Knowledge management system model for learning organisations

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Abstract: Based on the literature of knowledge management (KM), this paper reports on the progress of developing a new knowledge management system (KMS) model with components architecture that are distributed over the widely-recognised socio-technical system (STS) aspects to guide developers for selecting the most applicable components to support their KM practice in learning organisations (LO). This new model will bridge the literature gap found in KMS components which are not clearly defined, nor arranged and categorised for the most efficient use inside the organisation. Without this model, KMS developers should expect deficiency in their design due to the possibility of missing or misinterpreting important components for the intended design. Therefore, with this new model, the much clearer approach is achieved by ensuring that all KMS components are clearly identified and used to guarantee KMS effectiveness in the organisation. This research leads to a further study to test and confirm the new model for KMS development in LO's.

Keywords: KM; knowledge management; KMS; knowledge management system; LO; learning organisation; STS; socio-technical system.

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1 Introduction

Knowledge management systems (KMS) are modern systems made up from the combination of social and technical systems, widely recognised as 'socio-technical' systems (STS) introduced by Trist (1980) to enable developers and decision makers in learning organisations (LO) to manage the knowledge they need to perform their tasks. Those systems extend beyond the traditional information systems in that they must provide 'context' for the information presented (Gallupe, 2001). In recent years, several KMS models were developed and published by many leading researchers in this field, but regrettably, most of them have various component architectural terminologies which can lead to confusion in identifying and selecting the best components for the intended KMS design inside the targeted organisation. In addition, KMS is already labelled as a 'complex system' due to its complex interaction between people, process and technology and hence no single approach can be applied to all organisations (Lindner and Wald, 2011; Alavi and Leidner, 2001). Therefore, more complexity is expected with components that have non-unified terminology. Thus, to help in solving this problem and to make KMS designs more effective, an attempt was made to unify the terminology of KMS components through an academic exercise to collect, re-arrange, categorise and map them into both the socio and technical components. In this exercise, we made special attention to knowledge management (KM) main elements: people, technology and process (Bhatt, 2000) and the socio-technical system (STS) aspects (Trist, 1980). As a result, the new model was generated with the assurance to narrow the literature gap for KMS design with much clearer components which are an essential requirement for effective systems design.

1.1 Research problem

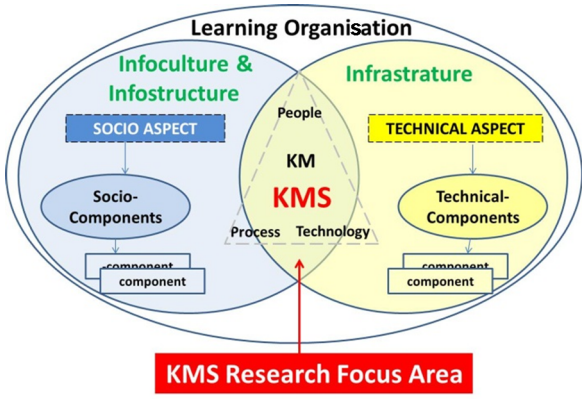
The research problem was identified as follows: KMS have vague and unclear terminologies of its components leading to confusion in selecting them for KM strategy in the targeted organisation and further leads to less effective KMS designs. Hence, the aim of this research is to find and develop a new approach to help KMS developers to clearly identify and apply all associated KMS components from a socio-technical system perspective.

1.2 Research focus area

Figure 1 shows the focus area of this research in order to solve the above problem and to generate the new KMS Model after going through an intensive literature review.

Other STS developments, such as Pan and Scarbrough (1999) dividing them by the following three perspectives: infra-structure, info-structure and info-culture. Another development in this field has added clearer approach to the components from the social and technological aspects. It has been concluded that the Social approach has components such as management of people and process, while the technological approach has components, such as information and communications technologies (Šajeva, 2010). However, those studies were still not enough to solve the problem of components being vaguely defined and not properly arranged within the socio-technical aspects. Hence, our research study was mainly to solve this problem and to produce an alternative clear solution by introducing the new model.

Figure 1 The research focused area (see online version for colours)



This research leads to a further study for data collection and analysis to confirm if the new model could be applied effectively on a sample of stakeholders in a learning organisation. After some practical considerations, a public-sector organisation in the Kingdom of Bahrain was selected for this case study. The reason for selecting this organisation is because it is currently a leader in practising KM as a corporate strategy for the learning and growth, has KM community of practice (CoP) and supported by a strong IT group. The anticipated outcome of this research endeavour is that more KM awareness and effective KMS usage support could be influenced by various interested organisations in the Kingdom of Bahrain once the Government adopts the model as a guide for their current and future KMS development plans.

2 Literature review

This literature review highlights the following important aspects that were considered during the new KMS model development.

- learning organisation (LO)
- knowledge management (KM)
- knowledge management system (KMS)
- components architecture.

2.1 Learning organisation

The organisational learning (OL) is complementary to KM (King, 2009). Therefore, OL has to do with embedding what has been learned into the fabric of the organisation. At the same time, KM is based on the premise that, just as human beings are unable to draw on the full potential of their brains, organisations are generally not able to fully utilise the knowledge that they possess (King, 2009). Through KM, organisations seek to acquire or create potentially useful knowledge and to make it available to those who can use it at any time and place that is appropriate for them to achieve maximum effective usage in order to positively influence their organisational performance (King, 2009).

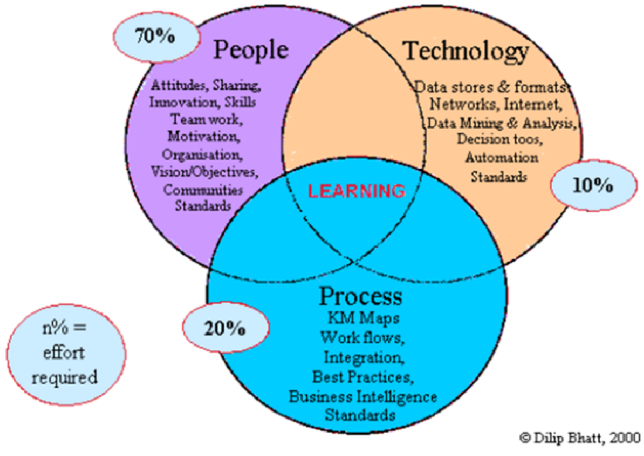
2.2 Knowledge management

Knowledge management (KM) is a process of identifying, capturing, and leveraging the collective knowledge in an organisation to help the organisation compete, as stated by Alavi and Leidner (1999). However, knowledge and knowledge management are labelled as complex, multi-faceted concepts (Alavi and Leidner, 2001) with many definitions made by leading authors. The most appropriate definition to support our KMS and LO based research work was defined as follows: knowledge management is the deliberation and systematic coordination of an organisation's people, technology, processes, and organisational structure in order to add value through innovation and utilisation of knowledge (Dalkir, 2011). This is achieved through "the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into the corporate memory in order to foster continued organisational learning" (Dalkir, 2011). In addition to this, King (2009) indicated that that KM is largely an organisational activity and effort that focuses on what employees can do inside their organisation to enable better knowledge sharing practices, improved organisational behaviours, decisions making and organisational performance.

2.2.1 Knowledge management elements

In general, KM has three (3) key elements, as shown in Figure 2. They are people, process and technology. An interesting study found that KM's success inside the organisation greatly comes from people's effort. In his study, Bhatt (2000) found that *People's* effort is 70%, *Process* effort is 20% and *Technology* required the effort of only 10%. Hence, people's effort can make KM a successful initiative inside the organisation once supported and accepted by them (Bhatt, 2000). Therefore, people and related organisational culture should be taken into consideration when designing KMS.

Figure 2 KM elements (see online version for colours)

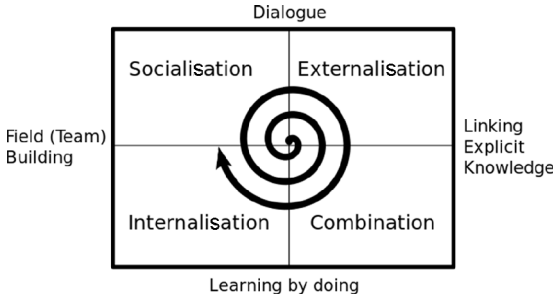


Source: Bhatt (2000)

2.2.2 Knowledge creation process

Most KM related studies still have an association with the two types of knowledge (tacit and explicit) and with the SECI model (socialisation, externalisation, combination and internalisation) for knowledge creation and sharing, which was originally developed by Nonaka and Takeuchi (1995), as shown Figure 3.

Figure 3 The SECI model by Nonaka and Takeuchi (1995)



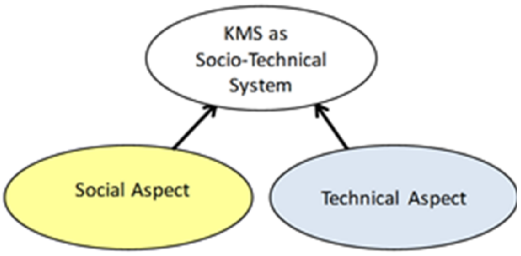
Source: Nonaka and Takeuchi (1995)

The SECI model suggests that "knowledge creation is a spiral process going from socialisation (direct experience) to externalisation (explicit knowledge), then to the combination (learning by doing) and to internalisation (field building)". Those four (4) modes are simply used for combining, converting knowledge, how knowledge can be shared and, how knowledge is created. They are still forming the basis of most KM model designs. The spiral in the middle represents the continuous movement between different modes of knowledge creation. In other words, while the spiral radius increases, the movement and diffusion of knowledge through different organisational levels is increasing.

2.3 Knowledge management system

With the advancement of information and communication technology (ICT), KMS has been realised as an adequate modern tool for supporting and enabling KM process in the organisation (Šajeva, 2010; Alavi and Leidner, 2001). KMS is a labelled as a complex system (Alavi and Leidner, 2001) due to its complex composition of people, technologies and data or information, where these components should then interact with one another (Gallupe, 2001). Due to this complexity, each organisation then has a unique design and this should be considered during its implementation in organisations (Alavi and Leidner, 2001; Gallupe, 2001). Further to this, we need to ensure that this complexity is minimised in KMS designs by applying a valid approach. We found that the socio-technical system approach (STS) which was coined in the 1960s by Eric Trist and Fred Emery who were working as consultants at the Tavistock Institute in London and then developed it throughout the 80's, and further enhanced by Pan and Scarbrough (1999), as the best approach for KMS designs. Many leading authors have then highlighted the interrelationship between the social aspect and technological aspect in the organisation. This approach has become more important in today's modern organisations as the social aspects and technological aspects play a critical part in the business process (Trist, 1980). The concept is shown in Figure 4.

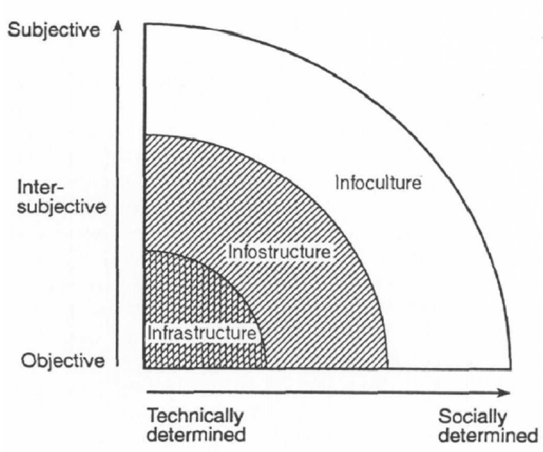
Figure 4 KMS based on social and technical system (see online version for colours)



Source: Trist (1980)

Meanwhile, in the approach by Pan and Scarbrough (1999), we noted three (3) perspectives: infra-structure, info-structure and info-culture. The infra-structure refers to the hardware and software while the info-structure aspect refers to social systems that consist of the organisational structure. The organisational culture (info-culture) such as background knowledge, are those cultures embedded in social relations surrounding work group processes which define the cultural constraints on knowledge and information sharing, as shown in Figure 5.

Figure 5 A socio-technical perspectives of knowledge management



Source: Pan and Scarbrough (1999)

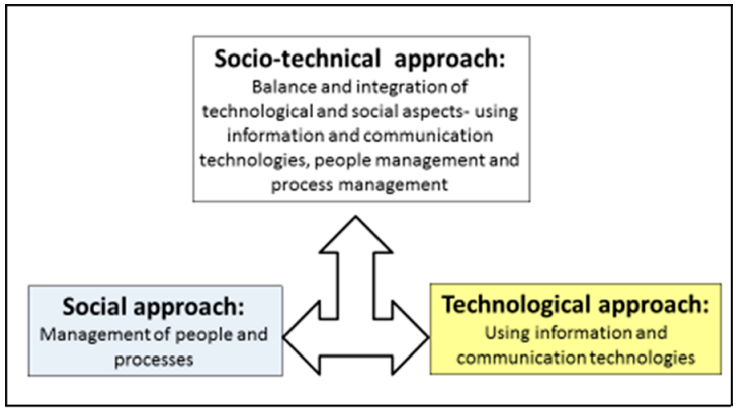
Furthermore, Šajeva (2010) suggested that KMS could have two main functions. They are managing people interaction and managing knowledge/information and organisations should cautiously choose the type of KMS they should adapt. Šajeva (2010) also suggested that every KMS has different behaviour and factors and therefore, KMS developers will need to know how to develop KMS that are able to fit-in the organisational strategic needs and take the correct decision of choosing the appropriate tools for KMS to support the organisation. In addition, like any other ICT based system, KMS designs need to be well engineered to be able to function correctly, hence, we need to ensure that it is well engineered and for that purpose, will need to identify and correctly specify its components architecture (Finneran, 1999). This leads us to the conclusion that since the architecture of systems is a combination of engineering art and

engineering science, then its component architecture is a representation of the underlying set of interrelated components that define and describe the required functionality for KM practice inside the organisation, as was previously indicated by Finneran (1999).

2.4 Components architecture

All knowledge-based systems are made up from multiple components (Jennings et al., 1998). In KMS perspective, these components can be also considered as a self-contained, reusable building block that can be used independently or assembled with other components to satisfy enterprise requirements (Finneran, 1999). In addition, another study by Šajeva (2010) has examined the socio-technical approaches from the component's perspective. Figure 6 shows socio-technical approaches that are divided into the social and technological components. The socio approach has components such as management of people and process, while the technological approach has components, such as information and communications technologies (Šajeva, 2010).

Figure 6 The socio-technical approach (see online version for colours)



Source: Šajeva (2010)

From the above approach, we started to have clearer appreciation of KMS component architecture terminologies. During this study, we note the non-existence of important components referred to as 'characteristics'. The 'characteristics' as a component was studied in details by Deve and Hapanyengwi (2014). Our attempt is to split them into social and technical characteristics, as per Assegaff and Hussin (2012) recommendation. Therefore, the characteristics of components have been included for its importance to the KMS architecture. We continued collecting different components from various literature until the end of the exercise reached successfully (refer to Table 1). The summary of terms was listed in Table 2. We note that only two components have single and clear terminologies 'Characteristics and Processes' that are widely used but the rest of components are associated with other similar terminologies which add to the confusion when selecting them by KMS developers if not categorised in one place, as in Table 1.

The collected components terminologies were then summarised in Table 2 so that each set of components has similar terminologies for easy identification and use by the KMS developers.

Table 1 Different components terminologies collected from literature

List of literature related to KMS designs	*Component*	*Examples from literature*	*System aspect*
Tserng and Lin (2004), Abdullah and Selamat (2005), Lin and Huang (2006) and Assefa et al. (2014)	*Model*/Framework/ System/Solutions/ Architecture	KM system/KM solutions/ KMS architecture/KMS model	Social-Technical
Trist (1980), Pan and Scarbrough (1999)	*Socio* Characteristics	Acceptable, useful, up-to-date, sustainable, adaptable to change	Social
Šajeva (2010)	*Technical* Characteristics	Quality, availability, accurate, effective, scalable, upgradable, expendable, secured, flexible, heuristic, etc.	Technical
Abdullah and Selamat (2005), Pinto (2012), Saito and Umemoto (2005), Deve and Hapanyengwi (2014), Tiwana (1999), Šajeva (2010) and Milton et al. (1999)	*Technologies*/ Systems/Solutions/ Functionalities/ Enablers/Instruments	IT, Internet and intranet, like web 2.0; Enterprise 2.0, communication technologies like email, mailing lists, discussion forums, chat and instant messaging, and audio and video conferencing; database management systems and data warehousing; authoring tools like word processors, spreadsheets, presentation and graphic tools; workflow systems, servers, security, others	Technical
Ontrup and Ritter (2008), Gupta et al. (2008), McDermott and O'Dell (2001), Pinto (2012), Ahmad et al. (2007), Tserng and Lin (2004), Lin and Huang (2006) and Saito and Umemoto (2005)	*Tools*/Techniques/ Methods/Applications	Lessons learned, expertise directories or employee yellow pages, communities of practice (CoP) forum, knowledge maps, knowledge repository, e-library, calendar, wiki, others	Technical
Ahmad et al. (2007), Abdullah and Selamat (2005), CEN (2004), Lindner and Wald (2011), Gupta and Govindarajan (2000), Hansen et al. (1999), Orr (2000) and Rus and Lindvall (2002)	*Organisation*/Strategy/ Culture/Environment	leadership, knowledge workers, communities of practice (CoP),goals, ISO9001, structure, strategy, initiatives, services, others	Social

Table 1 Different components terminologies collected from literature (continued)

List of literature related to KMS designs	*Component*	*Examples from literature*		*System aspect*
Saito and Umemoto (2005), Hvorecky (2012), Tammets (2012), Berelson (1952), Sharif et al. (2005), and Abdullah (2008)	*Activities*/Practices/ Mechanisms	Interviews, meetings, capturing, collecting, storytelling, discussions, brain-storming	Verifying, categorising, planning, scheduling	Social
		Self-training, group training, workshops, e-discussions, awareness, rewards ceremonies	Publishing, searching, exploring, analysing	Social
Jennex (2008), Nonaka and Takeuchi (1995)	Processes	Socialisation	Externalisation	Social
		Creating	Storing	
Alavi and Leidner (2001) and Hsia et al. (2006)		Internalisation	Combination	Social
		Sharing	Applying	

Source: Various authors

Table 2 Summary of components terminologies

Characteristics
Technologies/Solutions/Systems/Functionalities/Enablers/Instruments
Tools/Techniques/Applications/Methods
People/Organisation/Culture/Environment
Activities/Practices/Mechanisms
Processes

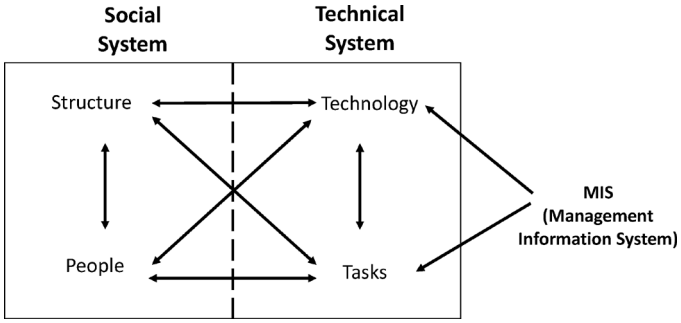
2.5 Components interaction

Since 1977, researchers have identified a strong association between the components of the STS based on the interaction or interface between them. A basic STS components interaction was first introduced by Robert et al. (1977), shown in Figure 7.

In year 2012, another development to the STS interaction concept was introduced by Sofian and Sensuse (2012) on which the emphasis was more focused on the social structure, community and people (individuals), as shown in Figure 8.

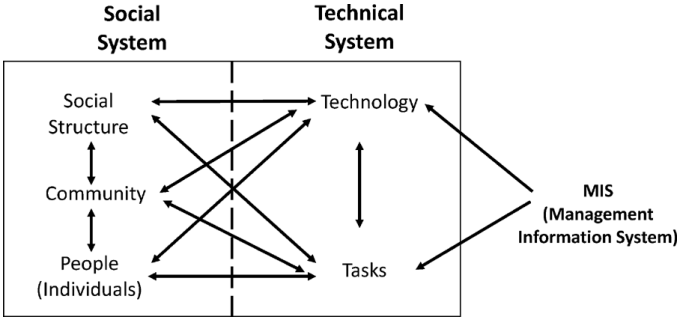
Furthermore, Hester (2012) indicated KMS requires a significant amount of social interaction to facilitate effective knowledge sharing and they are becoming more and more dependent on social interaction. He confirmed system use can be impacted by complex relationships across task, technology, and social concerns. In his study, Hester warned that failure to address these areas with a holistic approach will negatively impact system usage.

Figure 7 Problems and failures: a socio-technical perspective



Source: Robert et al. (1977)

Figure 8 Classic dimension of socio-technical aspects



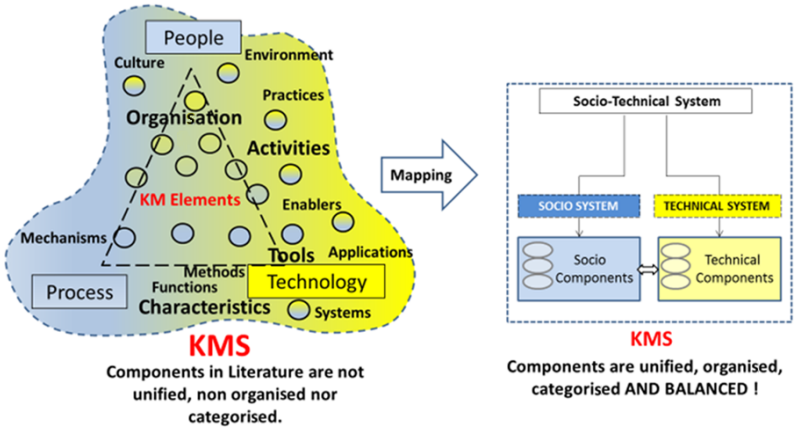
Source: Sofian and Sensuse (2012)

2.6 Components mapping

The system mapping was used as a logical approach for identifying and presenting KMS components in a structured and organised way to categorise them and represent the interaction between them. It is a very useful approach for identifying gaps, duplications, strengths and opportunities, and can inform decision making such as resource allocation (or re-allocation), set goals and track change (CCSA, 2014). Its benefits are also in making complex systems more approachable which are particularly valuable in dealing with the specific problem(s). Furthermore, a well thought-out architecture for the system provides an effective blueprint for the system and leads to the right implementation with little error (CCSA, 2014). Thus, the architecture of the system is its backbone and offers guidelines for its development (Parka and Sugumaran, 2005). With the system mapping approach, we can ensure the development is being carried out in a systematic way through analysing its ultimate design goals, bearing in mind that the implementation of the system is only as good as its design (Parka and Sugumaran, 2005).

Therefore, in order to analyse, identify and organise the KMS components found in literature, it was necessary to map them systematically in order to generate two (2) types of component tables representing the ultimate design goals for KMS socio-technical aspects, as shown in Figure 9.

Figure 9 Mapping of KM elements and KMS components into the socio-technical system aspects (see online version for colours)



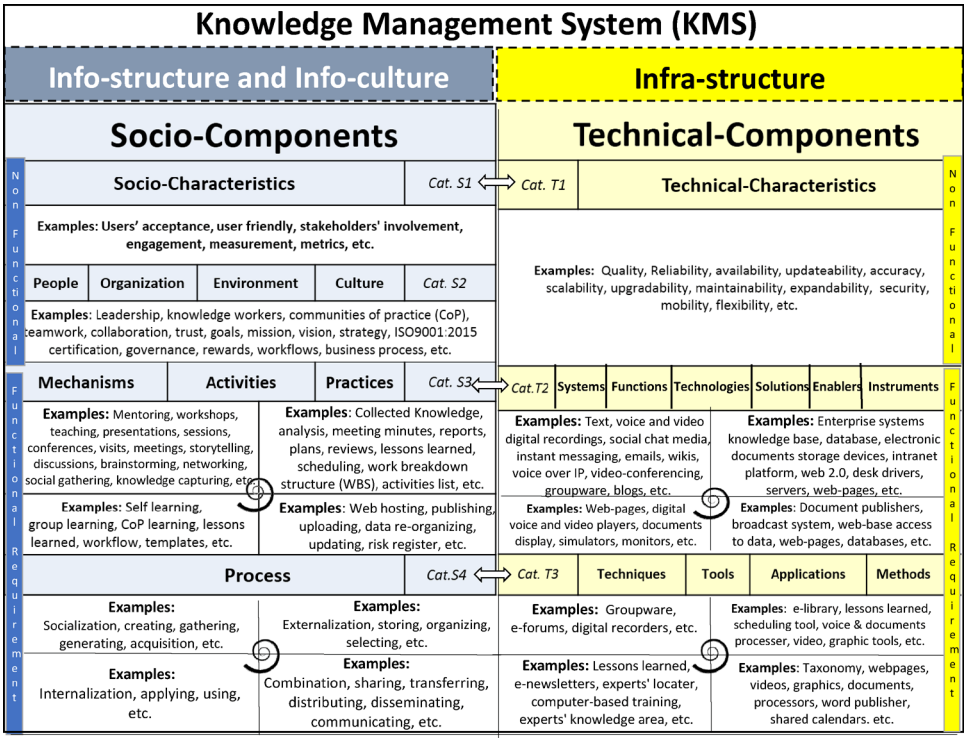
During the mapping stage, we paid special attention to two critical functions of KMS. They are: managing people interaction and managing knowledge/information inside the organisation as suggested by Šajeva (2010). We also made attempt to identify the social and technological characteristics identified by Deve and Hapanyengwi (2014). We labelled and categorised them as main components along with the other well-known components in KMS literature. However, until we produce the final research study outcome, this approach assumes that KMS developers should carefully decide what type of KMS to adapt in their organisations (Šajeva, 2010). Since each KMS is unique for each organisation and has different treatments and factors for attention, the right decision of choosing which tools (as components) to support and enable their KM practice in the organisation is considered a critical decision because it would affect the KMS overall effectiveness and benefit (Šajeva, 2010).

2.7 Proposed new model

The mapping exercise is based on Table 1 that contains various contributions of components from the socio-technical aspects. Those selected examples are relatively fixed in the social side unless new research emerged to add or modify them but they are dynamically changing in the technical side due to technology changes and KMS continues development. The new model is shown in Figure 10 and it was developed by mapping the components found in the literature with the KMS STS aspects in relation to the info-structure (organisation), info-culture (culture) and the infra-structure (hardware and software) components. The model contains two component parts (social and technical) with each part divided into categories that are distributed and arranged carefully for easy selection by KMS developers in their organisations after conducting the users' requirement to build the system. To help developers select the most appropriate components, they were also grouped as functional and non-functional components which will help a lot during the drafting of the system requirement based on user needs. Another feature provided by the model is that it clearly shows where the STS components

are interconnected by arrows in the centre. There are also spirals of knowledge dimensions, which mean that there are continuous movement of knowledge creation between different modes in the model. Those modes are based on the SECI modes (Socialisation, Externalisation, Combination and Internalisation) for knowledge creation and sharing, originally developed by Nonaka and Takeuchi (1995). The KMS model is also supported with practical examples of relevant components of each category for clarity purposes which are indeed useful to the users and developers when drafting the users' requirement. However, those examples are subject to continue updating whenever new technology or theories are generated in literature.

Figure 10 Proposed KMS components architecture model for LO (see online version for colours)



2.8 Component categories

The KMS components architecture are divided into two (2) parts to maintain the STSs aspect. They were labelled and arranged as socio-components and technical-components with their associated sub-components in a categorised type arrangement. The following are the descriptions of the sub-components associated with two STS aspects.

1 The socio-components: are composed of four (4) categories such as:

Cat. 1- Socio-characteristics

Cat. 2- People, culture, environment and organisation

Cat. 3- Activities, practices and mechanisms

Cat. 4- Process.

2 The technical-components: are composed of three (3) categories such as:

Cat. 1- Technical-characteristics

Cat. 2- Technologies, solutions, functions, systems, enablers and instruments

Cat. 3- Tools, techniques, methods and applications.

3 Research methodology

Further research will be conducted to test the model with a sample of stakeholders inside a KM practising organisation. The aim is to test and confirm the new KMS model rather than validate an existing model (Ko et al., 2005). We will test the new KMS model acceptance by the system stakeholders to an extent to which the KMS components can be clearly identified, arranged, categorised and interact with the two socio-technical aspects. The data collection is to be carried out with the mixed method approach based on Triangulation (Qualitative + Quantitative) and the analysis results will be in a form of statistical numbers collected from the quantitative questionnaire with the survey. Partial least squares (PLS) analysis will be used for this study. In addition to this, the survey will be extended to all type of stakeholders (including users, top management, IT supporting group, etc.) to ensure that the strategic goals for KM are supported by all the organisation decision makers (professionals) which will help to guarantee a valid and reliable data collection.

4 Conclusion

This research paper is a presentation of a new KMS model aimed to narrow the literature gap for non-uniformly defined, arranged and categorised KMS based components in accordance with the widely-recognised socio-technical aspects. Indeed, this newly proposed model can be an effective tool for KMS developers in learning organisations (LO) who are seeking for effective learning and change towards a more efficient, innovative and productive work culture. This new model with clearly organised components architecture is beneficial to KMS users and developers for accuracy in selecting and deciding what type of KMS components they should select and adopt based on the organisational business, culture and available resources (Hecht et al., 2011). All of those needs were incorporated into the model.

The final model will be concluded after testing it with aid of a research-based survey to be conducted on a sample of KMS stakeholders located on a large public based organisation in the Kingdom of Bahrain with a KM based strategy to gain wider acceptance on the proposed new model.

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