: a ten-year update, Journal of Management Information Systems 19(4), 2003, pp. 9–30.

[10] W.H. DeLone, E.R. McLean, Measuring e-commerce success: applying the DeLone & McLean information systems success model, International Journal of Electronic Commerce 9(1), 2004, pp. 31–47.

[11] W.J. Doll, G. Torkzadeh, The measurement of end-user computing satisfaction, MIS Quarterly 12(2), 1988, pp. 259–274.

[12] W.J. Doll, G. Torkzadeh, Developing a multidimensional measure of system-use in an organizational context, Information & Management 33(4), 1998, pp. 171–185.

[13] C. Fornell, D.F. Larcker, Evaluating structural equation models with unobservable variables and measurement error, Journal of Marketing Research 18(1), 1981, pp. 39–50.

[14] E. Garrity, E.G.L. Sanders, Introduction to information systems success measurement, in: E.J. Garrity, G.L. Sanders (Eds.), Information Systems Success Measurement, Idea Group Publishing, Harrisburg, PA, 1998, pp. 1–12.

[15] M. Gelderman, The relation between user satisfaction, usage of information systems and performance, Information & Management 34(1), 1998, pp. 11–18.

[16] P.H. Gray, The effects of knowledge management systems on emergent teams: towards a research model, Journal of Strategic Information Systems 9(2–3), 2000, pp. 175–191.

[17] H.D. Hadjistavropoulos, I.K. Frombach, G.J.G. Asmundson, Exploratory and confirmatory factor analytic investigations of the illness attitudes scale in a nonclinical sample, Behaviour Research and Therapy 37(7), 1999, pp. 671–684.

[18] J. Hahn, M.R. Subramani, A framework of knowledge management systems: issues and challenges for theory and practice, in: Proceedings of the 21st International Conference on Information Systems, Brisbane, Australia, 2000, pp. 302–312.

[19] J.F. Hair, R.E. Anderson, R.L. Tatham, W. Black, Multivariate Data Analysis With Readings, 5th ed., Prentice Hall, NJ, 1998.

[20] C.W. Holsapple, Knowledge and its attributes, in: C.W. Holsapple (Ed.), Handbook on Knowledge Management. Part 1, Springer–Verlag, New York, 2003, pp. 165–188.

[21] C.W. Holsapple, K.D. Joshi, An investigation of factors that influence the management of knowledge in organizations, Journal of Strategic Information Systems 9(2–3), 2000, pp. 235–261.

[22] M. Igbaria, M. Tan, The consequences of information technology acceptance on subsequent individual performance, Information & Management 32(3), 1997, pp. 113–121.

[23] B. Ives, M.H. Olson, J.J. Baroudi, The measurement of user information satisfaction, Communications of the ACM 26(10), 1983, pp. 785–793.

[24] M.E. Jennex, L. Olfman, Organizational memory, in: C.W. Holsapple (Ed.), Handbook on Knowledge Management. Part 1, Springer–Verlag, New York, 2003, pp. 207–234.

[25] M.E. Jennex, The issue of system use in knowledge management systems, in: Proceedings of the 38th Hawaii International Conference on System Sciences, Big Island, Hawaii, 2005.

[26] X.A. Koufteros, Testing a model of pull production: a paradigm for manufacturing research using structural equation modeling, Journal of Operations Management 17(4), 1999, pp. 467–488.

[27] A.L. Lederer, D.L. Maupin, M.P. Sena, Y. Zhuang, The technology acceptance model and the worldwide web, Decision Support Systems 29(3), 2000, pp. 269–282.

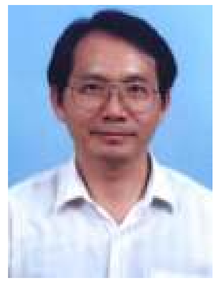
[28] K.C. Lee, S. Lee, I.W. Kang, KMPI: measuring knowledge management performance, Information & Management 42(3), 2005, pp. 469–482.

[29] R. Maier, Knowledge Management Systems: Information and Communication Technologies for Knowledge Management, Springer–Verlag, New York, UK, 2004.

[30] T. McGill, V. Hobbs, User-developed applications and information systems success: a test of DeLone and McLean's model, Information Resources Management Journal 16(1), 2003, pp. 24–45.

[31] R.S. Poston, C. Speier, Effective use of knowledge management systems: a process model of content ratings and credibility indicators, MIS Quarterly 29(2), 2005, pp. 221–244.

[32] A. Rai, S.S. Lang, R.B. Welker, Assessing the validity of IS success models: an empirical test and theoretical analysis, Information Systems Research 13(1), 2002, pp. 50–69.
[33] A. Ragowsky, N. Ahituv, S. Neumann, A model for identifying the value and the importance of an information system application, Information & Management 31(2), 1996, pp. 89–102.
[34] T. Raykov, On the use confirmatory factor analysis in personality research, Personality and Individual Differences 24, 1998, pp. 291–293.
[35] V. Sambamurthy, M. Subramani, Special issue on information technologies and knowledge management, MIS Quarterly 29(1), 2005, pp. 1–7.
[36] P.B. Seddon, M.Y. Kiew, A partial test and development of the DeLone and McLean model of IS success, in: Proceedings of the International Conference on Information Systems, Vancouver, Canada, 1994, pp. 99–110.
[37] P.B. Seddon, A respecification and extension of the DeLone and McLean model of IS success, Information Systems Research 8(3), 1997, pp. 240–253.
[38] W. Skok, C. Kalmanovitch, Evaluating the role and effectiveness of an intranet in facilitating knowledge management: a case study at Surry County Council, Information & Management 42(5), 2005, pp. 731–744.
[39] I. Spiegler, Knowledge management: a new idea or a recycled concept? Communications of the AIS 3(14), 2000, pp. 1–24.
[40] D.S. Staples, I. Wong, P.B. Seddon, Having expectations of information systems benefits that match received benefits: does it really matter? Information & Management 40(2), 2002, pp. 115–131.
[41] J. Stevens, Applied Multivariate Statistics for the Social Sciences, Mahwah, Lawrence Erlbaum Associates, New Jersey, 1996.
[42] T. Stewart, Is this job really necessary? Fortune 137(1), 1998, pp. 154–155.
[43] D. Straub, M. Limayem, E. Karahanna-Evaristo, Measuring system usage: implications for IS theory testing, Management Science 41(8), 1995, pp. 1328–1342.
[44] O. Vassend, A. Skrondal, Validation of the NEO personality inventory and the three-factor model. Can findings from exploratory and confirmatory factor analysis be reconciled? European Journal of Personality 11, 1997, pp. 147–166.
[45] M.M. Wasko, How are knowledge management systems different from information systems, and who cares? in: Proceedings of the America's 5th Conference of Information Systems, Charlotte, North Carolina, 1999.
[46] B.H. Wixom, H.J. Watson, An empirical investigation of the factors affecting data warehousing success, MIS Quarterly 25(1), 2001, pp. 17–41.
[47] K. Zhu, K.L. Kraemer, S. Xu, J. Dedrick, Information technology payoff in e-business environments: an international perspective on value creation of e-business in the financial service industry, Journal of Management Information Systems 21(1), 2004, pp. 17–54.



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