FACTORS INFLUENCING PERCEIVED BENEFITS AND USER SATISFACTION IN KNOWLEDGE MANAGEMENT SYSTEMS

by

Y. Karlinsky*
M. Zviran**

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* Faculty of Management, The Leon Recanati Graduate School of Business Administration, Tel Aviv University, University Campus, Tel Aviv 69978, Israel.

** Faculty of Management, The Leon Recanati Graduate School of Business Administration, Tel Aviv University, University Campus, Tel Aviv 69978, Israel. E-mail: zviran@tau.ac.il

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Abstract

With the ever-growing deluge of information, knowledge management systems (KMS) have become a key technology, enabling the extraction and filtering of valuable information by integrating seemingly unconnected or hidden pieces of information to create invaluable business insights. KMS may use sophisticated technical methods such as text analysis, search and querying, or facilitate state of the art Web 2.0 tools for sharing knowledge and collaborating.

Research on the factors influencing user behavior and attitudes must regard modern KMS differently from IS. The reason for this is the great importance of the human factor in organizational knowledge management (KM): the user is not only a consumer of the system's output, as in information systems (IS), but also in many cases a producer of knowledge and an active participant in the system's functioning; global firms today are dependent mostly on e-communication; and KM is playing an ever-more important role in facilitating organizational competitiveness.

Based on existing research in the area of effectiveness of IS and KMS, with modifications designed to include the special characteristics of KMS, this study offers a model for predicting user's perceived benefits and user satisfaction, accepted factors of system success, in organizational KMS. Four constructs are theorized to influence the dependent variables: system quality, knowledge quality, user IS competence and organizational attitude to KM. In addition, a new measure for KMS quality is proposed.

The model was empirically tested among 100 respondents working in the knowledge-intensive software industry. The survey method was used to collect data on the personal and organizational dimensions of KMS in the organization from the user's perspective. The results show that knowledge management systems, though being special types of information systems, hold certain characteristics that should be taken into consideration when evaluating technical and socio-psychological factors of users' perceptions and attitudes towards the systems. Specifically, unique knowledge characteristics and the level of knowledge management in the organization are important components of the KMS model. Implications and future research directions are discussed in light of the results and the relevant literature.

Keywords: knowledge management, knowledge management systems, information systems, perceived benefits, user satisfaction, knowledge quality, information quality

1. Introduction

The business world today is highly computerized and technology oriented. Information systems serve as important enablers of business processes in organizations. Still, there is no obvious positive relation between IT investments and business performance: on the one hand, top-performing companies in terms of revenue, return on assets, and cash-flow growth spend less on IT on average than other companies; on the other hand, the highest IT spenders typically under-perform by up to 50 percent compared with their best-in-class peers (Malhotra 2005). It is now clear that investing in cutting-edge technologies is not enough to gain increased business performance. Moreover, socio-psychological factors such as users' motivation and commitment play an important role in determining IT performance

(Strassmann 1997, Malhotra and Galleta 2003). The IS literature long ago recognized users' perceptions and attitudes as factors of system effectiveness (DeLone and McLean 1992). In particular, a comprehensive work by DeLone and McLean (2003) identified three quality dimensions affecting use behavior and user satisfaction in IS: system quality, information quality and service quality. This research focuses on knowledge management systems, special types of information systems that support and enhance knowledge processes, and examines user satisfaction and perceived benefits from using these systems.

Knowledge management is the practice of selectively applying knowledge from previous experiences of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness. It is a multi-faceted discipline that aims at managing the knowledge assets of the organization, holistically combining behavioral and organizational theories, information systems and computer science models. KMS are defined as the systems that are created to facilitate the capture, storage, retrieval and reuse of knowledge (Jennex 2005b). Importantly and in sum, it is a practice that creates a synergy of the information processing capabilities afforded by information technology with the innovative and creative capabilities of human and social elements in the organization (Malhotra, 2000).

A study by the Economist Intelligence Unit (Ernest-Jones, 2005) found that knowledge management tools are the most important technology for achieving strategic goals, improving decision making processes and competing for customers. The wealth of available information today is unmanageable – information technology enables the storage and access to practically endless amounts of data, which is, in many cases, inaccurate or irrelevant to the person consuming it. While IS provide

tools for the operation and management of the organization, KMS often add to them by integrating seemingly unconnected or hidden pieces of information to create invaluable insights for employees and managers. They do so by using sophisticated technical methods such as text analysis, search and querying, or by facilitating state of the art Web 2.0 tools for sharing knowledge and collaborating.

A model of factors influencing perceived user benefits from and user satisfaction with KMS is presented in this work. The model originates in the D&M IS model, elaborating it with conceptions of knowledge and knowledge management, as well as concepts drawn from technology acceptance models. On the structural level, considering the differences between IS and KMS, the proposed model incorporates elements that exist purely in KMS. On the measurement level, a new multi-item measurement scale is proposed for the KM system quality factor. The model was validated through surveying employees working in the knowledge-intensive software industry. Results of the study and implications are discussed.

2. Literature review

2.1 User's perceptions and attitudes in information systems models

Estimating the benefits gained from harnessing an information system to improve business processes is critical to an organization wishing to assess the value of its investment in the technology. Perceived usefulness and user satisfaction are commonly accepted as strong predictors of IS effectiveness (e.g. Seddon 1997, DeLone and McLean 2003).

Perceived usefulness, also referred to as performance expectations, is defined as "the degree to which a person believes that using a particular system would enhance his or

her job performance" (Davis 1989), meaning this is a subjective assessment of the benefits the system produces for the user. Perceived usefulness is a strong predictor of intention to use the system and consequently use behavior (Venkatesh et al. 2003). This is important, since system use or intention to use often appear as predictors of IS success. Usage, however, is a complex variable: its measurements vary (e.g. frequency of use, time of use, number of accesses) and do not properly capture the relationship between usage and the realization of expected results (DeLone and McLean 2003). System use is often interpreted as benefits from use, and especially in cases of mandatory usage, perceived benefits is considered a better measure (Seddon 1997). To sum up, use or intention to use is a predictor of IS success, but due to measuring and defining difficulties, perceived benefits serves as a proxy for it.

User satisfaction is a subjective evaluation of the various outcomes of IS use evaluated on a pleasant-unpleasant continuum (Seddon 1997). It may include factors related to system characteristics, information characteristics or the service and support given to users (DeLone and McLean 1992, Saarinen 1996).

DeLone and McLean (2003) closely interrelate intention to use/use and user satisfaction: in a process sense, use must precede satisfaction and in the causal sense, positive use experience will yield higher satisfaction; hence the relation intention to use/use → user satisfaction. Increased satisfaction will lead to increased intention to use and thus use; hence the relation user satisfaction → intention to use/use. The updated DeLone and McLean IS success model (2003) is shown in Figure 1. The model argues that three quality factors influence attitudes and perception of IS users. In the remainder of this section, variables affecting perceived usefulness and user satisfaction will be explained.

Information quality refers to the dimensions of the information that resides in the system or is produced by it, e.g. accuracy, timeliness, completeness, relevance, and consistency (DeLone and McLean 2003).

Insert Figure 1 about here

System Quality is a measure of technical success. Its dimensions range from straightforward engineering-oriented characteristics (e.g. response times), to more holistic characteristics (e.g. ease-of-use or functionality) (DeLone and McLean 2003).

Service Quality in the updated D&M model is a measure of the reliability, responsiveness and supportiveness of the IS team, being both an information provider (producing an information product) and a service provider (providing support for end-users). The dual role of the IS team argues for a quality measure for the aspects of service. The influence of the facilitation and support on intention to use is controversial: some researchers find it significant (e.g. Ajzen 1991) whereas others find it non-significant (e.g. Venkatesh et al. 2003).

Self-efficacy is the belief that one has the capability to perform a particular behavior; computer self-efficacy is an individual's perception of his or her ability to use a computer in the accomplishment of a job task (Compeau and Higgins 1995). Computer self-efficacy, sometimes referred to as *perceived ease of use* or *effort expectancy*, was found by numerous researchers to be a precursor of use behavior (e.g. Compeau and Higgins 1995).

2.2 Knowledge management systems in the organization

Computer-based technology has transformed the way in which individuals and organizations accomplish knowledge work by amplifying, complementing,

leveraging, and improving on innate human knowledge handling capabilities (Holsapple 2005). Knowledge management systems (KMS) are designed to support the creation, storage/retrieval, transfer, and application/reuse of knowledge in the organization. KMS enable the sharing and reuse of knowledge in the context of the user's needs. Therefore, knowledge has to be modeled, appropriately structured and interlinked to support its flexible integration and its personalized presentation to the consumer (Staab et al. 2001).

Alavi and Leidner (2001) identify three common applications of organizational knowledge management: (1) Coding and sharing of best practices using internal benchmarks or knowledge repositories. Organizational best practices are documented and codified, and can be stored, searched for and retrieved. (2) Creation of corporate knowledge directories or knowledge maps – mapping of internal expertise held by individuals in the organization. Realizing that much tacit knowledge remains uncodified and that such knowledge is hard to capture, it is important to map it in an organized way (Ruggles 1998, Spiegler 2000). (3) Creation of knowledge networks such as online forums, bringing experts together so that important knowledge is shared and enhanced.

Two classes of knowledge technologies supporting different needs of users are free access and structured provision (Davenport 2011). The free-access approach is suitable for situations in which the task is unstructured and contingencies are difficult to predict. Free-access tools provide search capabilities and access to sources of data or information, and the rest is up to the employee. These tools could range from Internet access to various online databases and social media, to work tools such as e-mail, spreadsheets, presentation tools, and more complex business intelligence analytics (e.g. data-warehouses). Structured provision technologies are suitable for

more structured and bounded tasks or units of work. These technologies may be information portals, business rules or algorithms to automate decisions, document or content-management systems, business process management-and-monitoring systems, and collaboration tools. Tools can be combined according to personal and organizational needs.

KMS differ from IS in that they are designed to not simply provide access to data or information, but to extract the pieces of information relevant to the user in a specific situation. In order to understand the context of the situation, KMS use advanced technical tools (text analytics, to name one example) and are inseparable from the social structure of the organization. Examination of an enterprise search tool as an example of KMS will demonstrate the unique principles of KMS vs. IS. Enterprise search is available to the organization's employees for conducting work-related searches. Unlike web search, enterprise search integrates information from multiple corporate sources, such as databases, customers' portals or knowledge bases. An effective search solution must be user friendly, secured, quick and scalable – all well-known characteristics of a successful IS. However, it also includes text analytics to extract concepts, names of important people and the relationship between them; specialized vocabularies and taxonomies tuned according to a particular industry or task; categorization or clustering for browsing results, and the ability to connect to a wide variety of repositories and applications (Feldman, 2008). These high-quality, context-related capabilities are very different from just extracting data from a database or a knowledge base and presenting it to the user in its original form.

Another important difference between IS and KMS is that the latter are essentially social systems. Whether it is a knowledge map based on employees' expertise or a knowledge base composed of best practices and experiences

documented by employees, the social and human factors play a dominant role in the system's structure and functionality. Requiring users' good will while providing results that often connect people in the organization (e.g. knowledge maps), it is clear how satisfaction and perceived usefulness, the success factors used in IS research, may be valid in predicting KMS success as well.

3. A Model of perceived benefits and user satisfaction in KMS

3.1 Adapting IS Models to KMS

Defining and measuring KM success is important to provide a basis for company valuation, to stimulate management to focus on what is important, and to justify investments in KM activities (Jennex et al. 2007). It is difficult to directly tie knowledge management practices and organizational competitiveness due to the many intervening variables, the fact that most knowledge management benefits are intangible and the long-term nature of those benefits (Bots and de Bruiin 2002, Lee et al. 2005, Kulkarni et al. 2006). While much research has been done on IS users, less is available on KMS users, particularly studies that incorporate actual knowledge functions in their measurement tools. Similarly to IS, user's perceptions and attitudes are commonly used in predicting KMS effectiveness, with modifications to some parts of the model to accommodate the unique characteristics of KMS.

System use – The extent of system use per se is not considered a good measure of KMS success; of greater importance are the quality of that use and the intention to use (Jennex et al. 2007). Sometimes the most useful knowledge is not gained through extensive use of the system, but rather discovered in specific, ad-hoc search in the system (Jennex 2005a). Increased consumption and creation of knowledge via KM tools will not necessarily lead to increased benefits to the individual and the

organization. Extensive use of faulty or inaccurate information will lead to mistakes and loss of business value. It is important for accurate and correct knowledge to be used by the right person at the right time and in the right context. The research model therefore uses the perceived benefits construct as defined above.

System quality – Unlike IS models, in KMS models system quality may include not only technical aspects of the system but also KM form and KM level (Jennex and Olfman 2006). KM form refers to the extent to which knowledge and knowledge management processes are computerized and integrated: online accessibility, common interfaces etc. KM level refers to the level of the KM mnemonic functions (Stein and Zwass 1995): search and retrieval, manipulation, and abstraction. KM level reflects how well knowledge processes are integrated within organizational routines and supported by organizational IS. In the proposed research model, system quality is composed of three sub-constructs: technical resources of the system as measured for IS (DeLone and McLean 2003), KM level as noted above and system linkages. The systems linkages construct refers to common interfaces between KM systems, communication between them and mutual usage. Two dimensions capture the nature of the interrelation between the systems: linkage width and linkages depth. Linkages width describes the horizontal relations between systems: the extent to which a KMS uses other KM systems output in order to produce new knowledge/information. The more linkages exist, the higher the width level. Linkage depth describes the vertical relations between systems: the extent to which a KMS output is used as an input to another KMS, the output of which is used as an input to another KMS and so on. The greater the number of such relations, the greater the depth level. Systems linkages measure the quality of the organizational KM infrastructure and its ability to use

existing knowledge resources in a sophisticated way and to support advanced navigation and retrieval capabilities.

Knowledge quality – The bounds between information and knowledge are not always clear and often depend on meaning to the processor and relevance to the task (Holsapple 2003). For that reason, information quality is just as valid a construct in KMS models as knowledge quality. The knowledge quality construct may include: the KM strategy/process, richness and linkages (Jennex and Olfman 2006). The KM strategy/process looks at the organizational processes to identify knowledge and knowledge users, the formality of the processes, and the format and context in which knowledge is stored. Richness reflects the accuracy, timeliness and sufficiency of organizational context that make the knowledge useful. Linkages reflect expertise and topic maps available to identify sources of knowledge in the organization. The context issue arises again and again: knowledge is sometimes unstructured and is often created by adding pieces of information, experiences and personal common sense in unpredictable ways. It is therefore important to provide users with appropriate search and navigation infrastructure and search know-how, in order to increase their satisfaction with the KMS (Terill and Flitman 2003). Consequently, knowledge quality in the research model includes classic information quality dimensions (accuracy, reliability, relevancy, importance and adequacy) as well as unique knowledge dimensions to describe the quality of the knowledge in terms of context and linkages.

3.2 A KMS model for predicting perceived benefits and user satisfaction

The proposed research model and its hypotheses are shown in Figure 2. The extended system quality and knowledge quality constructs are assumed to be predictors of perceived benefits and satisfaction.

Insert Figure 2 about here

System quality is defined by numerous IS and KM researchers as pertaining to the dependent variables (Delone and McLean 1992, Saarinen 1996, Jennex and Olfman 2006, Kulkarni et al. 2006, Wu and Wang 2006). In the research model it comprises *technical resources*, *KM level* and *systems linkages*. The dimensions of technical resources used in this study are hardware and software level, network infrastructure level, the availability of personal workstations, response times – all mentioned by the above researchers, as well as the existence of data recovery and data security procedures. Technical resources are at the organization level.

H1a: Technical resources will be positively related to the perceived benefits of using KMS.

H2a: Technical resources will be positively related to users' satisfaction from KMS.

KM level describes the level of knowledge management in the organization in terms of sophisticated knowledge acquisition, retention, maintenance, search and retrieval (Jennex and Olfman 2006). It is also defined by the richness of KM software used in the organization and the way it is applied through different knowledge management processes.

H1b: KM level will be positively related to the perceived benefits of using KMS.

H2b: KM level will be positively related to users' satisfaction from KMS.

Systems linkages is a new sub-construct that includes common interfaces between KM systems (as in Jennex and Olfman 2006), actual relations between systems and mutual usage, as described above.

H1c: Systems linkages will be positively related to the perceived benefits of using KMS.

H2c: Systems linkages will be positively related to users' satisfaction from KMS.

Knowledge quality describes the quality of the output of the KMS. As with information quality, knowledge quality dimensions are typically: accuracy, reliability, relevancy, importance and adequacy (Delone and McLean 1992, Saarinen 1996, Jennex and Olfman 2002, Kulkarni et al. 2006). In addition, two specific knowledge-oriented dimensions are included to describe the quality of knowledge over the quality of information in terms of the context in which the knowledge is provided to the user and the linkages between the knowledge items (Jennex and Olfman 2006, Wu and Wang 2006).

H3: Knowledge quality will be positively related the perceived benefits of using KMS.

H4: Knowledge quality will be positively related to users' satisfaction from KMS.

Jennex and Olfman (2002) found that high degree of computer literacy enhanced KM effectiveness and they included it in the technical resources dimension of system quality. However, as perceived benefits and consequently system use may be affected not only by the level of computers literacy, but also by the attitude of the

user to information technology in general and how it is applied in work tasks in particular, the research model includes as a factor of perceived benefits the independent variable user IS competence, which is defined as general knowledge of common software applications and finesse: the extent to which the user applies technology based tools in a creative and innovative manner in his work. The theoretical basis for this inclusion is the self-efficacy construct from IS research on technology acceptance (e.g. Davis 1989, Compeau and Higgins 1995).

H5: User IS Competence will be positively related to the perceived benefits of using KMS.

The importance of organizational support in IS/KMS adoption and use has been stressed by several researchers. The support may take different forms: from reliable and responsive training and professional services provided by the IS team or any other organizational or outsourced unit (Saarinen 1996, Delone and McLean 2003, Jennex and Olfman 2006), through active support of co-workers and direct management in the adoption of systems, to organized and declared KM strategy led by senior management (Jennex and Olfman 2006, Kulkarni et al. 2006). Accordingly, the variable *organizational attitude to KM* in the research model stands for the training and technical service provided to KMS users, as well as for the encouragement to use KMS and support given by co-workers and different levels of management.

H6: Organizational attitude to KM will be positively related to users' perceived benefits from KMS.

H7: Organizational attitude to KM will be positively related to users' satisfaction from KMS.

As KMS benefits are hard to measure due to their intangible and indirect nature, and based on the vast IS and KM literature on perceived usefulness (e.g. Seddon 1997, Wu and Wang 2006), perceived benefits are measured instead. *The perceived benefits* construct in the model measures the user's subjective evaluation of the extent to which using the system may improve his or her job performance, productivity, effectiveness, ease of use, interest and job opportunities.

User satisfaction is a widely accepted measure of IS/KMS success. Kulkarni et al. (2006) define it as a subjective evaluation of the degree to which a system provides easy access to knowledge and knowledge that meets one's needs. User satisfaction in the research model measures the following system and knowledge dimensions: content, accuracy, format, ease of use and timeliness, as suggested by previous studies (Jennex and Olfman 2006).

There is no consensus among researchers on the interrelation between intention to use and user satisfaction. Some claim that attitude cannot influence system benefits, while others assert that perceived system benefits can influence user satisfaction (Wu and Wang 2006). The research model thus hypothesizes:

H8: The perceived benefits of using KMS will be positively related to user satisfaction from KMS.

4. Methodology

4.1 Definitions and measures of the constructs

Survey measures were mostly taken from previous studies and a new measure was created for the system quality variable. The formal definitions of the constructs

and their sources are listed in Table 1. All items were measured using a seven-point Likert scale.

Insert Table 1 about here

Item analysis was performed for each construct and items found to detract from the reliability of the construct were removed. Results for Cronbach's αfor the modified constructs are shown in Table 2.

Insert Table 2 about here

The demographic variables gender (1-female 0-male) and organizational position (1-managerial, 0-non-managerial) were controlled for. The variables were self-reported by the respondents to the survey.

4.2 Data

Respondents were requested to answer on-line questionnaires. Two types of questionnaires were sent, one for employees using KMS and another for the organization's KM manager (if such a function existed) or the IT manager. The user's questionnaire is based on existing measures as listed above. The IT/KM manager questionnaire (see Appendix A) was created for the purpose of this study and validated prior to putting it to use by an expert panel of nine academic advisors and practitioners in the IS field.

The study population is composed of employees using KMS in an organizational context and the IT/KM manager of the respective organization. Ten Israeli hi-tech companies or Israeli branches of international companies participated in the study. The usable sample of 100, consisted of 34 females and 66 males. The

respondents are described in Table 3, the organizations in Tables 4 and their KM profile in Table 5.

Insert Tables 3, 4 & 5 about here

5. Results

Pearson correlations were calculated to measure the dependencies between the variables. Results are shown in Table 6. The correlation KQUALI-USESAT stands out as exceptionally high. This may indicate a lack of construct validity, meaning that the items are too similar and may actually measure the same effect. No action was taken and the issue is addressed in section 6.

Insert Table 6 about here

To assess the structural model, a regression was performed of the independent variables, which showed significant correlations with the dependent variable, on the dependent variables. The gender control variable was included in the regression of perceived benefits. Path coefficients and R^2 values are shown in Figure 3. Non-significant correlations are shown as dashed lines. Path coefficients reflect the strengths of the relationships between the independent and dependent variables. R^2 values represent the amount of variance explained by the independent variables.

H1 was not supported: none of the sub-constructs of system quality were found to affect perceived benefits from the system. The unexpected significant relation in the opposite direction to the one hypothesized, between technical resources and perceived benefits, will be discussed in the following section. H2 was partially supported as KM level had a significantly positive effect on user satisfaction, but technical resources and systems linkages had no such effect.

H3 and H4 were both supported, i.e. increased knowledge quality of the system was found to be associated with increased perceived benefits to the user as well as increased user satisfaction. H5 was not supported, i.e. user IS competence was not found to significantly affect perceived benefits. Organizational attitude to KM was not found to significantly affect user satisfaction, or the perceived benefits from the system, i.e. H6 and H7 were not supported. H8 was also not supported: perceived benefits had no significantly positive effect on user satisfaction.

Insert Figure 3 about here

Gender had an effect on perceived benefits, the perceived benefits being higher for the male employees. The gender effect in the regression is significant, and the fact that knowledge quality is still significant when gender is controlled for, shows that the effect of knowledge quality on perceived benefits exists beyond the effect of gender.

Seventy-three percent of the variance in user satisfaction was explained by KM level and knowledge quality. However, knowledge quality ($\beta = 0.74$) contributed to satisfaction significantly more than KM level ($\beta = 0.15$). The exceptionally high correlation found between knowledge quality and satisfaction will be addressed in the next section.

Organizational position was correlated with neither perceived benefits nor user satisfaction; gender was significantly correlated with perceived benefits.

6. Analysis

An IDC study[1] found that knowledge workers spend 15-30% of their time seeking specific information and that these searches are successful less than 50% of the time. It is not surprising then, that search and navigation facilities were found in another study to be factors of user satisfaction in integrative KMS (Terill and Flitman 2003). Employees today are flooded with information and need help in screening it and extracting what is important. The purpose of KM tools is not only to enhance sharing and circulation of knowledge among employees, but to do so in an efficient and effective manner (e.g. minimizing search and query times, keeping knowledge updated and reliable). The research model includes factors that are designed to support these needs, most important of them being the addition of the KM level and systems linkages as key characters of system quality and the adaptation of the information quality construct to specific knowledge characteristics, mainly context and linkages.

6.1 Perceived benefit factors

The knowledge quality construct is based on the information quality construct, which has been found in various IS studies to affect perceived benefits and satisfaction. In the adaptation to the KMS model, the classic information/knowledge dimensions are measured (e.g. consistency, importance) and characteristics of context and linkages to experts or information sources are added. The context of the knowledge provided and the quality of the linkages are important in light of the following issues: (1) The value of information/knowledge may change depending on the circumstances – today's information is tomorrow's data. (2) The deluge of information that employees face and the time spent on finding information or finding

[1] Cited by http://freshconsulting.com/blog/enterprise-2-0-technology-delivers-more-efficiency-4-of-10/

the right person to ask. Consequently, the value of the information or knowledge provided by the KMS is dependent on the specific query and its relevancy to the user at the time it is requested.

The results show that knowledge quality has a significant positive influence on perceived benefits, as hypothesized. This is another empirical proof of the importance of adopting knowledge characteristics when predicting perceptions of KMS and attitudes towards them.

An unexpected result is the relationship between gender and perceived benefits: gender was found to have an effect on the average level of perceived benefits that is higher for male employees. A survey conducted among employees in Taiwan (Ong and Lai 2006) found that men's rating of perceived usefulness of e-learning was higher than women's. On the other hand, Gefen and Straub (1997) found that women's rates for the perceived usefulness of e-mail were higher than men's. This is interesting, since both e-learning and e-mail may be considered as types of KM tools. In order to determine the impact of gender on the perceived benefits of KMS, future research should examine the differences between the genders while considering specific skills and activities (e.g. communication or knowledge sharing) that are involved in the use of the KMS and are thought to be different for women and men.

User IS competence had no significant effect on perceived benefits. A possible explanation for this result may be the fact that the research population is composed of knowledge workers with very high technological competence, which does not necessarily relate to perceptions of benefits from IS or KMS. Though the relationship between user competence and perceived benefits has been demonstrated in IS research (Davis 1989), and though it could also be valid in KMS despite the empirical results

of this study, and considering the previously noted finding of this study regarding the specific knowledge dimensions adopted by the model, it seems appropriate to use a construct called *user KM competence* in future research. Knowing how to utilize the search and query tools, how to collaborate and exploit organizational KMS, may significantly increase user's perceived benefits from the system. Workers spend time looking for information and experts, and capabilities that enable them to save this time will probably affect perceived benefits. The KM competence measure may be especially relevant to software employees and other knowledge-intensive workers, who commonly use more sophisticated tools requiring higher expertise.

Organizational attitude to KM in the present study measured the social factors and support provided in adopting and utilizing KMS, on the assumption that a knowledge-friendly culture with a positive orientation to knowledge will encourage employees to use KM tools and motivate them to ask for support and instruction. The role of social factors and facilitating conditions in empirical studies is controversial: though some researchers have found it to be a significant factor of perceived benefits (e.g. Taylor and Todd 1995), others have found it non-significant or significant only when examined in conjunction with gender, age and experience as moderators (Venkatesh and Morris 2000, Venkatesh et al. 2003). Organizational attitude to KM had no significant effect on perceived benefits in this study.

6.2 User satisfaction factors

In line with previous IS as well as KM research results, knowledge quality was found to be a very strong determinant of user satisfaction. The correlation between the two construct was extremely high, possibly indicating a lack of construct validity. Looking at the measures used for knowledge quality and for user satisfaction, there are indeed strong similarities among the dimensions measured: accuracy, clearness,

timeliness and more. It has been noted before, that most user satisfaction instruments include factors relating to information quality (Seddon 1997). In addition, considering the fact that both knowledge quality and user satisfaction data were collected from the same respondent, it might be that this is a case of same-source bias: respondents were unable to separate their perceptions of knowledge quality and their satisfaction from the system and the knowledge to be derived from it. Considering these two issues, it is recommended in future studies to collect the data pertaining to the dependent variables and the independent variables from different sources, or to define the constructs in a more distinct manner.

KM level was added to the research model as a sub-construct of system quality, with a new measure developed based on the knowledge functions: acquisition, retention, maintenance and search and retrieval. Judicious implementation of these functions is a prerequisite to knowledge richness (through acquisition), correctness and reliability (through retention and maintenance) and ease of access and usefulness of the system (through search and retrieval mechanisms and display forms). The high reliability of the KM level construct (Cronbach's $\alpha = 0.9$) allowed its utilization in the measurement model. It was found to have a significantly positive effect on satisfaction from the KMS, an important result indicating that the unique characteristics of knowledge, especially knowledge functions, should be measured when predicting attitudes of users towards KMS.

Organizational attitude to KM had no significant effect on user satisfaction. It could be that with their high level of technological competence the respondents have less of a need for technical support in using KMS. Since facilitating conditions is part of the organizational attitude to KM construct, this could explain the non-significant relationship.

To conclude this section, though the perceived benefits construct is viewed as a determinant of user satisfaction in both IS and KM studies, it has not been found to be correlated with satisfaction. Davis (1989) claims that people tend to use or not use an application based on the benefits they expect to derive from it, even though they believe that it is too hard to use. It is possible that users of KMS appreciate the system's benefits to their job performance, but do not consider it as fun to use. Thus, though theoretically hypothesized to be significant, the relation perceived benefits → satisfaction may not be valid in practice.

6.3 The effect of system quality

As noted above, KM level was positively related to user satisfaction, indicating that the unique characteristics of knowledge, especially knowledge functions, should be measured when predicting attitudes of users towards KMS. No correlation was found between KM level and perceived benefits. This may be explained by the fact that the measure deals mainly with technical specifications that relate more to general functionality and user experience – typically satisfaction dimensions, rather than with direct means of enhancing job performance – typically perceived benefit dimensions.

The system quality variable was composed of two additional constructs, technical resources and systems linkages, new measures being proposed for both of them. No significant correlation was found between technical resources and user satisfaction, and unexpectedly a significant correlation was found between technical resources and perceived benefits but in the opposite direction to the one hypothesized. This is inconsistent with prior IS and KMS research. A possible explanation might be that the scale proposed for the technical resources construct was not well designed. The newly added systems linkages construct had no significant effect on the

dependent variables. The research model hypothesized that in order to broaden the span of available knowledge and produce value to users, the infrastructure should also be well linked, i.e. systems in the organization should intercommunicate based on common interfaces and shared object representations. The hypothesis was not supported, probably due to issues concerning the scale, the reliability of which was barely on the edge of acceptability ($\alpha = 0.65$). Nevertheless, this seems to be an important measure of the overall KM infrastructure of the organization, and should be included as a factor of user's perceived benefits and satisfaction, using a better scale.

6.4 A note on the organization's KM profile

Viewing the knowledge management profile of the organizations it is immediately apparent that most organizations do not have a formally defined KM manager. In 60 percent of the organizations, the IT manager was the most suitable person to fill out the questionnaire on knowledge management. Organizations often disband the chief knowledge officer (CKO) since knowledge management is subsumed under information technology (Desouza and Raider 2006). This is an erroneous belief, since unlike the chief information officer (CIO), whose responsibilities are IT strategy, IT operations and managing the IT function, the role of the CKO is to lead KM initiatives, integrate KM tools, and design settings and processes to maximize knowledge creation, discovery and dissemination (Earl and Scott 1999). The existence of a CKO or KM manager is an indication of the importance of KM in the overall strategy of an organization. It may indicate, among other things, the organizational attitude to KM, as one of the CKO's roles is to encourage the creation of a knowledge-intensive environment and the utilization of knowledge and knowledge tools. The absence of a CKO in most organizations may

also explain the fact that the organizational attitude to KM was not significantly correlated with either of the dependent variables.

Most of the organizations reported the use of a portal as a means of communication (mainly internal), collaboration and documentation management, and as a single access point to applications, which indicate activities of knowledge sharing, knowledge creation and knowledge consumption using search tools. Less common were an expert/best practices directory and external communication. The second common KM utility was social networking/instant messaging, for quick communication and collaboration between employees, and for outgoing communication: for public relations, headhunting etc. This may indicate the maturity of the organizations, and the realization that communication today is via social media channels. The third commonly reported application was Wiki, used mainly as a best practices directory and in collaboration and communication among teams. As a KM tool that requires quite high computer literacy, due to its HTML format, Wiki may be more prevalent in software organizations, such as those of the present study, and less so among less technology-oriented workers.

7. Conclusion

The research makes two significant contributions, one on the structural level and the other on the measurement level. On the structural level, the results prove the need for adjustments to the IS model when applying it to KMS. Though knowledge and information are sometimes interchangeable, knowledge has certain unique characteristics that define its quality, mainly relating to linkages and context. Knowledge is of value only if it is produced in the right context, time and fits the query made. In addition, much of the value of KM tools often lies in the information

they provide regarding experts in the organization, best practices etc. At the systems level, organizational knowledge functions should be taken into consideration; acquisition, retention, maintenance and search and retrieval are functions facilitating effective knowledge management. These functions are the technical basis for accumulating knowledge in the systems, for integrating it with old knowledge, maintaining its integrity and providing sophisticated search and retrieval capabilities, both on the user interface level and in the logical operation of the systems. The model also suggests that linkages should be related to at the systems level and not only at the knowledge level. The claim is that in order to supply infrastructure to knowledge of high quality, the systems should also be interrelated and communicate among themselves. The need for considering knowledge characteristics and KM level in the model was confirmed by the empirical results. The addition of systems linkages was not supported by the results due to measurement issues, and should be further investigated.

At the measurement level, a new measure for KM level was introduced, based on the Stein and Zwass mnemonic functions (1995). The reliability of the new measure is high, and it showed a significant effect on user satisfaction. It can serve as a base for the development and validation of a KMS quality tool that will include the measurement of all aspects of system quality from the knowledge perspective. Also, following the discussion on IS user competence, a KM user competence construct should be defined and a measurement tool developed.

The research was done with a relatively small number of respondents from a limited pool of organizations. Future research should involve a substantially higher number of organizations and respondents. The study involved employees from the software industry, and future research should include respondents from other

industries in order to test the model on different job characteristics. Future research should also include interviews with managers as well as with KMS users. This will provide a deeper understanding of the role of knowledge management in the organization, its effect on the way employees perceive KMS and their satisfaction with KMS, and of the way users actually utilize KMS. Combining empirical results with insight based upon qualitative data will provide a base for a true understanding of factors influencing users' perceptions of and attitudes towards KMS.

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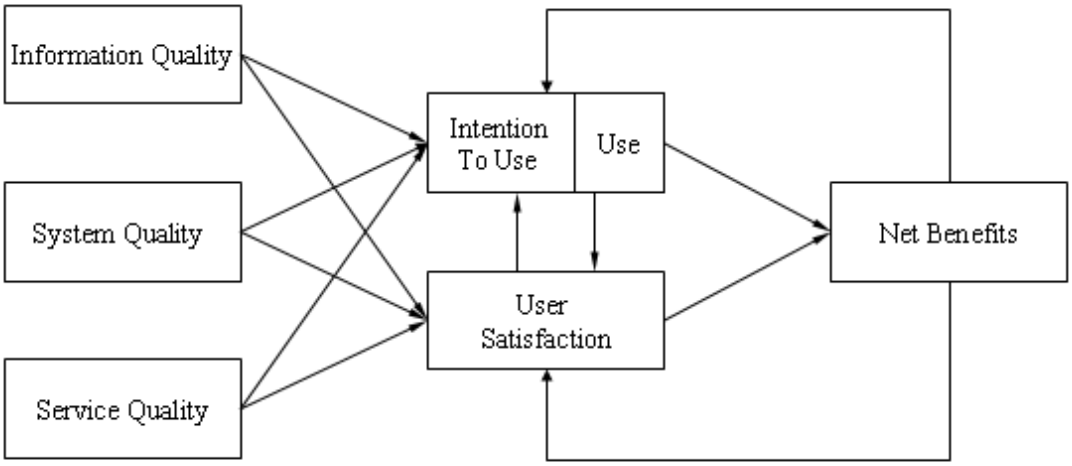


Figure 4. The updated DeLone and McLean IS success model (2003)

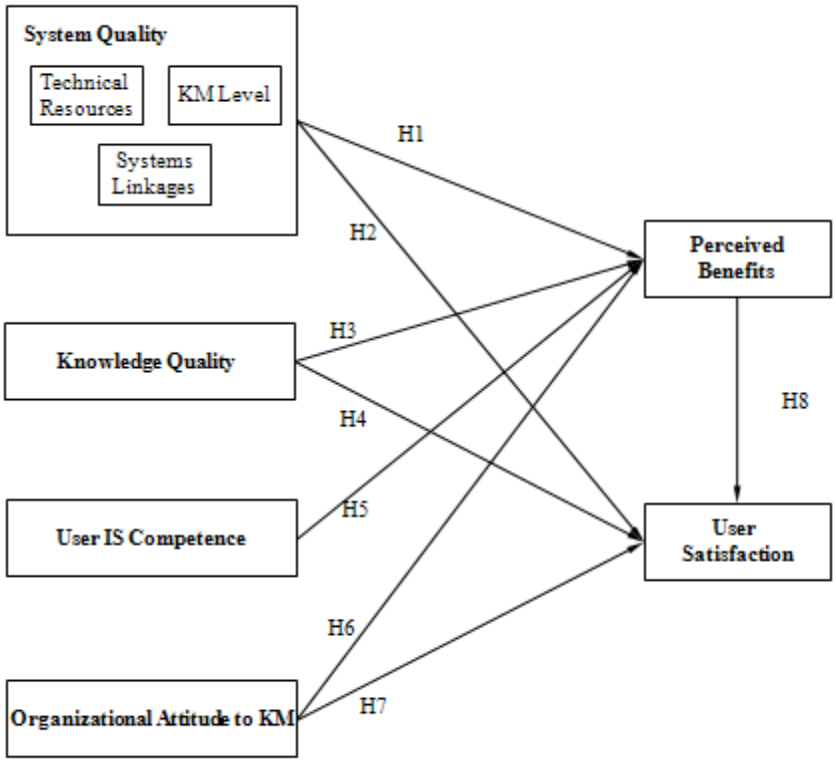


Figure 5: Factors influencing perceived benefits and user satisfaction in KMS

Table 1: Construct definitions

Construct	Definition	Source
System quality	The level of organizational technical resources, KM functions level (acquisition, retention, maintenance and search & retrieval) and system linkages (existence of common interfaces and linkages between KM systems)	Stein and Zwass (1995), DeLone and McLean (2003), Jennex and Olfman (2006)
Knowledge quality	Relevance, timeliness and accuracy of the system's knowledge/information and linkages	Wu and Wang (2006)
User IS competence	Level of knowledge of basic applications: creativity, self-sufficiency and ability to learn new things with regard to computer-based technology	Munro, Huff, Marcolin and Compeau (1997)
Organizational attitude to KM	Social factors and facilitating conditions - the support of co-workers and service teams in introducing and using KMS	Thompson, Higgins and Howell (1991)
Perceived benefits	Near-term consequences and long-term consequences – the extent to which using KMS will reap benefits.	Thompson, Higgins and Howell (1991)
User satisfaction	The degree to which the user is satisfied with the system and its information/knowledge components: content, format, accuracy, ease of use and timeliness	Doll and Torkzadeh (1988)

Table 2: Internal consistency indicated by Cronbach's α

Construct	Cronbach's α
Technical Resources[2]	0.83
KM Level[3]	0.90
Systems Linkages	0.65
Knowledge Quality	0.90
User IS Competence	0.87
Organizational Attitude to KM	0.87
Perceived Benefits	0.85
User Satisfaction	0.94

Table 3: Descriptive statistics of respondents

Demographics	Frequency/Percentage (N=100)
Gender	
Female	34
Male	66
Job Profile	
Research & Development	83
Operations	3
Sales & Marketing	3
Finance & Administration	0
IT	9
Services	2
Organizational Position	
Managerial	26
Non-managerial	74

[2] Items 3 and 4 removed
[3] Items 17, 19, 21 and 22 removed

Table 4: Profile of organizations

Demographics	**Frequency (N=10)**
Type	
Israeli based firm	5
Local subsidiary of multinational firm	5
Size	
Small (1 – 100 employees)	0
Medium (100 – 500 employees)	1
Large (over 500 employees)	9

Table 5: Knowledge management profile of organizations

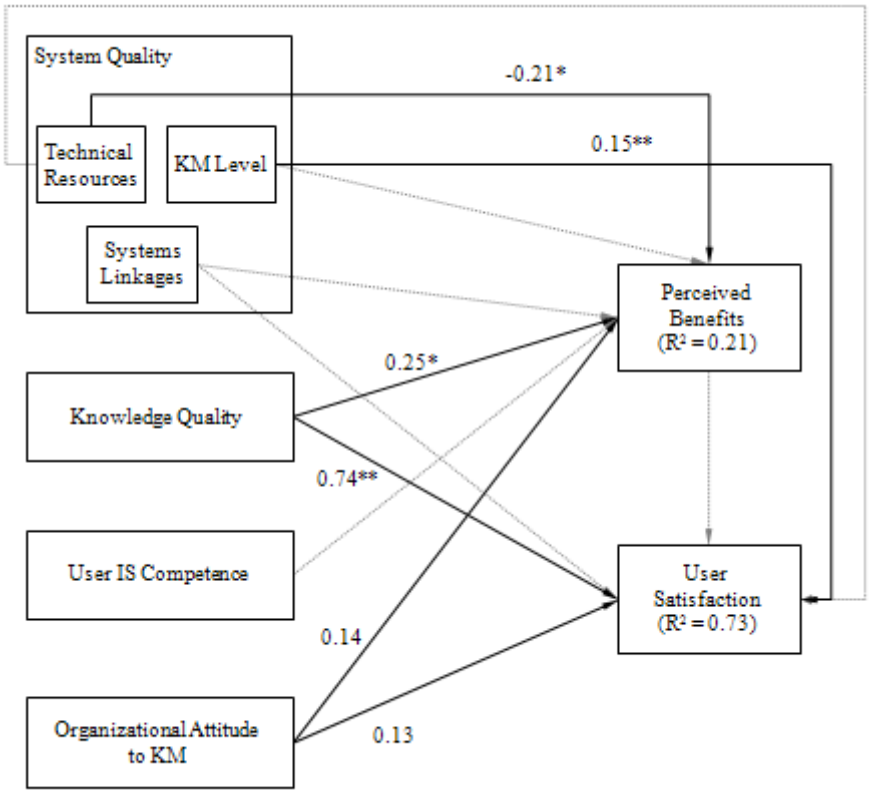
KM characteristic	**Frequency/total**
Organizational function in charge	
KM manager	3/10
IT manager	6/10
IT/KM manager (unified role)	1/10
Portal implementation	9/10
Internal communication	8/9
External communication	3/9
Single access point to org. applications	5/9
Document management	5/9
Collaboration space	7/9
Experts / best practices directory	4/9
Wiki implementation	6/10
Internal communication	2/6
External communication	0/6
Document management	1/6
Teams collaboration	2/6
Experts / best practices directory	3/6
Social networks or instant messaging tool implementation	8/10
Other knowledge management tools[4]	7/10

[4] Mostly collaboration and sharing tools (MS SharePoint, forums, blogs) and internal and external technical knowledge bases.

Table 6: Correlations between constructs

	FEMALE	MANAG	TECRES	KMLEVL	SYSLIN	KQUALI	USECOM	ORGATT	PERBEN	USESAT
FEMALE	1									
MANAG	-0.14	1								
TECRES	0.30	-0.24*	1							
KMLEVL	0.06	-0.24*	0.22*	1						
SYSLIN	-0.04	-0.12	0.35*	0.55**	1					
KQUALI	-0.01	-0.07	-0.14	0.07	0.03	1				
USECOM	-0.27**	0.18	0.10	0.14	0.04	0.07	1			
ORGATT	0.16	-0.18	0.04	0.08	0.15	0.65**	0.01	1		
PERBEN	-0.22*	0.05	-0.22*	-0.09	-0.05	0.34**	-0.03	0.25*	1	
USESAT	0.14	-0.13	0.14	0.20*	0.00	0.84**	0.06	0.62**	0.13	1

** Significant at the 0.01 level, *. Significant at the 0.05 level



** Significant at the 0.01 level, *. Significant at the 0.05 level

Figure 6: Hypotheses testing results