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Knowledge Integration and the Integration of Knowledge Management in the Organisation

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Hertfordshire Business School Working Paper (2014)

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Abstract

New knowledge is constantly created in the organisation, yet most do not realise the benefit of this new knowledge. Indeed, knowledge integration has been one of the key failures for Knowledge Management (KM) practice. In this paper, we propose a model of knowledge integration which encapsulates current thinking on the subject. We then use a case study to highlight some of the challenges experienced by organisations in their attempts to integrate knowledge. The upshot of our proposal is that integration of knowledge should be aligned to a wider KM philosophy and culture in the organisation instead of being regarded as a single and disparate activity within the KM process.

Key words: Knowledge, Knowledge Management (KM), Integration, KM culture, knowledge transactions, hoarding.

Introduction

Knowledge integration is the process of combining knowledge across business entities, for example teams, business units, departments and organisations in order to enhance organisational capabilities (Grant, 1996; Andreu and Seiber, 2005). The primary objective of knowledge integration is achieving a net learning effect in the organisation. Beyond this, knowledge integration creates new organisational capabilities, or in the very least, helps to identify previously un-noticed relationships that have the potential to enhance the functioning of the organisation as a whole. Therefore it has the potential to enhance an organisation's ability to create competitive advantages through the creation of new capabilities or simply the streamlining of process that comes with integrating business units (Andreu and Seiber, 2005). The focus is mostly on accessing the personal knowledge of employees and making it explicit through direction, procedures and routines (Grant, 1996). However, the use of procedure and routine as a mechanism for knowledge integration poses challenges for organisations as routine is synonymous with sameness and repetition. It is therefore likely that organisations may struggle with achieving a good balance between embedding existing knowledge and incorporating new ideas and knowledge into organisational practice. In this paper we explore

a number of perspectives on knowledge integration in order to fully understand the organisational point of view. To that end a brief discussion of knowledge types is undertaken in order to help the reader understand the integration process better. Furthermore, we examine the concept of knowledge integration and emphasise its importance as a core part of the KM process/activities of an organisation. We also juxtapose the theory of knowledge integration and practice in order to highlight the key challenges faced by organisations in implementing effective Knowledge Management practices that integrate new knowledge into well-established and sometimes rigid work processes. The upshot of our argument is that knowledge integration is not an activity that takes place at designated or scheduled times; it is an on-going part of a wider Knowledge Management (KM) effort within the organisation which has links to other activities that make up a holistic KM philosophy. In other words effective knowledge integration requires a conscious effort within the organisation to identify, share, safeguard and apply a range of information and knowledge that is relevant to organisational processes. We therefore posit that effective knowledge integration is dependent on the extent to which KM is integrated as part of the wider organisational management philosophy i.e. to say KM is not considered as a separate function in the organisation but has been “integrated” into daily operations. Finally, we propose a conceptual model that illustrates this argument and use a case study to support the assertions presented.

Knowledge Types and Knowledge Integration

There are two types of knowledge commonly referred to in KM literature: explicit and tacit although some have referred to implicit or latent knowledge (Beckman, 1999, Eppler, 2001). Explicit knowledge is fully encoded, conveyed by signs and symbols and hence shareable. It has been defined as knowledge that is transmittable in formal languages, mathematical equations or symbols. It can be expressed in forms of documents, manuals, computer codes and verbal languages, etc. (see Boisot, 1998; Nonaka and Takeuchi, 1995). Conversely, tacit knowledge is difficult to express externally as duly pointed out by Polanyi “people know more than they can say” (Polanyi, 1966). This type of knowledge is demonstrated by one’s skills, experiences and beliefs. A further distinction which is equally important to the discussion on knowledge integration is that between individual and group/collective knowledge (Cook and Brown, 1999; Spender and Grant, 1996). Collective knowledge is often associated with shared knowledge within communities, and is considered to be socially constructed (Berger and Luckmann, 1966). It follows, therefore, that culture, language, and a shared context is important to develop collective knowledge. The discussion of knowledge

types is particularly important because it helps to illustrate the dynamics of knowledge integration. In order to demonstrate our argument, we consider the application of knowledge in an operational context. An organisation possesses a vast amount of explicit knowledge in the form of manuals, flowcharts, etc. This type of knowledge can also be considered to be group or collective knowledge as it is in the public domain and available as a resource to the community. Tacit knowledge on the other hand is internal to an individual and is less accessible to the whole organisation except through its application to a particular operational process. Typically, tacit knowledge is less imitable and hence it is conceivable, for example, that two engineers may complete a task differently with varying degrees of quality regardless of having access to similar instructional manuals (explicit knowledge). While in most cases this is acceptable and perhaps inevitable, it is desirable to have consistency of quality in operations, more-so in some organisations than others. In such an instance, the focus of knowledge integration is directly linked to knowledge development activities where an organisation seeks to tap into the tacit knowledge of experts and develop those particular skill-sets in the entire organisation (see Kapofu et al, 2008). In this way, the organisation protects itself against knowledge atrophy that may result from resignations and retirements. A different but equally important scenario that illustrates the interplay in knowledge types in the organisation is the situation whereby bottlenecks and/or inefficiencies in process necessitate the creation of knowledge which is process-related. Typically, knowledge of this nature is not immediately captured and integrated into procedure for various reasons ranging from time pressure to a culture of knowledge hoarding. The usual outcome is the continuous re-invention of solutions which wastes resources. The other end of this scenario is that any type of newly created knowledge is captured resulting in the organisation being overwhelmed by the amount of knowledge being produced (see Remus and Schub, 2003). Furthermore, there is an assumption that shared or transferred knowledge will automatically be applied to business processes without due consideration for how it will be received, interpreted and subsequently integrated into the process. Therefore the challenge in the first instance is for organisations to identify the key knowledge that is truly value-creating. The second is to subsequently identify appropriate mechanisms to routinize it. It has been suggested that different types of knowledge require different “trajectories” of integration (Andreu and Seiber, 2005) suggesting that different kinds of mechanisms are more efficient than others in integrating knowledge, depending on knowledge type i.e. tacit or explicit. In spite of all the above challenges, the biggest barrier to knowledge integration remains the inability to embed

new knowledge long enough to realise the benefits of routinisation, but also to renew practice in time in order to stay competitive and innovative (Kapofu, 2009).

In each of the above scenarios, there is a constant interplay between individual and collective as well as explicit and tacit knowledge. The role that knowledge integration mechanisms play is that they make the tacit and individual collective and explicit. In effect, the more collective the knowledge base in an organisation, the more integrated the knowledge will become either as organisational culture, values and/or part of operational procedure. We also note the different levels of integration that emerge: firstly the integration of new and old process knowledge, secondly the integration of tacit and explicit knowledge and finally the integration of personal and collective knowledge. The illustrations also demonstrate how knowledge integration dovetails with other KM activities that are more widely referred to in extant KM literature. Therefore the success or failure of knowledge integration activities in an organisation is determined by the embeddedness of a KM philosophy in the organisation and the degree to which KM activities and, likewise knowledge integration, are practiced. An investigation into knowledge integration within the organisation is therefore necessary in order to gain a deeper understanding of the relationships that exist between knowledge types, processes of integration and other social dynamics that exist as knowledge is primarily accessed from people.

Knowledge Integration: some models

In their discussion of knowledge creation in the organisation, Nonaka and Takeuchi (1995) identified four modes of knowledge creation which are socialization, externalization, combination and internalization (the SECI model). The SECI model has generally been accepted in KM literature in the field of knowledge creation and management and is now adopted into a variety of research spectrum including social disciplines (Van Krogh, Ichijo and Nonaka, 2000). In the SECI model the spiral illustrates the relationship between tacit and explicit knowledge; *“this spiral illustrates the creation of a new concept in terms of a continual dialogue between tacit and explicit knowledge. As the concept resonates around an expanding community of individuals, it is developed and clarified”* (Nonaka, 1994 p.16). The socialization mode involves conversion of tacit to tacit through social interactions and shared experience among organisational members. The combination mode refers to the creation of new explicit knowledge by merging, categorizing, reclassifying and synthesizing existing explicit knowledge. Externalization refers to converting tacit to explicit knowledge while internalization refers to explicit converting to tacit knowledge). Although Nonaka and

Takeuchi's work is a model for creation of knowledge, it cannot be separated from the integration of individual and collective knowledge in a process described as a dialectic interaction of different perspectives (Nonaka and Toyama, 2003). The knowledge creation process is initiated by the enlargement of the individuals' knowledge within the organisation where personal subjective knowledge is validated, connected to, and synthesised with others' knowledge (Nonaka and Takeuchi, 1995). Hence there is a continual metamorphosis of individual and group knowledge as long as these activities are allowed to continue uninterrupted. Nonaka and Takeuchi's model focuses on the dialogue and interactions of individuals within a community. It is therefore rational to suggest that creation and integration are enhanced by environments where such interactions are more frequent and even enhanced. We refer to these exchanges as knowledge transactions. A knowledge transaction occurs when an exchange of knowledge is completed; i.e. when transferred knowledge is adequately accessed, synthesised with existing knowledge and applied. It follows that the more knowledge transactions that take place in an organisation, the more integrated knowledge becomes. Equally, the more knowledge transactions in an organisation, the less knowledge lag between individual and collective knowledge. A key challenge is creating the right conditions in the organisation whereby these interactions are fully exploited. A further rational suggestion is the need to incorporate appropriate technologies that augment individual cognitive capacity when managing and integrating large volumes of explicit knowledge.

Cook and Brown's (1999) "generative dance" also describes the creation of new knowledge. Their perspective of knowledge creation illustrates the interaction between the knowledge types, particularly tacit and explicit. However they go further to submit that this interaction between knowledge types occurs as one interacts with their work environment. The "generative dance" is presented as an evolutionary process taking place as organisations continuously find better ways to improve their processes; both tacit and explicit knowledge are created. With regards to knowledge integration, they highlight the continuous combination of new and old knowledge that results when new knowledge is generated as an employee interacts with their work activities. Therefore the need arises to continuously combine knowledge; new and old, tacit and explicit, individual and collective in order to update organisational knowledge, continuously improve, avoid "re-inventing the wheel", and to innovate in terms of products/services or processes. Cook and Brown's contribution suggests that created knowledge is context specific process knowledge. It is therefore rational

to suggest that successful integration of knowledge of this nature requires the use of a feedback loop; hence process monitoring mechanisms are of paramount importance.

The SECI model and Cook and Brown's generative dance overlap and complement each other; together they provide a holistic theory of knowledge creation and integration. This is true despite the fact that Cook and Brown (1999) reject Nonaka and Takeuchi's (1995) assertion that knowledge is "converted" from one form to another. It is important to emphasise the conditions for knowledge integration we identify from the two models which together encapsulate a holistic theory of integration: firstly, the need for sufficient instances in the organisation where the interaction necessary for the "knowledge transactions" to take place. Secondly, the need for appropriate technologies that support limited individual cognitive abilities. Thirdly, the need for feedback loops that capture necessary data and/or information which triggers the actions to create new ways of interacting with the work environment; hence creating new knowledge. In the next section, we present the knowledge integration efforts in one organisation and highlight emerging challenges for organisations.

The Case of Manufacturing Co.

The context

Manufacturing Co.¹ is a gearbox manufacturing company in the North of England. It manufactures three different types of gearboxes, with fairly steady output produced by repetitive processes. Most processes are done daily, at given times and resources used are mostly the same. The shop floor divides into five sections and twenty-nine teams. The factory has seven hundred and forty employees that are made up of six hundred and forty hourly paid employees and one hundred full-time staff. In the course of our appraisal of Manufacturing Co's knowledge base, we found that there was a substantial rate of process-related data generated. The knowledge and information that was derived from data was used to improve product quality and production efficiency. However, day-to-day manufacturing activities usually do not require nor create substantial amounts of new knowledge except in the cases when Statistical Process Control (SPC) and other Total Quality Management (TQM) techniques are used to control and continuously improve production efficiency. Knowledge used and generated during normal production operations has various characteristics. For example, analyses of SPC charts have a relatively short exploitation time-frame and must be updated regularly. Furthermore, the knowledge extracted from the SPC data was useful not

¹ Name changed for confidentiality

only to the production engineers but also to quality and maintenance personnel. This knowledge was also useful to machine operators, managers, graduate engineers, apprentices etc. The wide range of knowledge users necessitated that knowledge was frequently updated and made accessible as it had a short period from which to extract its utilisation. However, the information and knowledge had a high re-utilisation rate where past work, and procedures for problem-solving were revisited to avoid re-inventing the wheel.

Integration trajectories

In exploring the possible knowledge integration trajectories (see Andreu and Seiber, 2005) in Manufacturing Co, we found that the low variation and repetitiveness of tasks lent itself to traditional mechanisms such as routines, procedure and direction (outlined in organisational manuals and flowcharts) as posited by Grant (1996). Manufacturing Co. had a structured week which was essentially a routinized weekly schedule for undertaking process and knowledge maintenance work. As such most knowledge associated with process was standardised. Notably, the structured week featured an intensive meeting schedule for the production managers with the various teams in Manufacturing Co. Meetings are considered an important knowledge sharing mechanism as exchange of ideas and debate forms an integral part of explicit and tacit knowledge exchange. Furthermore, the integration of new knowledge associated with problem-solving and maintenance of machinery was supposed to be recorded and accessed electronically on a “W-drive,” an internal repository. However, use of the “W-drive” had not been efficient for two reasons: firstly, there was no time to record process work done on machinery and secondly, the initiative stalled unless there was someone in management driving it. The production team revealed that a maintenance coordinator who was responsible for driving the initiative was no longer in the employ of Manufacturing Co. and hence the initiative had suffered. Moreover, regardless of a seemingly structured and fit-for-purpose knowledge management system, Manufacturing Co. was constantly in crisis mode. The most significant symptom of the problem they had was a continuous breakdown of machines. Breakdown and bottlenecks in manufacturing processes are usually an opportunity to create new knowledge to resolve the issues (see Cook and Brown, 1999). Besides the “W-drive” Manufacturing Co indicated that the other significant knowledge integration mechanism in use was their apprenticeship programme. We recognise the potential gains to be realised by use of this mechanism from a knowledge transfer and development perspective (and the transfer of tacit knowledge), nevertheless we found

minimal merit with regards to the integration of newly created process knowledge. What we discovered in Manufacturing Co was that although there was a substantial rate of new knowledge creation (as a result of problem solving), this was not matched with its capture, recording and subsequent integration through re-use.

The challenges and barriers

During interviews with the production team it was found that a barrier to the integration of new knowledge was knowledge hoarding. Employees in Manufacturing Co. were paid overtime rates if they could demonstrate that they were capable of solving the machine breakdown issues affecting production. This situation was summarised by the following interview excerpt:

“If someone knows something he will not share his knowledge so he can get his Saturday. The people that are overtime hungry will not tell you anything or bare minimum. If I tell you how to fix that machine you might come out on Saturday...next week there might be something that you might know so we get into a sparring of not sharing information”.

As a result, employees would not share their know-how out of fear of losing their opportunity to work over the weekends for overtime rates. As such there was an unending cycle of re-inventing the wheel. To add to the knowledge hoarding, the lack of management involvement in driving a KM philosophy throughout the organisation was a major barrier to the integration of new knowledge. While our previous research (Kapofu, 2009) has noted knowledge hoarding and lack of management support as two separate barriers to KM, in the case of Manufacturing Co. we concluded that there was a relationship between the knowledge hoarding culture and lack of management initiative and support for a KM philosophy. We noted that Manufacturing Co had mechanisms and structure in place to support KM, however there was a lack of explicit leadership support to embed KM practice as epitomised by the lack of personnel championing the KM philosophy in the organisation. Knowledge hoarding became the de-facto knowledge culture catalysed by the overtime remuneration structure. The incentive system in Manufacturing Co was clearly a divisive issue and raises an important element for consideration when establishing a KM philosophy in an organisation. Nevertheless, this discussion is beyond the scope of this instalment.

With respect to the use of meetings in Manufacturing Co., we analysed documentary evidence pertaining to the structured week activities and found that out of the whole week, the production management had only 6 hours that were not devoted to meetings. Further

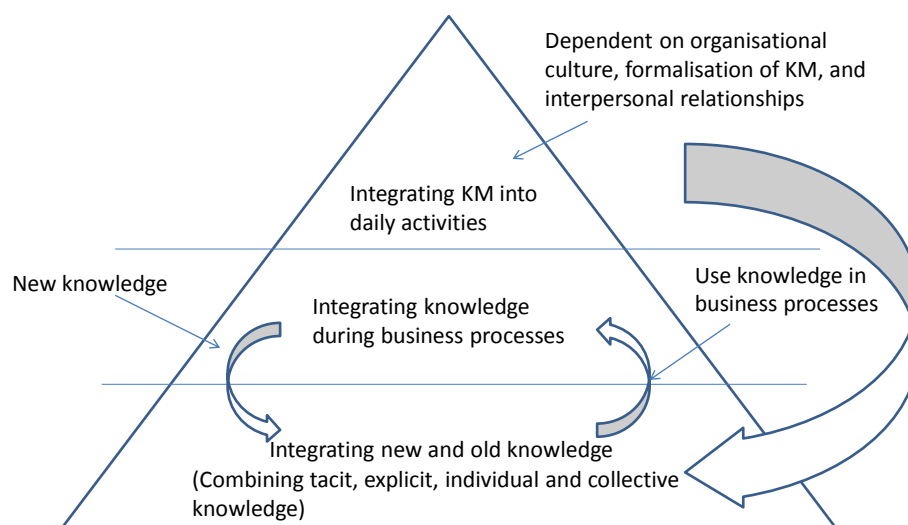
inquiry from one interviewee revealed that there was a problem of “over-implementation” of the structured week. Though the structure is present, it was revealed that there were too many meetings and the organisation was too “regimental” with the process. This is classic example of a situation where implementation of KM activities yields sub-optimal deliverables. As argued by the interviewee, *“you can identify as many problems as you want, unless you have got the time to do it, it is not going to get done...in terms of all this meeting stuff, when am I actually supposed to do anything? Just going round meeting after meeting after meeting...it’s a waste of time to be honest”*.

It is quite clear from the above that Manufacturing Co was aware of the knowledge trajectories that were required in order to integrate the type of knowledge it created. Their use of the “W-drive” repository and meetings (to mention the most significant) as a KM mechanisms for sharing, capturing, storing and accessing large amounts of knowledge is supported by research (for example Binney, 1999; Davenport et al., 1998). However, we noted the inadequate and inefficient use of the mechanisms which resulted in inefficient knowledge integration. The problems we found in Manufacturing Co are not exhaustive but are typical of issues encountered as barriers to knowledge integration in organisations. We emphasise three elements that inform our model of knowledge integration in the organisation. Firstly, the lack of management involvement in fostering a KM philosophy throughout the organisation allowed a knowledge hoarding culture to thrive. KM philosophy does not automatically thrive because there is infrastructure to support it; it thrives where there is explicit support to engender it. Secondly, the organisation missed an opportunity to use the breakdown in production (machine breakdowns) to capture all the solutions and make them available throughout the organisation. This way new knowledge is captured at source and recycled within the everyday production process; effectively combining two seemingly separate tasks. Thirdly, the presence of appropriate knowledge integration mechanisms did not automatically translate to knowledge transactions; hence infrastructure is no guarantee for success. The next section presents our model for knowledge integration.

The Knowledge Integration Model

The integration model has three levels. The broad base of the model represents the broad range and richness of knowledge within an organisation. This is all the knowledge that is present in business units, teams, individuals as well as the manuals, repositories, procedures and directives and policy documents. To refer to the knowledge typology mentioned above, all knowledge types explicit, tacit, individual and collective are represented at this level as are

the various knowledge processes that occur (see the SECI model). The second level of the model represents systemic process related knowledge. This is the organisation's "how-to" knowledge; the core competence which essentially creates value; the operations core knowledge. The top level of integration represents a value system concerning knowledge, the KM philosophy, the knowledge culture and the formalisation of KM in the organisation. Unsurprisingly, this is at the top of the model as the initiation and support of such a philosophy must be visibly supported from the top.



The integration model has interesting inter-relationships depicted by arrows which will now be discussed in greater detail. The top and bottom level of the integration model are related in the sense that a KM culture and value system in the organisation supports the development of the knowledge base that exists in the organisation at the bottom level. Translated into the organisational context, the more explicit and visible the support for a KM philosophy is in the organisation particularly from top management, the larger the knowledge investment in terms of knowledge development, infrastructure and range at the bottom level. It follows that an organisation that has a robust KM value system and culture will translate that into a larger knowledge base which is supported by the right infrastructure and support for interactions that facilitate knowledge transactions to take place. Hence a robust KM culture and philosophy might be evidenced by investment in KM technology, knowledge sharing platforms, etc. An organisation with a robust KM culture will also exhibit a small lag

between individual and collective knowledge. It is important to note, using the example of Manufacturing Co. that the strength of the KM philosophy and culture (at the top level of the integration model) is heavily influenced by interpersonal relationships and as such may be affected by people leaving or joining the organisation. It is therefore important to have teams of KM champions driving the culture rather than individuals (see also Handzic, 2003).

The interchange between level one and two (of the integration model) is best described by Cook and Brown's (1999) "generative dance." Working on business process creates new knowledge as employees discover more effective and efficient methods to complete tasks. This knowledge becomes part of the broad knowledge base of the organisation (which is level one of the integration model). It is important to note that this newly created knowledge can become part of the collective knowledge of the organisation if appropriate sharing channels are used to effect this, otherwise it remains the possession of the individual or team working on that process. In Manufacturing Co. the machine maintenance and problem solving knowledge remained the possession of the engineer working on that machine. Although the knowledge was still part of the organisation's knowledge base, it was individual and not collective knowledge hence Manufacturing Co could suffer impaired performance if the said engineer left the employ of the organisation. As noted above, it is imperative to avoid such situations arising by capturing knowledge at its source, storing it for protection and future access, and use. The continued use and re-use of this knowledge on business process not only completes the knowledge transaction but integrates knowledge into the organisation's process knowledge base. It is our argument that if KM is formalised and integrated as part of the organisational activities then activities that integrate new knowledge whenever it has been created and identified occur naturally (arrow from level two to level one of integration). They are no longer viewed as separate to the day-to-day processes.

Discussion and Conclusion

The model of knowledge integration presented in this paper encapsulates some important KM theories (the SECI model, Cook and Brown's (1999) generative dance, and Grant's (1996) knowledge integration). A critical element to the model is the formalisation of a KM culture which is imperative for efficient integration of knowledge. The cultivation of a robust KM culture creates an environment where (a) the integration of existing multi-disciplinary knowledge (from a variety of business departments) to create new capabilities is possible (b) knowledge that is created from interacting with business processes is incorporated to form part of the daily process (c) KM and operational processes are intertwined. We have

introduced the concept of knowledge transactions and posit that the more knowledge transactions the more the integration of knowledge. A knowledge transaction is completed when transferred knowledge is adequately accessed, synthesised with existing knowledge and applied. We emphasise that completion of a knowledge transaction involves the completion of various knowledge processes (capture, storage, sharing, access and application). Therefore knowledge integration is not a stand-alone KM activity; it is part of a series of KM processes that together constitute a complete KM philosophy.

To summarise our discussion on knowledge integration models we identified the following conditions necessary for knowledge integration: the need for sufficient instances for the “knowledge transactions” to take place; secondly, the need for appropriate technologies that support limited individual cognitive abilities; thirdly, the need for feedback loops that capture necessary data and/or information which triggers the actions to create new ways of interacting with the work environment; hence creating new knowledge. At this point it is necessary to reflect on how Manufacturing Co. matches these three conditions. In the case of Manufacturing Co, we found that the “W-drive” repository and meetings were the most important mechanisms based on the investment and time resources devoted towards them. Nevertheless, both mechanisms had minimal impact on knowledge integration in the organisation. In the first instance, the culture of knowledge hoarding rendered the W-drive repository valueless because employees were not willing to share their knowledge. In the second instance, the sheer volume of meetings created an overload of information which made it difficult to engage the proper process for integration of knowledge and feeding back on progress made. These two challenges typify the difficulties and challenges of integrating knowledge. They highlight the necessity of robust KM culture which becomes the basis for good KM practices which encourage and enhance knowledge transactions.

It is important to note that in the context of the discussion of knowledge trajectories, the mechanisms were found to be appropriate for the knowledge types and context in Manufacturing Co. For example, there is consensus on the appropriateness of repositories to manage large volumes of explicit knowledge (see Binney (1999); Handzic, (2003)). However, as demonstrated above having the appropriate infrastructure in the organisation does not translate to efficient knowledge integration. Clearly, achieving the correct balance between use and effectiveness of KM mechanisms is paramount and supports assertions we have made on the assessment of knowledge management systems (Kapofu, 2009).

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