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The Integrated Knowledge Management Maturity Model

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Abstract: Although many organisations worldwide are introducing knowledge management (KM) practices, there is no generally acknowledged methodology for assessing where the organisation stands, compared to its competitors. Several knowledge management maturity models have been developed, but they are so heterogeneous that the practice is evidently calling for a universal and standardised knowledge management maturity model. Most of the models have something in common: they are all based on the selected KM factors and they all define maturity through different maturity levels. The main goal of this paper is to propose the integrated knowledge management maturity model (I-KMMM) based on literature review. The purpose of determining the model is to set a standard or a framework for future assessment of knowledge management.

Keywords: knowledge management, maturity model

JEL Classification: M110

Introduction

For many companies, the time of rapid technological change is also the time of incessant struggle for maintaining a competitive advantage. It is obvious that knowledge is slowly becoming the most important factor of production, next to labour, land and capital (Sher, Lee, 2004). Even though some forms of intellectual capital are transferable, internal knowledge is not easily copied. This means that the knowledge anchored in employees' minds can get lost if they decide to leave the

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organisation. Therefore, the key objective of management is to improve the processes of acquisition, integration and usage of knowledge, which is exactly what knowledge management (KM) is all about (Jordan, Jones, 1997).

The general problem of the knowledge management theory is that individual researchers define it differently. Maier and Remus (2003) assess that the theory splits into two trains of thought. The first one is found to be more people-oriented, while the second one is more technology-oriented. While closely examining the literature, we run into even more alternative theories, but overall, in the broadest sense, we can define knowledge management as the ability to leverage knowledge for achieving organisational goals (Rubenstein-Montano, Buchwalter, Liebowitz, 2001).

Although many organisations worldwide are introducing KM practices, there is no generally acknowledged methodology for assessing, where the organisation stands, compared to its competitors. Several KM maturity models have been developed, but they are so heterogeneous that the practice is evidently calling for a universal and standardised KM maturity model.

The main purpose of such a model is to measure knowledge management in organisations and to provide a feedback on where an organisation stands in regard to its competitors. Without having a proper measuring system like that, it is almost impossible to manage the knowledge as the most important asset (Ahn, Chang, 2004). Basically, KM maturity tells us where we stand and what areas we need to work on to advance and to use the potential competitive advantage.

The main goal of this paper is to propose the integrated KM maturity model based on literature review.

Measuring Knowledge Management

There are several reasons for the importance of assessing knowledge management maturity in an organisation. Anantatmula and Kanungo's (2006) research shows that such performance measures secure budgetary support for KM implementation, assessing implementation success, providing feedback on implementation and deriving lessons for future implementation. But next to that, measurements of KM systems are crucial to the understanding of how such systems should be developed and implemented and they also show an organisation a good way to compare with competitors. By doing that, an organisation can see what needs to be achieved in order to gain additional competitive advantage. Ahn and Chang (2004) state that it is of utmost importance to measure knowledge. Without having a reliable measurement, a comprehensive theory of knowledge or knowledge assets is very difficult to develop. Consequently, there is no visible progress in the efforts to treat knowledge as a variable to be researched or asset to be managed.

The reasons for determining the level of knowledge management maturity are quite similar to those for measuring effectiveness, efficiency or results of KM efforts in general. The findings proposed by Hefke and Kleiner (2007) indicate that a reference model would help organisations to achieve successful accomplishment of KM based on structured and therefore comparable experience made by others. To define such reference model we used a similar methodology as that used to define business process orientation maturity by McCormack and Johnson (2001), because it is a similar concept that helps organisations assess their current state and plan their future actions.

First, we reviewed the relevant literature and established what the critical success factors for KM are. Secondly, we ascertained which of those CSF are measurable and how each factor contributes to higher or lower maturity levels, and defined the KM maturity measures. Thirdly, we defined the knowledge management maturity model that integrates those factors into a valuable reference model.

Defining Critical Success Factors

Knowledge management related CSF were mostly found in literature by Ahn, Chang (2004), Akhavan, Jafari, Fathian (2006), Anantatmula, Kanungo (2006), Artail (2006), Chourides, Longbottom, Murphy (2003), Davenport, Jarvenpaa, Beers (1995), Degler, Battle (2000), Hefke, Kleiner (2007), Lim, Ahmed (2000), Mason, Pauleen (2003), Moffett, McAdam, Parkinson (2003), Nonaka, Takeuchi (1995), Robinson et al. (2006) and Turban, Aronson (2001).

The list of assessed critical success factors includes: KM strategy, education of KM users, support of leadership, business process reengineering, knowledge networks, dissemination and transfer of knowledge, organisational climate, pilot projects, capturing and revision of knowledge, organisational knowledge architecture, macro environment, use of information technology tools for KM, people, measuring the effects of KM, quality assurance and marketing.

Defining Measurable KM Factors

After having defined the critical success factors of knowledge management, we did a thorough research to measure which of those CSF and possibly new KM factors were already used as measures in other empirical researches. Such measurements were mostly found in the studies by Almashari, Zairi, Alathari (2002), Choi, Poon, Davis (2006), Darroch (2003), Jordan, Jones (1997), Law, Ngai (2007), Lee, Choi (2003), Lee, Lee, Kang (2005), Marqués, Simón (2006), Moffett, McAdam, Parkinson

(2003), Salojärvi, Furu, Sveiby (2005), Syed-Ikhsan, Rowland (2004) and Tseng (2006).

While assessing the factors and determining, whether they could make a good measure of KM, we grouped them into three categories - knowledge, organisation and information technology (IT) related factors. The paragraph below lists measurable factors that were found in literature.

The knowledge-related factors are accumulation, utilisation, sharing and ownership of knowledge. The organisation-related factors are KM strategy, organisational learning, environment, people, organisational climate and processes. Lastly, the IT-related factors are capturing knowledge and using IT tools.

Defining Knowledge Management Measures

Defining knowledge management measures meant combining the first step (defining critical success factors) with the second step (defining measurable factors). By doing such cross-section, we composed a list of measurable CSF that were used in the empirical research in the past, and were analysed with the exploratory factor analysis and validated as good constructs for measuring KM.

During further research some of the factors from previous sections and were excluded from the list because they failed to meet the required terms (as measurability) or did not fit into any of the three defined categories (knowledge, organisation and IT).

Table 1: Review of knowledge management measures and their authors

FACTOR	DIMENSION	AUTHOR	
I. KNOWLEDGE	knowledge accumulation	internal or external, occasional or intended, through externalisation or internalisation	Akhavan, Jafari, Fathian (2006), Almashari, Zairi, Alathari (2002), Artail (2006),
	knowledge utilisation	individual or group knowledge, learning from previous experience or innovative solutions, experimental or theoretical, to solve current issues or to perform a radical change	Choi, Poon, Davis (2006), Darroch (2003), Degler, Battle (2000), Jordan, Jones (1997), Law, Ngai (2007), Lee, Choi (2003),
	knowledge sharing	informal or formal, narrow or broad	Lee, Lee, Kang (2005), Mason, Pauleen (2003), Nonaka, Takeuchi (1995), Robinson et al. (2006), Salojärvi, Furu, Sveiby (2005).
	ownership of knowledge	individual or group identity, specialist or general sources of knowledge, knowledge networks	

2. ORGANISATION	strategy, plans and realisation of knowledge management systems	clear and concise strategy and plans as the foundation for reaching KM objectives and as a tool for obtaining competitive advantage	Ahn, Chang (2004), Akhavan, Jafari, Fathian (2006), Almashari, Zairi, Alathari (2002), Anantatmula, Kanungo (2006), Artail (2006), Chourides, Longbottom, Murphy (2003), Davenport, Jarvenpaa, Beers (1995), Gooijer (2000), Hefke, Kleiner (2007), Lee, Choi (2003), Lim, Ahmed (2000), Marqués, Simón (2006), Mason, Pauleen (2003), Moffett, McAdam, Parkinson (2003), Robinson et al. (2006), Salojärvi, Furu, Sveiby (2005), Starns, Odom (2006), Syed-Ikhsan, Rowland (2004), Tseng (2006), Turban, Aronson (2001).
	organisational learning	centralised or formalised	
	environment	technology changes, politics, organisation as a global system	
	people and organisational climate	values, trust, motivation, creativity, team work, collaboration, role of employees and managers in decision-making, development of innovative culture etc.	
	processes	execution, business process reengineering, connections between internal and external processes	
3. INFORMATION TECHNOLOGY	capturing knowledge	capturing tacit or explicit knowledge	Akhavan, Jafari, Fathian (2006), Almashari, Zairi, Alathari (2002), Artail (2006), Choi, Poon, Davis (2006), Chourides, Longbottom, Murphy (2003), Darroch (2003), Degler, Battle (2000), Jordan, Jones (1997), Lee, Choi (2003), Moffett, McAdam, Parkinson (2003), Robinson et al. (2006), Salojärvi, Furu, Sveiby (2005), Sher, Lee (2004), Starns, Odom (2006), Syed-Ikhsan, Rowland (2004), Wu, Wang (2006).
	usage of information technology tools	quality of tools, quality of information, user satisfaction, usage, benefits, efficiency, accessibility etc.	

Source: Literature review, 2007.

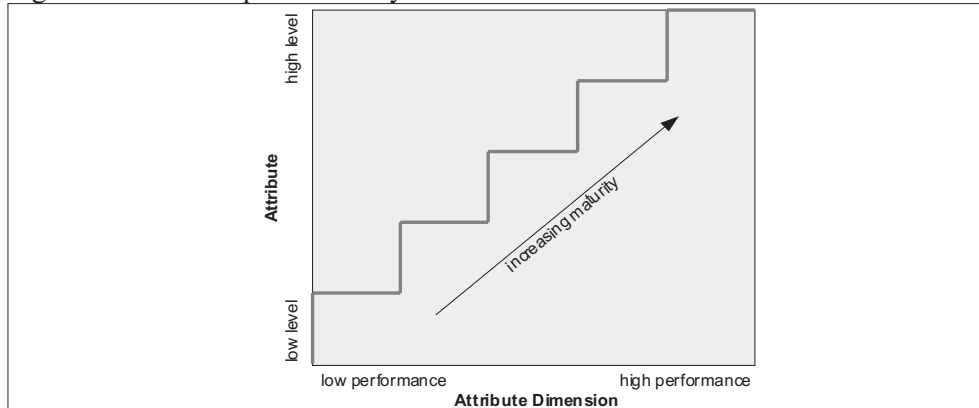
Table 1 shows the review of measurable CSF and their authors (in alphabetical order). The Factor column lists the measurable factors, the Dimension column shows a description of that factor, and the Author column lists the relevant authors in alphabetical order.

Knowledge Management Maturity Concept

Before defining a knowledge management maturity model, it is important to understand what a maturity concept is about. Kulkarni and Louis (2003) conclude

that KM maturity is the extent to which an organisation consistently manages its knowledge assets and leverages them effectively. Therefore, KM maturity is used to measure the level of compliance with a standard set of KM processes.

Figure 1: The concept of maturity



Source: Robinson et al., 2006.

The maturity concept proposed by Robinson et al. (2006) is shown in Figure 1. The vertical scale indicates the key attributes of KM from low to high activities (e.g. the activity of understanding the concept of KM could be assessed as low or high). The horizontal scale shows attribute dimensions from low to high performance (e.g. the attribute “resources” could vary from limited to sufficient). By increasing the number of high level activities of KM (such as measurement) while decreasing the number of low level activities (e.g. understanding the concept of KM) and by increasing the performance of attribute dimensions (e.g. from limited to sufficient resources), we increase the maturity level of a given organisation.

Authors define five stages of KM maturity:

- Start-up stage (1); the organisation is characterised by only a few KM activities;
- Take-off stage (2); the organisation’s KM strategy is developed and its development is characterised by the need of KM structure and resources;
- Expansion stage (3); the organisation is increasing visibility of KM leadership and initiatives and is characterised by a more structured approach to address the barriers and risks;
- Progressive stage (4); the performance of KM activities is improving and the organisation is characterised by an increased emphasis on KM measuring methods;

- Sustainability stage (5); the highest stage, where the organisation strives to sustain the performance of KM activities and KM becomes an integral part of the organisational culture.

Rumizen (2002) uses the five-level people capability model developed at the Carnegie Mellon University that was adapted by Hewlett-Packard Consulting. The Carnegie Mellon University model was also used by Kulkarni and Louis (2003) and Martin et al. (2005) to define their Relationship Management Maturity Model with five levels of maturity, as follows:

- Fragmentation and Dissatisfaction (1); addressing the division between business and information technology;
- Facilitation and Co-ordination (2); addressing the gradual identification of knowledge and information needs;
- Transparency and Consistency (3); addressing the full definition of relationship management processes and practices;
- Enculturation and Understanding (4); addressing the better understanding of knowledge and social interactions by staff and a resulting climate change;
- Integration and Participation (5); meaning that the full, or almost full, participation is reached and that people are creative about their use of knowledge, know how to share it and where it is located.

Other maturity models can be found in literature, as Hefke and Kleiner's (2007) five-stage model that is based on Kochikar's Capability Maturity Model for Software, or the Jordan and Jones' (1997) definition of maturity of KM or the Winkelen, McKenzie and McGuigan's (2004) five-step maturity model, based on organisational knowledge flows.

Harris (2006) also defines a KM maturity model, but this one illustrates six levels of maturity. The first one being "Level 0" or "Non-existent" level, in which there are no recognisable processes in place and no strong awareness of KM opportunities to be addressed. The second stage, "Level 1" is called "Initial", where the organisation recognises an opportunity in KM, but there is still a lack of real effort in pursuing it. Level 2 named as "Repeatable" is reached when there are consistent approaches to KM for key applications, and people in different parts of the organisation use similar approaches. The "Defined" Level 3 represents high awareness of KM and a growing use of consistent processes, technology and shared infrastructure. Level 4 is the "Managed" level, when KM is planned and funded on a regular schedule, while Level 5 is "Optimised", meaning that KM is integrated into management practices and knowledge and intellectual assets are managed well.

Going from Level 0 to Level 5 is a process of continual improvement. According to Harris, the focus must be in getting to Level 3 and building a sustainable KM programme. Level 5 is not always achievable or even necessary for every organisation. They also define the three pillars of KM maturity, i.e. strategy and intent, infrastructure and people.

Those are all different approaches, but all of them are fundamentally based on a simple concept shown in Figure 1. Consequently, all of the above mentioned models have something in common: they are all based on the selected KM factors and they all define maturity through different maturity levels. The outcomes of our research show that selecting the factors that comprise a maturity model is the key decision in the assessment of knowledge management maturity. That is particularly significant if we want to test the model empirically, because it is of utter importance that all the factors are measurable and add up to the value of KM maturity in an organisation.

Therefore, before selecting the knowledge management maturity measures we must answer the three questions below:

- Is the given factor defined as the critical success factor of KM?
- Is the given factor measurable?
- Is the given factor appropriate for classifying organisations into maturity levels?

Evaluating Knowledge Management Measures

At this point we can go back to our factors (knowledge-, organisation- and IT-related). After being subjected to the three-question test, eight of them were chosen to form the KM maturity model. We eliminated the strategy and the environment factors because they are difficult to measure. The findings proposed by Choi, Poon and Davis (2006) include strategy as a measurable factor, but the measures focus only on determining the type of KM strategy and not on its impact or effectiveness. And we also found a questionnaire for measuring environmental issues by Darroch (2003), but it was meant to measure a response of an organisation to changes on the market and not its impact on KM.

Thus, the eight chosen factors that build the KM maturity model are:

- Knowledge-related (accumulation, utilisation, sharing and ownership);
- Organisation-related (people & organisational climate and processes);
- IT-related (capturing knowledge and usage of IT tools).

To fulfil the third-question requirement, we determined how each factor affects knowledge management. The conclusions are stated below:

1. Knowledge

- **Accumulation:** the higher the effectiveness of knowledge accumulation (internal, external; through internalisation or externalisation) in an organisation, the greater the KM maturity (Choi, Poon, Davis, 2006; Almashari, Zairi, Alathari, 2002; Lee, Choi, 2003; Lee, Lee, Kang, 2005; Darroch, 2003; Rumizen, 2002; Salojärvi, Furu, Sveiby, 2005);
- **Utilisation:** the higher the effectiveness of utilising the (existing) knowledge in an organisation, the greater the KM maturity (Kulkarni, Louis, 2003);
- **Sharing:** the higher the effectiveness of sharing of knowledge (formal or informal), the greater the KM maturity (Lee, Lee, Kang, 2005; Salojärvi, Furu, Sveiby, 2005; Rumizen, 2002; Jordan, Jones, 1997; Hefke, Kleiner, 2007; Winkelen, McKenzie, McGuigan, 2004; Kulkarni, Louis, 2003; Darroch, 2003);
- **Ownership:** the better the accessibility of knowledge, the greater the KM maturity (Almashari, Zairi, Alathari, 2002; Lee, Choi, 2003; Hefke, Kleiner, 2007).

2. Organisation

- **People & Organisational climate:** the better and higher the trust, creativity, team work and collaboration among employees, the greater the KM maturity (Lee, Choi, 2003; Salojärvi, Furu, Sveiby, 2005; Martin et al., 2005; Robinson et al., 2006; Kulkarni, Louis, 2003);
- **Processes:** the more the KM activities are integrated into processes, the greater the KM maturity (Salojärvi, Furu, Sveiby, 2005; Rumizen, 2002; Martin et al., 2005; Robinson et al., 2006; Kulkarni, Louis, 2003).

3. Information Technology

- **Capturing knowledge:** the higher the level of capturing knowledge (explicit or tacit) with information technology tools, the greater the KM maturity (Lee, Choi, 2003; Choi, Poon, Davis, 2006; Lee, Lee, Kang, 2005);
- **Usage of IT tools:** the higher the quality of tools, quality of information, user satisfaction, usage and accessibility, the greater the KM maturity (Almashari, Zairi, Alathari, 2002; Artail, 2006; Sher, Lee, 2004; Lee, Choi, 2003; Wu, Wang, 2006; Salojärvi, Furu, Sveiby, 2005; Martin et al., 2005; Kulkarni, Louis, 2003; Darroch, 2003; Sherif, Hoffman, Thomas, 2006).

Some researchers assess maturity levels based upon only one factor and its level of development. Winkelen, McKenzie and McGuigan (2004) mostly base their

measurement upon knowledge flows, while Rumizen (2002) bases the measurement upon integration of KM activities into business processes.

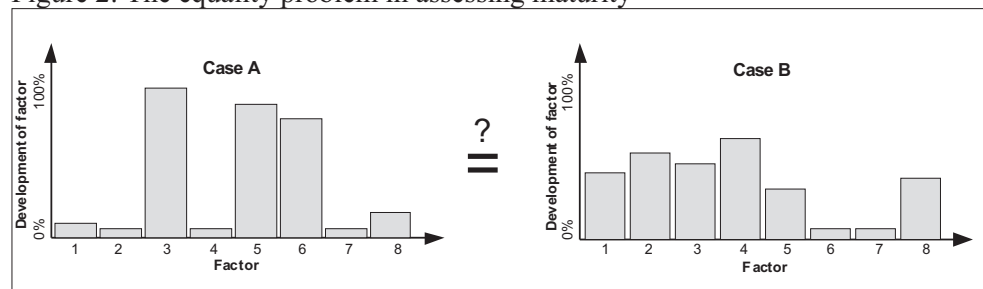
It is of utmost importance to determine, whether the KM maturity levels are going to be based upon one or several factors. We propose that the model should consist of more than one factor, because our findings show that:

- One factor cannot represent a general situation of KM maturity in an organisation because the latter is dependent on more than one CSF.
- Some factors are interdependent and cannot be taken out of context (e.g. high quality of IT tools does not yet mean there is an adequately developed organisation climate to support the use of it).

There are several important interdependencies to be considered, like the influence of organisational climate and technological infrastructure on KM (Moffett, McAdam, Parkinson, 2003), the influence of accessibility of knowledge and organisation climate on transfer of knowledge (Syed-Ikhsan, Rowland, 2004), the influence of people on successful KM strategy (Marqués, Simón, 2006), the influence of social capital on knowledge accumulation and transfer (Sherif, Hoffman, Thomas, 2006) or the influence of people skills on the processes of creating and accumulating knowledge (Lee, Choi, 2003).

The literature review demonstrates that it is better to take several factors into consideration when measuring knowledge management maturity, but by doing that, another question quickly arises: Is the Case A organisation, in which three of the given eight factors are highly developed and the other five are not developed, more mature (from the KM point of view) than the Case B organisation, in which six of the given eight factors are moderately to highly developed? The problem is shown in Figure 2.

Figure 2: The equality problem in assessing maturity



The equality problem in assessing maturity is related to the fact that both of our compared case organisations exhibit similar (average) levels of performance. Thus,

we may wonder, which is actually better in introducing knowledge management. If we keep in mind that some factors are interdependent and that high performance of one factor without the other is not so successful after all, we can perhaps conclude that the Case B organisation is better situated than the Case A organisation.

Therefore, when using a maturity model we always have to keep in mind that one of its limitations is that the same average values of maturity do not necessarily mean the same maturity in practice.

Our maturity model will be based on three groups of measurable and interdependent factors. From literature we can establish that there are at least two strong connections among them:

1. The connection between the ORGANISATION and KNOWLEDGE-related factors

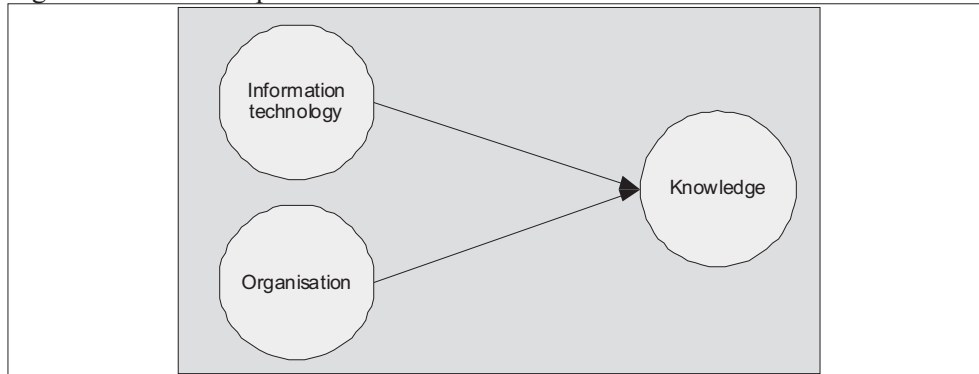
- the better the collaborations among employees, the better the processes of creating knowledge (Lee, Choi, 2003);
- the better the trust among employees, the better the processes of creating knowledge (Lee, Choi, 2003);
- the better the organisational climate, the better the transfer of knowledge (Syed-Ikhsan, Rowland, 2004);
- the organisational climate directly affects the knowledge management practices (Moffett, McAdam, Parkinson, 2003).

2. The connection between the IT and KNOWLEDGE-related factors

- the better the use of IT tools, the better the knowledge creating processes (Lee, Choi, 2003);
- extensive use of IT tools has a positive relationship with the performance of knowledge transfer and the creation of knowledge assets (Syed-Ikhsan, Rowland, 2004);
- technological infrastructure directly affects the knowledge management practices (Moffett, McAdam, Parkinson, 2003).

Due to the interdependence of the three groups of factors as shown on Figure 3, we named our model The integrated knowledge management maturity model (I-KMMM).

Figure 3: The interdependence between factors in I-KMMM



The facts about the I-KMMM are as follows:

- The integrated knowledge management maturity model (I-KMMM) is based on several measurable critical success factors, which are classified into three categories: knowledge-related, organisation-related and IT-related factors.
- All three groups of factors are equivalent, and we will not make any analytical differences between them, but will keep the limitations of the model in mind.
- The level of maturity in an organisation will be determined empirically and based on self-assessment. According to Conway and Huffcutt (1997) it must be kept in mind that the limitation of self-assessment methods is a slightly positive deviation from the overall estimate.

The Integrated Knowledge Management Maturity Model

The overview of literature as presented in this section shows, among other things, that most knowledge management maturity models are missing the Gartner's "zero" level (Harris, 2006), being the state, in which the given organisation has no recognisable KM processes and there is no awareness of potential KM activity opportunities. Maturity models must include that level and organisations need to strive to reach the highest level of maturity possible, keeping in mind that the top level of maturity is not necessarily achievable. Therefore it must be ensured that KM is fully integrated into management practices and that the goals of key enterprise initiatives are in creating and managing intellectual capital. To conclude, the pillars of KM (in Harris' case defined as strategy and intent, infrastructure and people, and in our case, defined as information technology, organisation and knowledge) need to be fully inter-connected, strongly supported by each other and integrated into management practices.

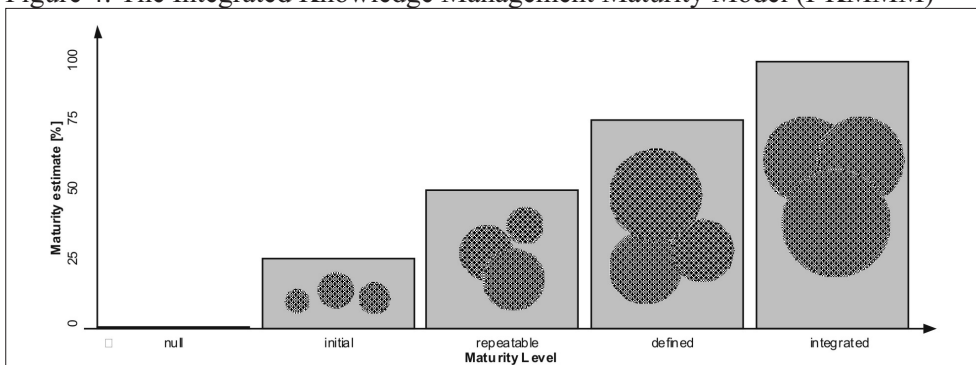
Based on the limitations of the model, we cannot make any differences among the ‘pillar’ factors, which compose the I-KMMM. Therefore, it is not important which factor is more developed than others, but what the average or the aggregate level of maturity in a given organisation is. We defined the KM maturity scale, which consists of five levels, as shown in Tabel 2.

Table 2: Five maturity levels of I-KMMM

LEVEL	DESCRIPTION
4 Integrated	There is a very high perception of KM performance in the organisation and the estimate of KM potential is assessed to lie between 75 % and 100 %. Such result clearly shows that all three groups of factors are highly managed, strongly inter-connected and, consequently, integrated into organisation’s management practices.
3 Defined	There is a high perception of KM performance in the organisation and the estimate of KM potential is assessed to be above 50 % to 75 %.
2 Repeatable	There is a moderate perception of KM performance in the organisation and the estimate of KM potential is assessed to be above 25 % to 50 %.
1 Initial	There is a basic perception of KM performance in the organisation and the estimate of KM potential is assessed to be above 0 % to 25 %.
0 Null	In the organisation there is no perception of KM performance and the estimate of KM potential is assessed to be 0 %.

The I-KMMM is graphically illustrated in Figure 4. The rectangles represent the estimate of KM maturity in an organisation, while the three circles inside represent the three groups of chosen CSF (the size of them is not relevant).

Figure 4: The Integrated Knowledge Management Maturity Model (I-KMMM)



Conclusions

The main goal of this paper was to propose the integrated knowledge management maturity model (I-KMMM) based on the literature review. The I-KMMM is based on several measurable critical success factors, which are classified into three categories: knowledge-related, organisation-related and IT-related factors.

The purpose of determining the integrated knowledge management maturity model is to set a standard or a framework for future assessment of knowledge management. The results of our past and current research demonstrate that the I-KMMM is ready to be empirically tested, as a measure of KM maturity.

According to literature examined in this paper, KM practices have a positive influence on business performance. Such influence is not easily measurable (Ahn, Chang, 2004) and the results depend on the chosen research methodology (Sherif, Hoffman, Thomas, 2006). These issues will be explored in future research using the Structural Equation Modelling (SEM) methodology, which is used to test and estimate casual relationships.

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