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*Full Length Research Paper*

# The indirect impacts of management support and commitment on knowledge management systems (KMS) adoption: Evidence from Malaysian Technology Industries

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**The study investigates the impacts of management support and commitment on the adoption of knowledge management systems (KMS) in Malaysian technology industries. By analysing data from a survey of 108 managers across the Malaysian technology industries, the study contributes to the KMS adoption literature by empirically establishing the indirect impacts of organisations' management support and commitment through the mediations of other organisational elements. First of all, the results suggest that the effects of management support and commitment are only indirect through the mediation of other variables, namely knowledge classification and knowledge sharing culture. Moreover, knowledge classification has a positive influence on perceived benefits, which is a determinant of KMS adoption. Second, even though management support and commitment has a positive impact on rewards and incentives, and policy and procedures, the findings indicate that these organisational elements did not have any influence on KMS adoption. However, policies and procedures did influence perceived ease of use, which is a determinant of perceived benefits. The theoretical and practical implications of these findings are discussed.**

**Key words:** Knowledge management systems, adoption, management support and commitment, Malaysia.

## INTRODUCTION

Managing organisational knowledge to achieve sustainable competitive advantage has become a critical strategic issue (Grant, 1996a, b; Nonaka, 1994). The challenge for organisations is to generate and leverage collective knowledge, which leads to the need for effective knowledge management (KM) (Tomas et al., 2003; Zhang, 2007). KM is a socio-technical process that can be defined broadly as the process, and/or efforts, of systematically acquiring, organising, distributing, and applying knowledge to achieve the strategic aims of an organisation (Alavi et al., 2001; Marwick, 2001). Knowledge in the organisational context includes both the experiences and understanding of the organisation's personnel as well as the knowledge artefacts such as solutions to problems, design rules, best practices and lessons learned which are available within and also outside of the organisation (Marwick, 2001). The fundamental objectives of KM are to avoid "reinventing the wheel" and to leverage collective organisational knowledge for better informed decision making, problem solving, transfer of best practices between different parts of an organisation, codification of individual employee knowledge to protect against knowledge loss, and acquiring knowledge from different sources for the completion of collaborative projects (Kankanhalli et al., 2004).

Organisations can achieve enormous benefits by

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deploying knowledge management systems (KMS) which offer an exceptional capacity to distribute knowledge between individuals, and across teams and organisations. KMS refer to a class of information systems applied to managing organisational knowledge. These systems are defined as "IT-based systems developed to support and enhance the organisational processes of knowledge creation, storage/retrieval, transfer, and application" (Alavi and Leidner, 2001: 114). KMS infrastructure that encompasses communication infrastructures, groupware, e-mail, intranet, knowledge repositories, workflow software, and decision support systems, allow organisations to deliver products and services that are of better quality, thus helping to achieve an organisation's competitive advantage and profit (Holsapple et al., 2002; Lynn et al., 2000; Sher et al., 2004).

## LITERATURE REVIEW

### Knowledge management in Malaysia

In Malaysia, KM is identified as a key factor in achieving organisational success as research on Malaysian KM has highlighted the importance and benefits of KM to local organisations (Bontis et al., 2000; Gan et al., 2006; Hegde et al., 2007; Helmi, 2002; Rahman, 2004). Of this importance and benefits, perhaps the most critical reason to effectively manage knowledge in Malaysian organisations is the apparent need to develop new areas of growth in knowledge-intensive areas in line with the nation's shift to a knowledge-based economy (Gan et al., 2006; Salleh et al., 2003; Syed-Ikhsan et al., 2004). The transformation of a production-based economy into a knowledge-based economy, globalisation, and the trend for international organisations to be more IT savvy, have brought new threats to Malaysian organisations. Consequently, it has become imperative for Malaysian companies to enhance their KMS adoption in order to reap and sustain competitive advantage from KM, in the era of globalisation and a new economy (Zailani et al., 2006). Further, the literature on Malaysian KM also identifies certain issues that could potentially be resolved by the augmentation of KMS usage in the local organisations. For example, Malaysian organisations have been focusing on a human-oriented KM strategy that may prove to be unsustainable in the long term, if it is not backed up by the use of KMS to codify and preserve tacit knowledge in an explicit form (Tan, 2004). The transformation of a human-oriented KM strategy, to one that focuses on codification and preservation of knowledge, is especially crucial to overcome the challenges of retaining talented employees since their loss leads to knowledge loss, faced by many Malaysian organisations (Salleh et al., 2003). Moreover, Ahmed (2006), in his study of information and communication technologies (ICT) and the role of human capital in achieving a knowledge-based economy in Malaysia, indicates that achieving a knowledge-based economy through the use of IT-based systems, in terms of geometric progression, is faster than achieving it through human capital or skilled labour. For example, an organisation would arguably attain a higher innovative capability when KMS are employed to enable knowledge to be effectively dispersed and leveraged within the organisation (Ahmed, 2006).

In a series of interviews conducted within listed Malaysian organisations, management support and commitment has emerged among the top three most important organisational factors that enhances the extent of IT use to support KM in these organisations (Aman et al., 2010). However, despite the availability of some research on Malaysian KM (Chong et al., 2007; Choy et al., 2006; Gan et al., 2006; Kumar, 2003; Salleh et al., 2003; Syed-Ikhsan and Rowland, 2004; Tat et al., 2007; Wei et al., 2006; Wong et al., 2005; Zoo et al., 2006) in the past few years, none has empirically investigated the adoption of KMS to support KM in Malaysian organisations. Therefore, this study aims to fill this research gap by empirically investigating the impact of management support and commitment on the adoption of KM in Malaysian organisations, specifically in those from the technology industries that are listed on the Kuala Lumpur Stock Exchange company database at the Bursa Malaysia website (Bursa, 2008). The Economic Planning Unit of Malaysia reports that RM25 billion (approximately USD8 billion) worth of turnover was generated across the listed organisations in 2009, which indicates that a significant portion of the Malaysian economy stems from the earnings of these organisations (EPU, 2010). Thus, these organisations play a significant role in the nation's capability of attaining a knowledge-based economy.

In this paper, the term *KMS adoption* is used to describe the implementation stage in which the KMS are already deployed in an organisation as opposed to the development stage where they are being introduced. This paper is organised and presented as follows: First, the literature review discusses the theoretical background and presents the research model and hypotheses of the study. Second, the research method is provided followed by the results of the study. Third, the discussion, implications and limitations of the research findings are discussed. Finally, the conclusion is drawn and recommendations for further study are suggested.

### User acceptance of technology

Among the different research models developed to understand technology usage or acceptance, the most well known is the technology acceptance model (TAM) (Davis, 1989), which has been successful in explaining the usage of information systems (Venkatesh et al., 2000). TAM, shown in Figure 1, was originally conceived by Fred Davis in 1986, based on Fishbein and Ajzen's

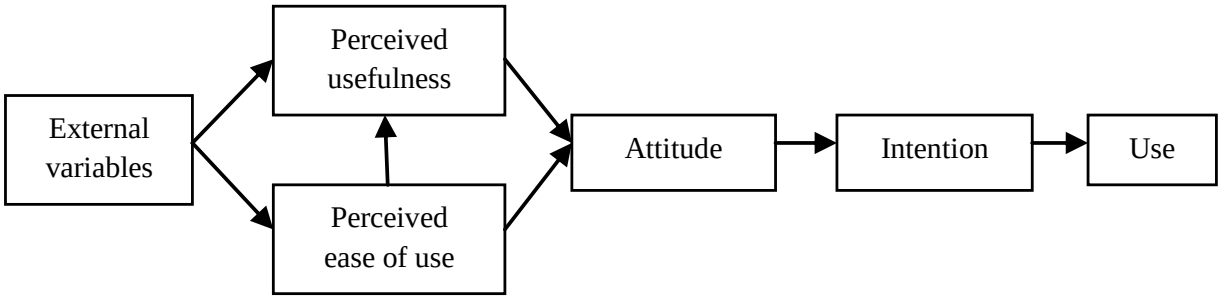


**Figure 1.** Technology acceptance model (TAM) (Davis 1989).

(1975) theory of reasoned action (TRA). The model suggests that the perceived usefulness of IT and its perceived ease of use are major determinants that affect an individual's attitude and intention to use IT. In addition, it is also suggested that perceived ease of use has an impact on perceived usefulness. TAM is chosen as the theoretical basis for this study as the model has been specifically applied to KMS adoption in information systems research (Kuo et al., 2009; Money et al., 2005; Quaddus et al., 2005; Vitari et al., 2007; Wu et al., 2007).

The application of TAM for KMS user acceptance indicates that users, who have been using the systems for an extended period of time, would have already formed their beliefs regarding the usefulness and ease of use of the systems, thereby reducing the effects of intention to use (Money and Turner, 2005). Similarly, research by Straub et al. (1995) suggests that the TAM intention to use construct is critical only in the research stage, where users are associated with the technology only through a brief introduction. Thus, as this study investigates the use of KMS that are already being implemented in an organisation, we propose that the TAM constructs relevant to this study are the perceived usefulness, or benefits of using KMS (PB) and perceived ease of use of KMS (PEOU), which will determine the adoption, or use of KMS in the studied organisations. Perceived usefulness is defined as an individual's subjective assessment according to the degree to which using a particular system would improve his or her job performance; whereas, perceived ease of use is defined as the degree to which a person believes that using a particular technology would be free of effort (Davis, 1989).

A discussion on the impact of management support and commitment on KMS adoption based on a review of the relevant literature is as presented as follows.

## Management support and commitment

Research indicates that management's support for KMS use in an organisation can be seen in the amount of funds that are allocated for the systems' resources, training, and infrastructure to support KM initiatives (Davenport et al., 1999; Jennex et al., 2004; Moffett et al., 2004). Management's commitment to KMS use, on the other hand, can be demonstrated by having managers lead and support the system-use, and not just by promoting the system itself (Damodaran et al., 2000; Purvis et al., 2001). The management support and commitment factor has been found to directly influence the extent of KMS use (Aurum et al., 2007; Butler et al., 2007; Kulkarni et al., 2007; Moffett et al., 2004; Vitari et al., 2007).

In addition to contributing to the extent of KMS use in an organisation, management's support and commitment is also recognised as an important factor in determining the successful promotion of a knowledge sharing culture within an organisation. Benbya and Belbaly (2005), in their exploratory study of the mechanisms for KMS effectiveness, describe how an employee's perception of management's commitment can influence the knowledge sharing culture. Numerous KM practitioners have also attested to this argument by suggesting that management were the ones responsible for driving the required cultural and systems changes to increase KMS usage (Butler et al., 2007; Subramaniam et al., 2009). Further, management support and commitment was also reported as a factor influencing the level of knowledge content quality. It was indicated that the commitment exhibited by senior leadership affects the quality of shared knowledge, by way of spearheading the task of developing an organisational-wide taxonomy of knowledge that can be fed into a KMS (Kulkarni et al., 2007). In other words, management support and commitment determine the organisational strategies of defining and classifying knowledge (Aurum et al., 2007) and thus, could be an important factor that influences the quality of knowledge classification in an organisation. Accordingly, the following hypotheses are proposed:

$H_{1a}$: Management support and commitment have a positive influence on the level of KMS use in Malaysian technology firms

$H_{1b}$: Management support and commitment have a positive influence on the knowledge sharing culture in Malaysian technology firms

$H_{1c}$: Management support and commitment have a

positive influence on the extent of knowledge classification in Malaysian technology firms.

Another aspect of management support and commitment towards KMS adoption is the establishment of rewards and incentives systems that could encourage the use of KMS in an organisation. An example of such rewards and incentives mechanisms could be by means of incorporating KMS utilisations into employees' evaluation process so that a standardised reward system can be achieved (Jennex et al., 2001; Kulkarni et al., 2007).

Finally, management support and commitment could also be demonstrated by the institutionalisation of KMS use to support routine work processes, as well as projects across organisations (Damodaran and Olphert, 2000). In this study, the perspectives from the institutional theory were observed in order to operationalise the concept of institutionalisation of KMS use. The institutional theory suggests that the individual's behaviour within an organisation is influenced by the norms, values, culture, and history that are prevalent in the organisation (Orlikowski, 1992). Further, the theory suggests that the individual's behaviour in an organisation is guided by the institutional structures, such as organisational routines, rules, guidelines, and procedures. The ways in which the institutional structures influence individual behaviour, such as the use of technology in an organisation, are described in the study of Orlikowski (1992). From the perspective of institutional theory, this study proposes that the institutionalisation of KMS use in an organisation can be achieved by establishing organisational policies and procedures for KMS use.

Based on the preceding discussions, the following hypotheses are proposed to investigate the impact of management support and commitment on KMS use:

$H_{1d}$: Management support and commitment have a positive influence on the extent of rewards and incentives for KM in Malaysian technology firms.
$H_{1e}$: Management support and commitment have a positive influence on the extent of policies and procedures for KMS use in Malaysian technology firms.

Next, we further explain the factors identified here, and their impact on KMS use.

## Knowledge sharing culture

A knowledge sharing culture can be described as an organisational culture that is in favour of knowledge sharing (Alavi et al., 1999), and is said to exist in an organisation in which the employees are intellectually curious, willing, enjoy engaging in discussions of knowledge, and find pleasure in helping others in the organisation (Davenport, 1997). The impact of a knowledge sharing culture on the extent of KMS usage in an organisation has been a recurrent theme in recent KMS literature (Aurum et al., 2007; Butler et al., 2007; Vitari et al., 2007). For example, Desouza (2003) in his study on the use of a KM system in a software engineering organisation suggests that the establishment of a knowledge sharing culture can help to overcome engineers' resistance to using and contributing knowledge to the KMS, thereby leading to an increased usage of the system. Consequently, the following hypothesis is proposed:

$H_2$: Knowledge sharing culture has a positive influence on the level of KMS use in Malaysian technology firms.

## Knowledge classification

Research has suggested that the development and establishment of a suitable enterprise-wide taxonomy of knowledge that clearly defines knowledge, and thus avoids ambiguities of what constitutes knowledge within an organisation, could help to produce high quality content of reusable knowledge (Butler et al., 2007; Jennex and Olfman, 2004). Further, the ability of KMS to process knowledge that is relevant to specific business needs and adds value to individuals and teams, is identified as one of the underlying success factors of any KMS implementtation, which determines its continued usage (Damodaran and Olphert, 2000; Halawi et al., 2008; Mohamed et al., 2006). Thus, it is argued that having a knowledge classification system will lead to higher quality of knowledge to be deposited in and managed by KMS, which in turn, enhances the use of the systems. In addition, research has also observed that the users' perception of the benefits of using a KMS is more likely to improve if knowledge that is stored in the system is relevant, of high quality, and helps improve their work efficiency (Halawi et al., 2008; Jennex and Olfman, 2004; Kulkarni et al., 2007). Thus, relevant and high quality knowledge content that is available and accessible throughout an organisation is regarded as an important factor that influences one of the major TAM constructs of perceived benefits of a KMS (Jennex and Olfman, 2004; Kulkarni et al., 2007).

Based on these discussions, the following hypotheses are proposed:

$H_{3a}$: Having a knowledge classification has a positive influence on the level of KMS use in Malaysian technology firms.
$H_{3b}$: Having a knowledge classification has a positive influence on perceived benefits of using KMS in Malaysian technology firms.

## Rewards and incentives

In the context of KMS use, research has emphasised the importance of rewards and incentives as an effective way to motivate knowledge sharing, as well as the use of

KMS to support knowledge sharing (Benbya and Belbaly, 2005; Kankanhalli et al., 2003; Moffett et al., 2004). Recent studies have also provided empirical evidence on the positive effects of rewards and incentives on the intention to use KMS (Lai, 2009; Subramaniam and Soh, 2009). In this paper, the rewards and incentives factor is referred to as 'the extent to which an organisation has a standardised rewards and incentives system in order to encourage KM activities and the use of KMS to support these activities'. To ascertain the effect of rewards and incentives on the extent of KMS use, the following hypothesis is proposed:

$H_4$: Rewards and incentives has a positive influence on the level of KMS use in Malaysian technology firms.

### Policies and procedures

The importance of the institutionalisation of KMS that could lead to greater use of the system has gained support from numerous studies such as those of Huysman and Wit (2004), Jennex and Olfman (2004), Nevo and Chan (2007), and Purvis et al. (2001). From the preceding discussion and the institutional theory, the institutionalisation of IT use for KM in this study is represented by the establishment of 'policies and procedures that formalise, as well as facilitate the use of KMS to support KM activities in an organisation'. To ascertain the effect of this factor on KMS use in this study, the following hypothesis is proposed:

$H_{5a}$: The policies and procedures for KMS use has a positive influence on the level of KMS use in Malaysian technology firms.

In addition, the study also proposes that the establishment of the policies and procedures to facilitate the use of KMS would lead to an enhanced perception of the ease of using a KMS, and thus, leads to a positive impact on the TAM construct of perceived ease of use. Thus, to ascertain this association, the following hypothesis is advanced:

$H_{5b}$: The policies and procedures for KMS use has a positive influence on the perceived ease of using KMS in Malaysian technology firms

### Research model

Based on the hypotheses developed in the preceding discussions, the research model, as shown in Figure 2, was developed for the study. As shown in the figure, the focus of this study, that is, KMS use, is the main dependent construct in the research model. In conceptualising the KMS use variable, we adopt the views of Meso and Smith (2000) and Marwick (2001) who have categorised KMS use based on four critical KM activities: Knowledge use (application); knowledge search (share or transfer); knowledge creation, and knowledge packaging (organisation or storing). Thus in this study, KMS use is conceptualised as the use of KMS to support the four main KM processes of creating, storing, transferring, and applying organisational knowledge. Based on this conceptualisation, the dimension of KMS use in the research model is operationalised by the four sub-dimensions of; KMS use for knowledge creation; KMS use for knowledge storage; KMS use for knowledge transfer, and KMS use for knowledge application.

Based on the theoretical model used in this study, the variables of perceived benefits (usefulness) of KMS and perceived ease of use of KMS (ease of use) are posited to have direct effects on the extent of KMS use (Davis, 1989; Davis et al., 1989). Also, as per TAM, the perceived ease of use of KMS is posited to directly affect their perceived benefits. Therefore, the following hypotheses are proposed in this study:

$H_6$: Perceived benefits of using KMS has a positive influence on the level of KMS use in Malaysian technology firms

$H_{7a}$: Perceived ease of use has a positive influence on the level of KMS use in Malaysian technology firms

$H_{7b}$: Perceived ease of use has a positive influence on perceived benefits of KMS in Malaysian technology firms

## METHODOLOGY

### Operational measures of study variables

A survey methodology for data collection was chosen to empirically test the relationships implied by the research model and hypotheses. Multiple-item measures were identified and developed for the constructs in this study. Multiple-item measures are generally believed to enhance confidence that the constructs of interest are being accurately assessed and that the measurement of the variables will be more consistent (De Vaus, 2002). Initial scale items for most of the variables were adapted from multiple sources. For example, measuring items for the 'KMS use' construct were adapted from the studies of Gold (2001), Wang et al. (2007), and Lin (2007). Additionally, the measuring items for 'knowledge sharing cultures', 'rewards and incentives', 'perceived benefits', and 'perceived ease of use' constructs were adapted from studies of KM as an organisational capability (Gold et al., 2001), technological utilisation for KM (Moffett et al., 2004), and KMS acceptance (Money and Turner, 2005; Vitari et al., 2007). Finally, based on the review of relevant literature, all the underlying issues and essential details were carefully shaped into multiple-item measures for management's support and commitment, knowledge classification, and policies and procedures constructs (Aman and Aitken, 2010; Butler et al., 2007; Damodaran and Olphert, 2000; Davenport et al., 1998; Vitari et al., 2007). All measuring items were operationalised with a five-point Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree". Prior to administering the developed questionnaire to the target audience, all measuring items were first reviewed by two information systems (IS) academics, two statisticians, and six IT executives from six different Malaysian companies. Based on the

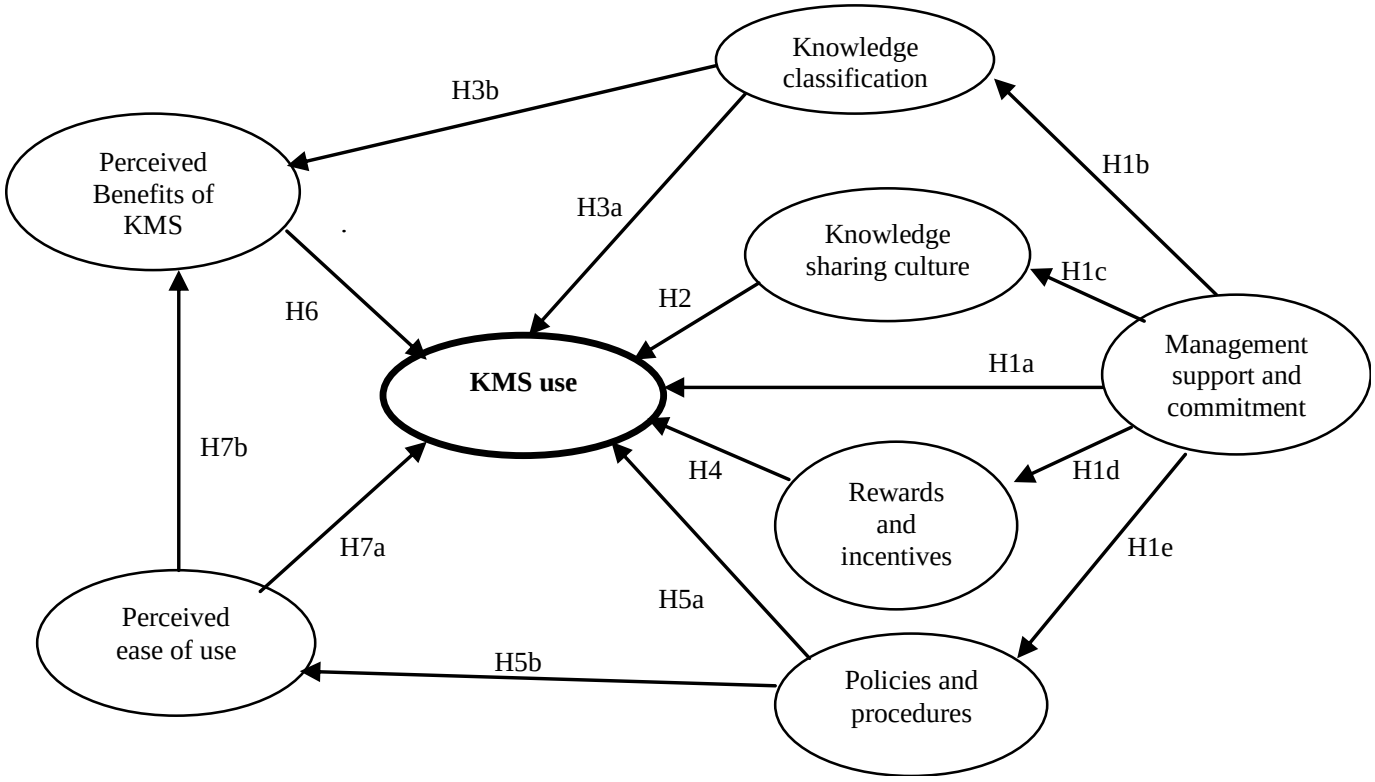


**Figure 2.** The proposed research model.

feedback obtained, some questions were rephrased and some were eliminated from the questionnaire.

**Participants and survey administration**

The questionnaire was administered via a web-based online survey to the target respondents who held at least a managerial position in an IT department in Malaysian technology firms. These managers were considered as the most appropriate 'informants' for this study as they were assumed to have the familiarity, experience, and good knowledge of KMS use in their firms. In cases where there was no IT manager in a particular firm, a KM or general administration manager was then chosen as the respondent for the survey. To ensure that the email invitation reached its intended participant, the invitations were sent to the specific email addresses of the IT or KM managers, rather than to the firms' general email addresses. Hence, a list of IT or KM managers email addresses from Malaysian technology firms (listed on Bursa Malaysia database as at March 2008) were compiled using information obtained from the firms' official websites, as well as recruited through telephone requests. Care was taken to ensure that there was no double counting, namely the same firm would not be included more than once in the sample.

The survey invitation emails were sent in August 2009 to 587 IT or KM managers. In order to entice participation, the potential respondents were offered an incentive in the form of the study's final report. Two weeks after the invitation, reminder emails were sent out. Three weeks after the reminder emails, we sent out another reminder emails to the organisations that had not yet participated in the survey. A total of 109 organisations responded to the survey, yielding a response rate of 18%. 108 had complete data usable for analysis (1 response contained invalid data).

**Data analysis**

Data collected from the survey were statistically analysed to understand and interpret the results obtained for this study. The structural equation modelling (SEM) approach was used for the quantitative data analysis and graphical presentation of the results. There are two parts in SEM data analysis approach, namely the measurement and structural model analyses. The measurement model was evaluated for individual item reliability, internal consistency, and discriminant validity. The structural model was analysed to obtain the standardised path loadings between constructs, the significance of path loadings, the $R^2$ values of the dependent constructs and the results of hypotheses testing.

## RESULTS

The responses were checked for non-response bias, which refers to the bias that occurs when respondents who failed to respond to a survey are different from those who responded in terms of demographics or attitudinal characteristics (Dillman, 2000). The Mann-Whitney test was conducted to compare the mean values of organisation size and type of industry between the first 35 respondents from the first email list and the last 35 respondents from the last email list. The results indicate that there are no statistical differences between the respondents from the two groups. This test suggests that the respondents in the survey can be considered representative of the population as a whole.

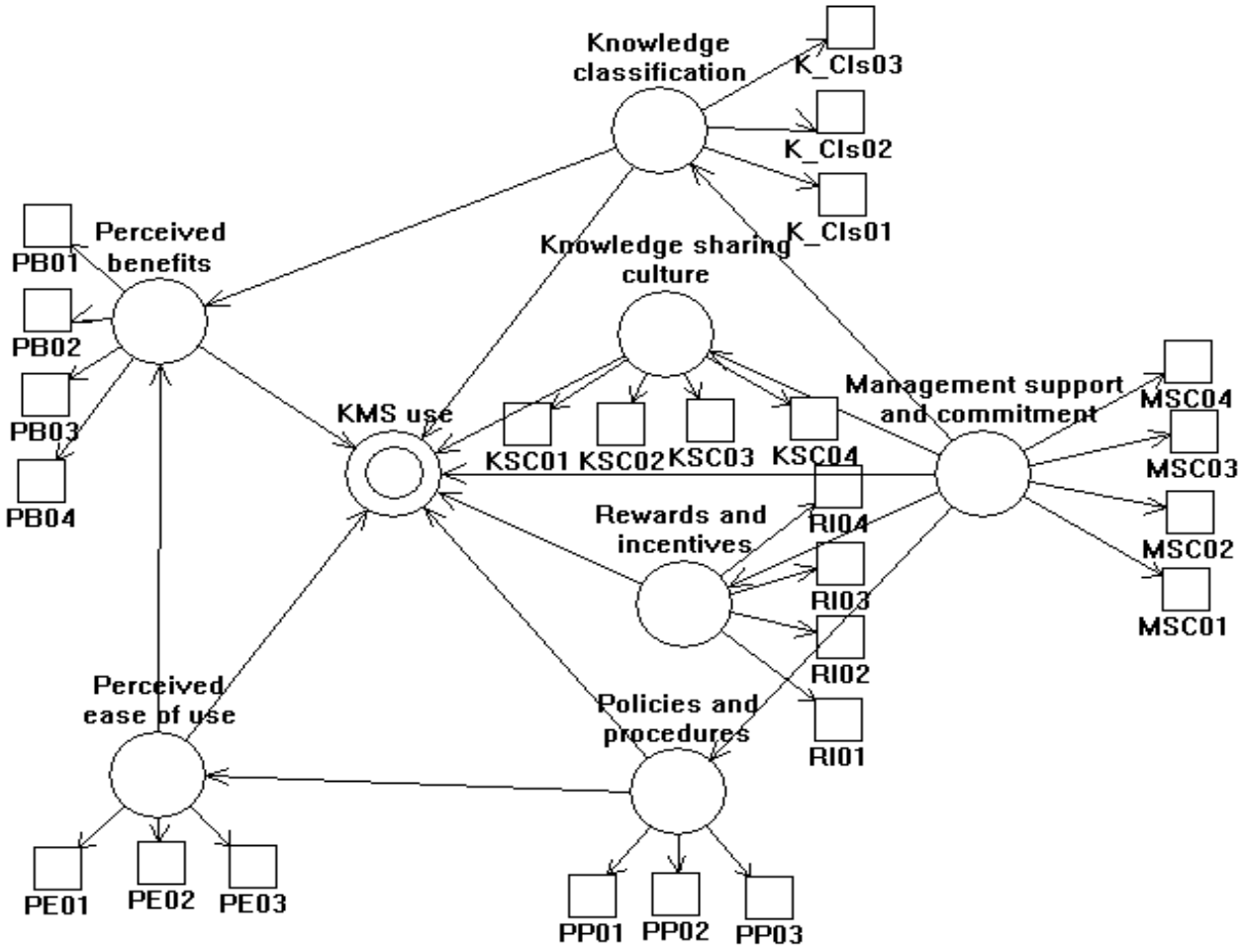


**Figure 3.** Measurement model diagram.

## The measurement model assessment

The measurement model, shown in Figure 3, was evaluated for the reliability and discriminant validity of the measuring items.

## Reliability analysis

Table 1 lists the results of the reliability analysis of the constructs, which shows that the internal consistency reliability (ICR) values for all constructs are well above the cut-off value of 0.7 (Hulland, 1999). Similarly, all constructs listed in the table demonstrate acceptable performances above the minimum value of average variance extracted (AVE), which is greater than 0.5 (Chin, 1998a; Fornell et al., 1981). Additionally, the computed Cronbach's alpha also indicated values of above the minimum requirement of 0.7 for all constructs. Thus, the reliability of all latent constructs in this study was verified and satisfied.

## Validity analysis

Discriminant validity was also demonstrated by the output of the bootstrap method of PLS-Graph software (Chin, 1998b). All indicators were found to load highest on their respective constructs in the cross-loading examination, and the square root of AVE for all constructs were found to be higher than any constructs' correlations, which satisfy the criteria of discriminant validity as suggested by Gefen and Straub (2005).

## The evaluation of the structural model

The analysis of the structural model involved a two-stage approach because the 'KMS use' construct was modelled as a second order factor in the structural model. Since PLS-Graph (Version 3.0) did not directly permit the representation of first and second order latent variables in the same model, it was necessary to assess the first order constructs associated with their second order

**Table 1.** Reliability analysis.

| Construct | ICR | AVE | Cronbach alpha |
|---|---|---|---|
| KMS for knowledge creation | 0.829 | 0.623 | 0.71 |
| KMS for knowledge storage | 0.913 | 0.723 | 0.88 |
| KMS for knowledge transfer | 0.913 | 0.723 | 0.82 |
| KMS for knowledge application | 0.903 | 0.700 | 0.85 |
| | | | |
| Perceived benefits | 0.921 | 0.745 | 0.86 |
| Perceived ease of use | 0.783 | 0.552 | 0.73 |
| Management support and commitment | 0.958 | 0.850 | 0.94 |
| Knowledge classification | 0.878 | 0.706 | 0.90 |
| Knowledge sharing culture | 0.884 | 0.656 | 0.84 |
| Rewards and incentives | 0.932 | 0.775 | 0.92 |
| Policies and procedures | 0.930 | 0.817 | 0.93 |

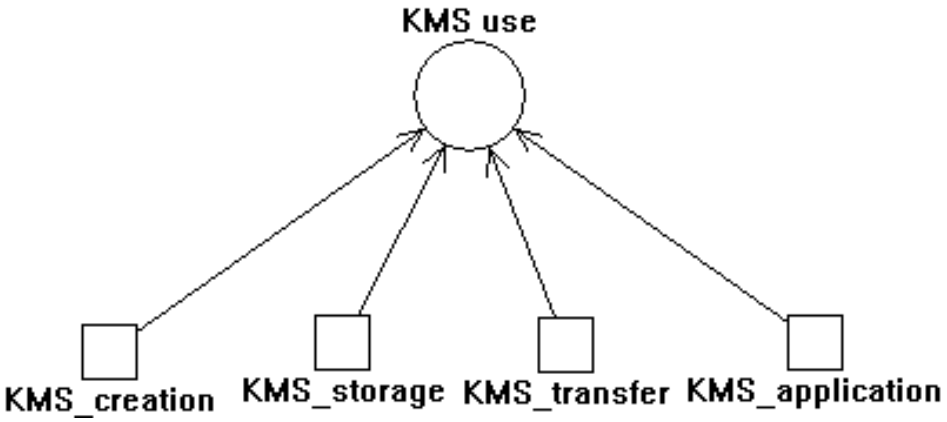


**Figure 4.** Sub-structural model for KMS use.

construct in a sub-model. The sub-structural model for 'KMS use' is shown in Figure 4.

In Figure 4, 'KMS use' is set as the second order factor with its associated first order factors of 'KMS use for knowledge creation', 'KMS use for knowledge storage', 'KMS use for knowledge transfer', and 'KMS use for knowledge application'. The relationship between the second order factor and the first order factors is designed as a formative or molar approach because the construct is made up of the dimensions of its first order factors that are not necessarily correlated (Chin et al., 1995).

A different approach was used to assess the measurement properties of the second order formative construct. The assessment does not include the estimation of ICRs, since formative indicators are not necessarily internally consistent (Chin, 1998b; Roberts et al., 2009). In addition, the AVEs were not evaluated, as the manifest indicators for formative constructs do not need to demonstrate convergent validity (Roberts and Thatcher, 2009). Instead, the weights of the indicators were examined to provide evidence of construct validity of the formative constructs (Petter et al., 2007), as listed in Table 2.

An indicator is said to explain a significant portion of the variance in the formative construct when the indicator's weight is significant (Roberts and Thatcher, 2009). As can be seen in Table 4, three indicators (KMS_KC, KMS_KT, and KMS_KA) were significant, and one indicator (KMS_KS) was not significant. Nevertheless, in the case of formative constructs, conceptual reasoning holds more influence than statistical results when deciding whether or not to drop formative indicators (Petter et al., 2007; Roberts and Thatcher, 2009). Because the insignificant indicators contribute conceptually to their intended construct, they are retained in the study's data analysis.

Next, the structural relationships were examined in a separate model. The computed first order factors' scores obtained from the PLS-Graph output run were used as manifest indicators for the second order factor of 'IT use for KM' construct (Agarwal et al., 2000; Yi et al., 2003). The bootstrap output produced the results of the

**Table 2.** Weights and t-statistic values for 'KMS use' formative indicators.

| Construct/indicator | Weight | T-statistic |
|---|---|---|
| KMS use | | |
| KMS_KC | 0.4079 | 3.13** |
| KMS_KS | 0.0233 | 0.11 |
| KMS_KT | 0.4321 | 3.44** |
| KMS_KA | 0.3513 | 2.79** |

** $p < 0.01$.

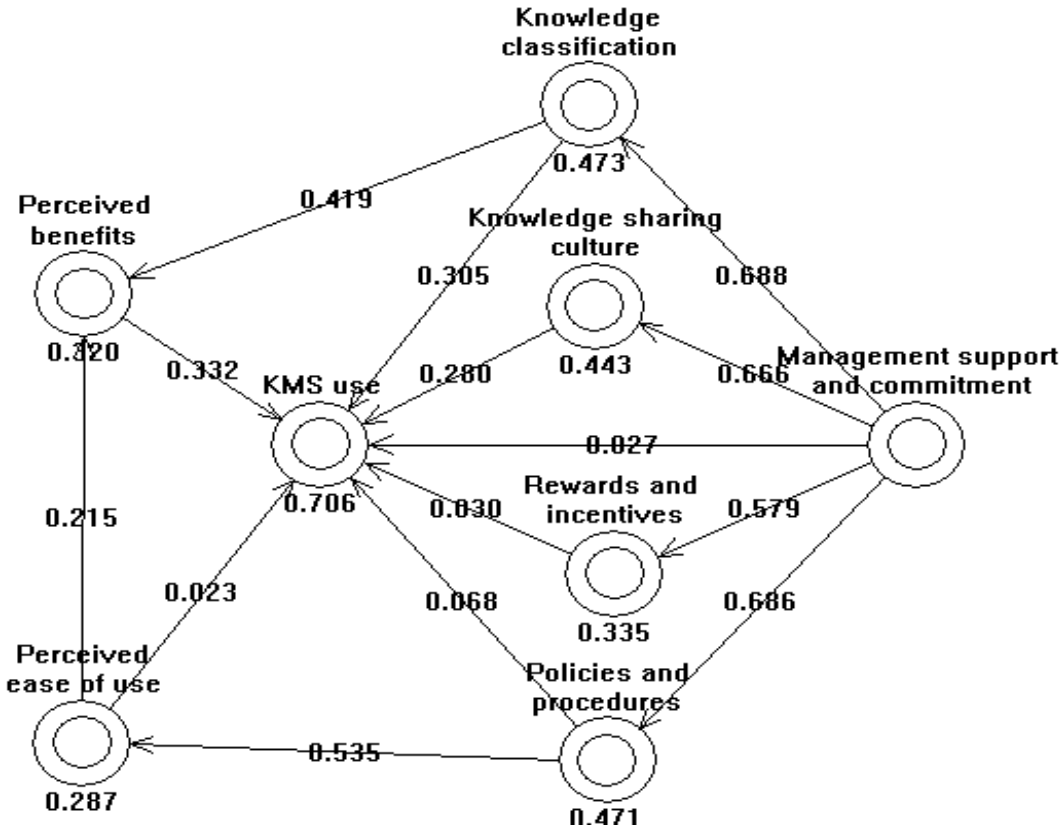


**Figure 5.** Structural model results.

structural model assessment as shown in Figure 5.

The structural model was evaluated to determine the predictive ability of the model and to produce a path coefficients assessment to test the hypotheses proposed. Table 3 shows the $R^2$ values for dependent constructs (KMS use, perceived benefits, perceived ease of use, knowledge sharing culture, knowledge classification, rewards and incentives, and policies and procedures), path coefficients, observed t-statistics, and significance level of the path coefficients extracted from the bootstrap output.

Based on the statistical outcome in Table 3, the results of the hypotheses testing in the structural model are summarised as in Table 4.

**The assessment of indirect effects**

In addition to the direct effects, or relationships reported in Table 5, relationships may also be indirect, meaning that the relationship between two variables in a model is mediated by one or more intervening variables. Path coefficient analysis was used to calculate the indirect effects of management support and commitment on KMS use. The indirect effects can be calculated by multiplying each path coefficient along an indirect route from an independent to the dependent construct (Chin, 1998a). Further, Chin (1998a) suggests that only the significant path coefficients need to be considered in the calculation. The significance of each indirect effect in the structural

**Table 4.** Summary of hypotheses testing.

| Research hypothesis | T-statistic | Significance level | Result |
|---|---|---|---|
| $H_{1a}$: Management support and commitment has a positive influence on the level of KMS use | 0.25 | Not significant | Not supported |
| $H_{1b}$: Management support and commitment have a positive influence on knowledge sharing culture | 12.90 | 0.01 | Supported |
| $H_{1c}$: Management support and commitment has a positive influence on knowledge classification | 12.98 | 0.01 | Supported |
| $H_{1d}$: Management support and commitment have a positive influence on the level of rewards and incentives | 10.37 | 0.01 | Supported |
| $H_{1e}$: Management support and commitment has a positive influence on the level of policies and procedures | 9.09 | 0.01 | Supported |
| $H_2$: Knowledge sharing culture has a positive influence on the level of KMS use | 2.41 | 0.01 | Supported |
| $H_{3a}$: Having a knowledge classification has a positive influence on the level of KMS use | 2.22 | 0.01 | Supported |
| $H_{3b}$: Having a knowledge classification has a positive influence on perceived benefits of KMS | 3.48 | 0.01 | Supported |
| $H_4$: Rewards and incentives has a positive influence on the level of KMS use | 0.39 | Not significant | Not supported |
| $H_{5a}$: Policies and procedures for KMS use has a positive influence on the level of KMS use | 0.58 | Not significant | Not supported |
| $H_{5b}$: Policies and procedures for KMS use has a positive influence on perceived ease of use | 8.12 | 0.01 | Supported |
| $H_6$: Perceived benefits of using KMS has a positive influence on the level of KMS use | 3.38 | 0.01 | Supported |
| $H_{7a}$: Perceived ease of use of KMS has a positive influence on the level of KMS use | 0.16 | Not significant | Not supported |
| $H_{7b}$: Perceived ease of use of KMS has a positive influence on perceived benefits of KMS | 2.01 | 0.05 | Supported |

**Table 5.** Indirect effect analysis.

| | Indirect effect | |
|---|---|---|
| | Dependent variable | |
| **Independent variable** | **KMS use (through knowledge sharing culture)** | **KM use (through knowledge classification)** |
| Management support and commitment | 0.186* | 0.21* |

model of this study was tested by using Sobel's test (Sobel, 1982) in which the Z value was calculated as:

$$z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2)$$

In the equation, $a$ and $b$ are the path coefficient values from variable $a$ to the mediating variable, and from the mediating variable to variable $b$, whereas $s_a$ and $s_b$ are the standard error values for the path coefficients. These values were obtained from the PLS-Graph bootstrap output. The null hypothesis is saying that the indirect effect is zero is rejected when the Z value is greater than 1.96. The indirect effects between independent variables and the dependent variables in the structural model were calculated, based on the path coefficient values, and are presented in Table 5.

## DISCUSSION AND IMPLICATIONS

### The application of TAM in the study

The current study's model was found to exhibit a higher explanatory power of 66%; whereas prior studies which have adopted the traditional TAM to explain the use or intention to use a KMS, such as Money and Turner (2005) and Venkatesh et al. (2003) have produced models with an explanatory power of 51 and 37%, respectively. Several comparisons were also made with prior studies, which have extended the original TAM to include other constructs explaining KMS acceptance, such as Vitari et al. (2007), Kuo and Lee (2009), and Wu and Li (2007). The explanatory powers of these studies, however, were also found to be lower than the current study's final model. Thus, the

application of TAM in this study appears to produce an overall favourable predictive capability, compared to prior studies that have adapted and/or extended TAM to explain the adoption and use of various types of KMS. The high explanatory power of this study's model could be due to the extension of TAM augmenting the constructs of organisational elements that were not considered in the other studies. .

The result of the study extends the support of the TAM construct, perceived benefits of KMS, in the context of KMS adoption in Malaysian technology firms. As hypothesised, perceived benefits were found to significantly affect the level of KMS use ($H_6$) and thus, corroborate the results of prior studies that have shown the positive impacts of perceived benefits, or usefulness, on the attitude and intention to use a KMS (Clay et al., 2005; He et al., 2009; Jennex, 2006; Kuo and Lee, 2009; Money and Turner, 2005; Vitari et al., 2007; Wu and Li, 2007). This finding thus confirmed that the linkage between expectations of benefits and KMS use is attractive to employees in Malaysian technology firms and thus is important to motivate their use of KMS.

The other TAM construct of perceived ease of use did not exhibit any significant relationship with the extent of KMS use in this study ($H_{7a}$). Prior studies have also reported mixed support for this construct. While some studies have found positive effects of perceived ease of use with the extent of KMS use (Kuo and Lee, 2009), there are also studies that have reported non-significant (Dasgupta et al., 2002; Keil et al., 1995; Lee et al., 2005; Lu et al., 2001) or relatively low effects of the construct (Money and Turner, 2005; Vitari et al., 2007). Some possible explanations for the lack of support of this construct include the fact that the mere existence of KMS that are designed to provide users with access to reusable knowledge is perceived as an adequate motivation for their use (Kulkarni et al., 2007). Users will accept the limitation of ease of use as long as they perceive the system is useful in their job (Davis et al., 1989). On the other hand, users will not tolerate and use a system that is not useful regardless of how easy it is to use (Money and Turner, 2005). Thus, in the Malaysian technology firms, IT is used to manage knowledge, regardless of the perception of its ease of use.

The results of the study also indicate a positive signifycant relationship between perceived ease of use and perceived benefits of KMS ($H_{7b}$). This finding is consistent with prior studies adopting TAM to explain KMS use (Kuo and Lee, 2009; Money and Turner, 2005). This outcome validates the contention that a KMS with high ease of use promotes an increased sense of its usefulness.

## The impacts of management support and commitment

The results of the study indicate that there is insufficient evidence to support the direct influence of management support and commitment on the extent of KMS use ($H_{1a}$) in the firms surveyed. This is contrary to the findings of previous studies (Al-Busaidi et al., 2005; Kulkarni et al., 2007), which have provided empirical evidence of management support, demonstrated by the belief in the importance of KMS and commitment of senior management, as having a direct positive influence on KMS use. However, Damodaran and Olphert (2000) had also observed the lack of effect between management commitment and belief in the strategic importance of KMS on users' uptake of the system in their study. They attributed this lack of association to the considerable shortfall between management's communication of the benefits of KMS and its actual delivery (Damodaran and Olphert, 2000).

Nevertheless, the assessment of the study's structural model indicates that management support and commitment exhibited significant indirect effects on the extent KMS use, through its intermediate effect on knowledge sharing culture ($H_{1b}$) and knowledge classification ($H_{1c}$). Both knowledge sharing culture and knowledge classification were found to have direct significant effects on KMS use ($H_2$ and $H_{3a}$). This confirmed that the level of knowledge sharing culture enhances the willingness of individuals in the surveyed firms to use KMS for the purpose of creating, storing, sharing and applying knowledge, and is consistent with what has been stated by prior KMS studies (Al-Busaidi and Olfman, 2005; Aurum et al., 2007; Benbya and Belbaly, 2005; Butler et al., 2007; Damodaran and Olphert, 2000; Davenport et al., 1999; Desouza, 2003). The results also validate the belief that, with a knowledge classification in place, KMS can then be designed to provide the accessibility and usability of the right knowledge to the needful recipients within an organisation, which in turn will add value to the systems and encourage its use (Aurum et al., 2007; Hendriks, 2001). Moreover, knowledge classification exhibited an expected positive influence on perceived benefits ($H_{3b}$). This is consistent with the findings of prior studies, which suggest that the quality of knowledge contained in a KMS is a key driver of positive perceptions of its usefulness (Clay et al., 2005; Hong et al., 2002; Lai et al., 2008).

Further, although the structural model results indicate that management support and commitment has positive effects on rewards and incentives ($H_{1d}$), and policies and procedures ($H_{1e}$), these factors did not exhibit any significant effects on KMS use ($H_4$ and $H_{5a}$). Similarly, although policies and procedures did demonstrate a significant positive effect on perceived ease of use ($H_{5b}$), a significant association between perceived ease of use and KMS use was not detected in this study ($H_{7b}$). Thus, the findings of the study confirmed the importance of management commitment to promote a strong knowledge sharing culture for a successful implementation of KMS (Benbya and Belbaly, 2005; Jennex et al., 2006), and, instead of a direct impact on the extent KMS use, management support and commitment would exhibit an

indirect impact through its effects on the quality of knowledge content that can be adapted as required by an organisational context (Kulkarni et al., 2007; Purvis et al., 2001).

## Implications for theory

First and foremost, the current study contributes to the body of knowledge of KMS adoption by assessing the applicability of TAM in the context of Malaysian technology sector. The extension of TAM in this study entails that, when TAM is applied to the context KMS adoption, perceived benefits, or usefulness, construct remains a determinant of KMS use although its influence is not as strong as in the general IS context (Vitari et al., 2007). In contrast, in line with prior applications of TAM in explaining KMS adoption, this study has also established a non-significant effect of the perceived ease of use construct on the level of KMS use. However, perceived ease of use remained as a significant determinant of perceived benefits.

Secondly, the extension of TAM by the augmentation of a number of organisational factors in this study also indicates that special considerations are needed for TAM applications in the KMS adoption domain. In essence, this study has empirically demonstrated that a KMS adoption model should include other organisational factor dimensions, namely the appropriate knowledge sharing culture and knowledge classification system, in order to improve the predictive power of TAM in explaining the extent of KMS use within the surveyed firms.

Thirdly, the demonstration of the application of TAM within a Malaysian context raised a legitimate question of whether the findings could be generalised to other countries. In other words, in what ways are the Malaysian technology firms different from other technology firms so that the results could not be applied in other countries? This question suggests that a number of characteristics that are unique to a country, such as its culture, infrastructure, level of education, and the developing nature of its economy may need to be considered when applying the study's research model in the context of other countries. Thus, arguably, the model of this study can conceivably be applied to countries having a similar background to Malaysia. Apparently, this requires the testing of the model in similar contexts in countries to ascertain how the results would differ or be comparable. Nevertheless, the study within the Malaysian context provides a useful extension of research on KMS adoption that can be a basis for future studies in other countries.

## Implications for practice

The main implication for practice is that the influence of management support and commitment occurs through specific mediation actions rather than directly through the use of KMS itself (Purvis et al., 2001). The absence of a direct influence, however, does not suggest that the management in these organisations should ignore this organisational element. Considering the indirect effects of management support and commitment on the extent of KMS use, the implication for management is that, instead of focusing solely on the use of KMS, management should focus on efforts to establish a knowledge classification system and to cultivate a knowledge sharing culture in their organisations. It is essential that management take up initiatives to determine the most important and relevant knowledge that needs to be preserved, shared, and reused in order to establish their firms' competitive advantages. This should be followed by the design of a taxonomy or classification system of knowledge that is comprehensible to users, as well as including enough details to be useful (Marwick, 2001). The goal of creating knowledge taxonomies is to make it easier for users to deposit and search for knowledge. For example, organisational knowledge can be classified according to the various business functions within an organisation. Another way to classify knowledge is by aligning the layout of a KMS to the organisational structure, so that the knowledge taxonomy could readily map the core functions in the organisational structure (Butler et al., 2007). In the case of project management, knowledge categories can be further broken down to the different time phases and processes within a project, such as knowledge about sales forecast, project planning, and project delivery.

Establishing a knowledge classification could be the most important strategy for management as it is also the determinant of perceived benefits of KMS, which consequently leads to the enhancement of the extent of KMS use. Compared with perceived ease of use, the perceived benefits is clearly a more important influence on the use of KMS in these firms. Thus, management could consider launching campaigns to demonstrate the features of KMS and their benefits in supporting KM. Once users perceive that the advantages outweigh the disadvantages, they will be more inclined to use the system

Next, management should also determine whether an appropriate knowledge sharing culture already exists in their firms. In the absence of such, managers must give close attention to developing the proper knowledge sharing culture in parallel with the introduction of a KMS. In other words, what needs to be addressed by the management is the question of how to stimulate a need to share knowledge among employees. It is only when this need exists that available technologies are likely to be used for knowledge sharing purposes (Huysman and Wit, 2004). For example, the need to share knowledge could be achieved by promoting a strong teamwork within employees' workgroups. The management could then encourage the use of KMS to facilitate the social network within and among the workgroups.

## Limitations

The limitations of the study include its utilisation of a single respondent for each firm, and its reliance upon self-reported usage. Therefore, the potential concern is that there might be respondent biases in the responses and views expressed in the survey. However, the individuals responding to the survey were IT and KM managers, and accordingly, they are expected to have specific organisational responsibility in their answers to the questions. Thus, the organisational role of the respondents reduces the severity of concerns about the biases in respondents' views (Purvis et al., 2001). In addition, since this research has been limited to the Malaysian technology firms, the KMS adoption model developed may not apply to other countries. Moreover, it cannot be assumed that the explanation of the results necessarily applies to other developing countries. Even though there are similarities between some cultural values of the Malaysian culture and those of other developing Asian countries, one must not confidently assume that the results will be applicable to all developing countries. Thus, it may be inappropriate for the model to be used in its entirety for the purpose of examining the extent of KMS use without taking the country's background into consideration.

## CONCLUSION AND FUTURE RESEARCH

This study has extended the TAM, while retaining its parsimony and technology use focus, to investigate the impact of management support and commitment on KMS adoption in a technology sector, and is possibly the first to demonstrate the application of TAM for KMS use within a Malaysian context. The study has provided empirical evidence for the indirect effects of management support and commitment on KMS adoption through the mediation of other organisational initiatives, namely the establishment of knowledge classification systems and cultivation of knowledge sharing culture. Further, evidence was also provided on the ineffectiveness of rewards and incentives and policies and procedures in influencing the extent to which KMS is used. Thus, the outcomes of the study evidently have important theoretical as well as practical implications for the management of these firms to formulate a better KM strategy that could enhance the adoption of KMS to support their KM initiatives.

The study has also singled out several avenues for future research. The lack of significant associations between perceived ease of use and the extent of KMS use indicates that this relationship is worthy of further investigation. One possible influencing factor in relation to perceived ease of use is the fit between user tasks and the tools provided to accomplish the tasks. Thus, future research could examine how the task and tool fit influences perceived ease of use, and consequently enhances the extent of KMS use. Additionally, future study could also look into the role of KM processes; creating, storing, transferring, and applying knowledge, in enhancing KMS adoption and how management support and commit to this adoption could influence the establishment of these processes in an organisation.

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