Determinants of Successful Knowledge Management Programs

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Abstract: The main objective of this paper is to investigate and identify the main determinants of successful knowledge management (KM) programs. We draw upon the institutional theory and the theory of technology assimilation to develop an integrative model of KM success that clarifies the role of information technology (IT) in relation to other important KM infrastructural capabilities and to KM process capabilities. We argue that the role of IT cannot be studied in isolation and that the effect of IT on KM success is fully mediated by KM process capabilities. The research model is tested with a survey study involving 191 KM practitioners. The empirical results provided strong support for the model. In addition to its theoretical contributions, this study also presents important practical implications through the identification of specific infrastructural capabilities leading to KM success.

Keywords: Knowledge Management Success, Infrastructural Capabilities, Process Capabilities, Institutional Theory, Technology Assimilation

1. Introduction

Knowledge management has become an important topic for both research and practice. The adoption of KM has accelerated in recent years[1]. The success of the new KM initiatives, however, is not obvious. There is a need for a better understanding of the prerequisites of successful KM programs. Several frameworks for KM implementation have been proposed in the literature, mainly by practitioners. For instance, Gupta and Govindarajan (2000) proposed a set of practice notes on the use of strategy and organizational culture in achieving KM success. Another example is the model developed by Leonard-Barton (1995), which identified several core capabilities crucial to successful KM initiatives. The former Arthur Andersen and The American Productivity and Quality Center (1996) set forward the major institutional enablers of various KM processes. Most proposed frameworks, however, lack theoretical underpinning and empirical validation.

Information technology is often cited in the literature as an important KM infrastructural capability, enabling or supporting core knowledge activities such as knowledge creation, knowledge distribution and knowledge application (Gold et al., 2001). Holsapple and Whinston (1996), for example, studied the effect of IT on knowledge acquisition and representation. Purvis et al. (2001), on the other hand, investigated the general impact of IT on KM. Most of these studies examined the role of IT in isolation, overlooking its relationships with other KM success factors and the effect of IT assimilation within KM processes.

[1] According to an IDC survey in 2002, 90% of fortune 500 companies have started formal KM programs.

The research objective of this study is therefore to develop a better conceptual model of KM success, capturing the complex interrelationships between IT and other key determinants. We include IT, KM infrastructural capabilities and KM process capabilities as the main success drivers based on the institutional theory (Orlikowski, 1992). To account for the importance of technology assimilation (Fichman and Kemerer, 1997), we postulate that the effect of IT on KM success is not direct but rather fully mediated through KM process capabilities. This approach represents a departure from previous KM studies, which modeled IT as a direct determinant of KM success. To validate the proposed model, we conducted a survey study involving 191 KM practitioners.

In the next section, we present the research model and its theoretical foundation. We then describe the research methodology, followed by a discussion of the empirical results and their implications. In conclusion, we summarize the key findings and suggest directions for future research.

2. The research model

According to the knowledge-based views of the firm (Spender, 1996), organizational effectiveness is an outcome of knowledge creation, explication, communication and application (King, 2003). KM objectives should therefore be derived from general organizational goals. Common benchmarks of KM success include innovativeness, coordination, time-to-market, adaptability and responsiveness to changes (Gold et al., 2001). In this research we define KM success by the extent to which the intended KM objectives are achieved. Our research model (see Figure 1) applies the institutional theory and the theory of technology assimilation in explaining KM success. The institutional theory (Orlikowski, 1992) postulates that individual behavior within an organization is guided by the institutional structures. These structures take the form of, for instance, organizational norms, culture and corporate policies. Previous studies identify three main categories of institutional structures according to their nature, functions and objectives. One type of structures *signifies* the value of the desirable behavior by ensuring that individuals understand the acts required to accomplish organizational objectives. Another type of structures constitutes normative governing mechanisms that verify and *legitimize* personal conducts. Any actions that are within the scope of the firm goals are legitimate. Finally, structures of domination represent regulations with which individuals comply to ensure they do not violate the prescribed firm practice. The institutional structures influence individual behavior through structuring actions introduced at the individual level (i.e. individual structuring) or at the top management level (i.e. metastructuring). The application of the institutional theory in the KM context implies that KM infrastructural capabilities are major factors that align individual behavior with KM goals and hence KM success. Consistent with Gold et al. (2001), we therefore hypothesize that

H_1: KM infrastructural capabilities have a significant positive effect on KM success.

IT has been identified by a number of studies as a major determinant of KM success (e.g. Purvis et al., 2001). The quality and speed of knowledge transfer, for example, is considerably improved with the support of technologies (Ruggles, 1998). Common IT applications employed by firms include intranets, knowledge repositories and group decision support systems. KM tools can be classified into three general categories: generation, codification, and transfer (Ruggles, 1997). Knowledge generation requires tools that enable the acquisition, synthesis, and creation of knowledge. Knowledge codification tools support the representation of knowledge so that it can be accessed and transferred. The capabilities of these tools vary depending on the targeted knowledge – i.e., process knowledge, factual knowledge, catalog knowledge, and cultural knowledge – and on whether that knowledge is explicit or tacit. Types of codification tools include knowledge bases, knowledge maps, organizational thesaurus/dictionaries, and simulators. Knowledge transfer tools alleviate the temporal, physical, and social distances in knowledge sharing. An alternative framework for classifying KM tools and technologies consists of five categories: business intelligence, collaboration, transfer, expertise, and discovery/mapping. Such frameworks can help organizations to select the appropriate technology for a given KM task.

Mere adoption of information technologies, however, does not necessarily achieve its intended purposes. According to the theory of technology assimilation (Cooper and Zmud, 1990; Fichman and Kemerer, 1997), technologies must be infused and diffused into business processes to enhance organizational performance. Assimilation is defined as "the extent to which the use of a technology diffuses across organizational work processes and becomes routinized in the activities associated with those processes" (Tornatzky and Klein, 1982; Chatterjee et al., 2002). It is a key factor that explains the influence of IT adoption on organizational performance (Jarvenpaa and Ives, 1991; Armstrong and Sambamurthy, 1999; Chatterjee et al., 2002). In the initial adoption stage, it is challenging yet users need to reconceptualize business process activities in order to use the technology effectively (Saga and Zmud, 1994; Fichman and Kemerer, 1997; Purvis et al., 2001). These challenges constitute 'assimilation gaps', i.e. the lag of rates of adoption between the organization and individuals (Chatterjee et al., 2002). Successful utilization hence requires, among other things (e.g. ease of use and reduced complexity etc.), mutual adaptation of the technology and the organizational context (Leonard-Barton, 1988; Purvis et al., 2001). In other words, IT must be adapted to the organizational and industrial arrangements (Van de Ven, 1986), while structures and norms may also need to be reformed to facilitate the use of the technologies (Kwon and Zmud, 1987). In the context of KM, IT should therefore become the *enablers* of KM processes to exhibit its effect on KM success. Without such assimilation within the KM processes, IT alone is not sufficient to improve firm performance. We hence hypothesize that IT does not affect KM success directly. Instead, its effect is ***fully*** mediated through KM process capabilities

H_2: Information Technology does not have a significant direct effect on KM success

H_3: Information Technology has a significant positive effect on KM Process Capabilities.

Most prior studies focused on the relationship between the different KM infrastructural capabilities and KM success. Little has been done to capture the relative importance of the various infrastructural capabilities in relation to KM process capabilities. KM processes are defined as “an ongoing set of practices embedded in the social and physical structure of the organization with knowledge as their final product” (Pentland, 1995). Capabilities of KM processes are essential to leverage the KM infrastructure capabilities. Effective KM processes should be conducted frequently, consistently and flexibly (Grant, 1996). Numerous attempts have been made to provide a categorization for KM processes. For example, DeLong (1997) classified the processes into capturing, transfer and use of knowledge. Leonard-Barton (1995), on the other hand, distinguished between acquisition, collaboration, integration and experiment. Nevertheless, these studies failed to capture the relative roles of KM infrastructural capabilities among these processes.

More recently, Gold et al. (2001) modeled both KM process capabilities and KM infrastructural capabilities as direct determinants of organizational effectiveness. Their model was empirically validated using surveys. Analysis of the results indicated that knowledge infrastructural capabilities and knowledge process capabilities have independent and direct effects over organizational effectiveness. The underlying assumption of this study is that successful KM essentially leads to firm competitiveness (Gray, 2001). Though their study represents one of the few endeavors in the development of a comprehensive framework on KM success, they yet did not account for the interrelationships between the KM infrastructure and KM process capabilities.

As the capabilities of KM infrastructure cannot be fully leveraged without the presence of KM process capabilities (Gold et al., 2001), the presence of both KM process and infrastructural capabilities is critical to reach the intended KM objectives. Appropriate KM processes should be implemented to routinize KM values and practice and to enhance knowledge application in daily business procedures (Grant, 1996). We therefore stipulate that KM process capabilities directly affect KM success. More specifically, we hypothesize that

H_4: KM Process Capabilities have a significant positive effect on KM success

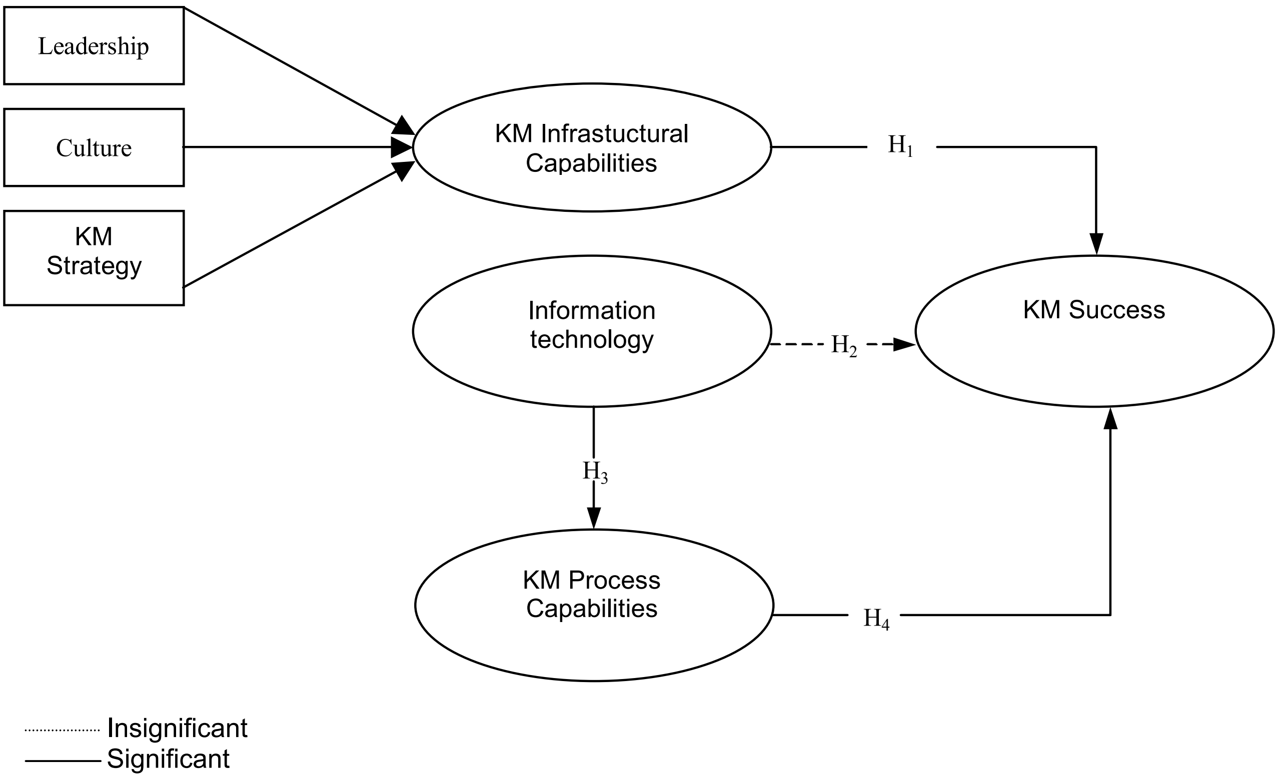

Figure 1: Research model

3. Research methodology and data analysis

We conducted a survey study with existing KM practitioners to validate our research model. The survey instrument consists of both formative items measuring KM process capabilities and reflective items for all other constructs (i.e. KM success, KM infrastructure capabilities and IT). The reflective items were generated from a comprehensive review of the literature and verified following the card sorting procedure proposed by Moore and Benbasat (1991) to ensure face and discriminant validity.

We measured KM infrastructure capabilities using formative items to identify a list of specific key KM infrastructure. This also facilitates and the assessment of their relative importance on KM success, which should be of particular interest to KM practitioners. We derived an initial pool of formative items from previous literature. We then performed a belief elicitation process with existing KM practitioners and added/removed some items based on their comments. Consistent with Gold et al. (2001) and Khalifa et al. (2001), we ended up with three main KM infrastructural capabilities, namely, culture, leadership and KM strategy.

All items are measured using a five-point Likert scale ranging from “strongly agree” to “strongly disagree”. The resulted instrument was pilot tested with current active KM practitioners to ensure its wordings are understandable and its length is appropriate. The final instrument was administered online to 1,000 KM practitioners randomly selected from various online KM discussion forums. After eliminating those with missing values, we totally collected 191 usable observations, amounting to an overall response rate of over 19%.

The data analysis was conducted with Partial Least Squares (PLS) procedure (Wold, 1989), using the technique of PLS Graph (Chin, 1994). These statistical techniques are appropriate for analyses of measurement models with both formative and reflective items. Specifically PLS facilitates a concurrent analysis of 1) the relationship between measures and their corresponding constructs and 2) whether the theoretical hypotheses are empirically confirmed.. The significance of all paths was tested with the bootstrap resampling procedure (Cotterman & Senn, 1992).

We also conducted tests on the measurement model. According to the standard approach, path loadings from constructs to measures are required to exceed 0.70. Internal consistency of the measures was verified using the composite reliability measures (ρ) (Chin, 1998) and the average variance extracted (AVE) (Fornell and Larcker, 1981). Discriminant validity was tested by comparing the square root of the AVEs for a particular construct to its correlations with the other constructs (Chin, 1998).

4. Results and discussion

The measurement model statistics are presented in Table 1. The loadings of all reflective items are high (above 0.7) with significance at 1% level, confirming convergent validity. The composite reliability scores of all constructs are higher than the recommended benchmark of 0.80 (Nunnally, 1978), verifying internal consistency. The weights and their significance of all formative measures indicate that the items contribute significantly to the formation of the construct of KM infrastructural capabilities. A comparison of the square roots of the AVE scores with the correlations among the constructs provided support for discriminant validity.

The results of the PLS analysis are presented in Figure 2. Each hypothesis is plotted as a specific path in the figure. The estimated path coefficients are generated, along with the associated t-statistics. Significant paths are denoted with two asterisks (**) at the 99% confidence interval and with one (*) at the 90% interval. The R^2 statistic is available next to each dependent variable. Significant links are represented by solid lines while insignificant ones are represented by broken lines.

Our research model demonstrates good explanatory power for KM success, with over 75% of the variance explained (R^2 = 75%). As hypothesized in H_1 and H_4, both KM infrastructural capabilities and KM process capabilities are significant drivers of KM success. The effect of KM infrastructural capabilities is, however, more dominant, with a direct path coefficient of 0.540 significant at the 1% level in comparison to KM process capabilities (path coefficient = 0.376; t = 4.05). These results represent a confirmation of the institutional theory (Orlikowski, 1992) that stipulates that knowledge capabilities must be leveraged to achieve organizational effectiveness (Gold et al., 2001).

Table 1: Measurement model statistics

Constructs	*Variables*	Weights	Loadings	Std. Error	T - statistics
KM Infrastructural Capabilities	Culture	0.3312		0.0734	4.5152
	Leadership	0.1200		0.0694	1.7296
	KM Strategy	0.6733		0.0656	10.2588
KM Success (ρ =0.86)	Item 1		0.8888	0.0208	42.6722
	Item 2		0.8941	0.0163	54.8529
	Item 3		0.7807	0.0427	18.2889
Technology Fit (ρ = 0.89)	Item 1		0.9119	0.0167	54.5346
	Item 2		0.8993	0.0183	49.2204
	Item 3		0.8544	0.0259	33.0280
KM Process Capabilities (ρ = 0.88)	Item 1		0.8753	0.0224	39.0618
	Item 2		0.8830	0.0202	43.6549
	Item 3		0.8470	0.0276	30.6649
	Item 4		0.9002	0.0184	48.9532

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Contrary to the results of previous studies (Gold et al., 2001; Goodhue and Thompson, 1995) there is no significant direct effect of IT on KM success, hence verifying H_3 (path coefficient = 0.031; t = 0.63). As hypothesized earlier (H_2), IT affects significantly KM process capabilities, explaining over 32% of the variance of the construct. These results confirm our argument that the effect of IT on KM success should be studied in the presence of KM process capabilities to better assess its relative importance. An important implication of these findings is that IT assimilation within KM process capabilities is critical to the achievement of KM success. Since the effect of IT is fully mediated through KM process capabilities, it should therefore be selected based on the requirement of these processes.

The weights and t-statistics of the formative items are presented in Table 1. KM strategy emerges as the most important infrastructure capability (weight = 0.673). These findings highlight the important role of KM strategy in the implementation of KM initiatives. KM strategy is “the balancing act between the internal capabilities of the firm (strengths and weaknesses) and the external environment (opportunities and threats)” (Zack, 1999). Its formulation involves identifying and assigning value the required KM initiatives. It is an important guideline for prioritization of KM investments (Alavi, 1997; Gopal and Gagnon, 1995). To enhance KM success, a KM strategy should be developed based on the overall business strategy to ensure the KM goals are in congruence with the strategic goals of the firm (Davenport, 1999; Hansen et al., 1999). Such congruence is essential for maximizing KM success and hence organizational performance (Liebowitz and Beckman, 1998). The emergence of KM strategy as the chief infrastructural capability also provides strong support for the adoption of a top-down approach of KM implementation. In other words, the starting point for KM is not some scattered initiatives, but rather a well-defined KM strategy (Horwitch and Armacost, 2002).

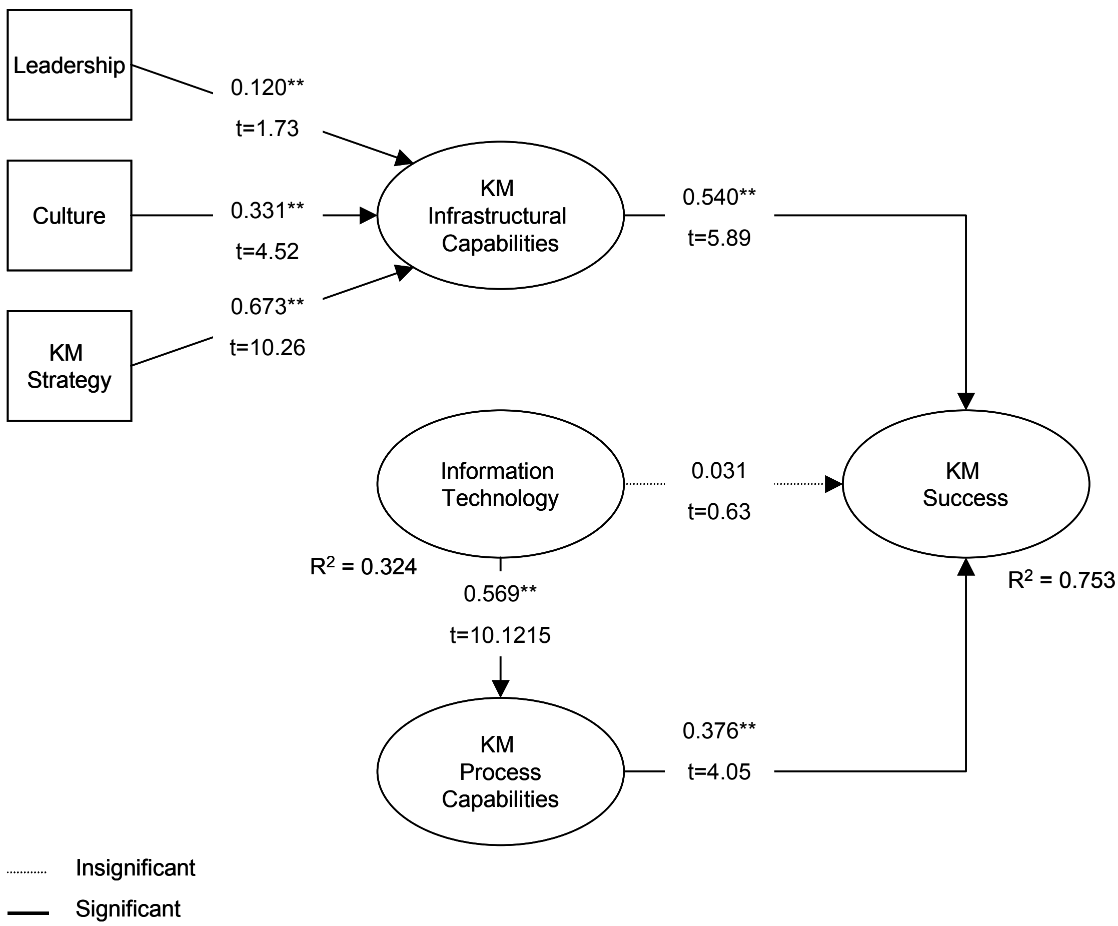

Figure 2 – Results of PLS Analysis

Culture emerges as the second important KM infrastructural capability (weight = 0.331). Organizational culture is "the set of shared, taken-for-granted implicit assumptions that a group holds and that determines how it perceives, thinks about, and reacts to its environment" (Schein, 1985). It shapes the behavior of organizational members through driving the norms and practices within the firm (Delong and Fahey, 2000). As suggested by many previous studies (e.g. Gopal and Gagnon, 1995), a supportive culture is essential for the successful implementation of KM initiatives. Appropriate norms and values motivate knowledge sharing and collaboration. This is particularly important for motivating the sharing of tacit knowledge, which is not likely to be transferred through predefined formal means (O'Dell and Grayson, 1998). Many practitioners, however, considered culture to be one of the most uncontrollable capabilities (Glasser, 1999). To foster a supportive culture for KM, employees must be able to appreciate and recognize the value of KM initiatives (Alavi, 1997; Gopal and Gagnon, 1995). Corporate vision statements and value systems are some effective means for communicating the individual and organizational benefits of KM (Gray, 2000). A vision states and defines unambiguously the desirable organizational goal (Kanter et al., 1992; Nonaka and Takeuchi, 1995). In promoting KM, the corporate vision provides a sense of purpose for getting involved in and contributing to KM initiatives (Leonard-Barton, 1995). Corporate value systems are complimentary to vision statements, determining the type of desirable KM activities (Miles et al., 1997).

Another important KM infrastructure capability is leadership (weight = 0.120). As suggested by the institutional theory, a management champion sets overall directions for the KM programs and assumes accountability for the related activities (Orlikowski, 1992; Purvis et al., 2001). More importantly, he/she obtains commitment from employees by operating metastructuring actions to achieve the desirable KM objectives. The role of leadership is usually embodied in the position of chief knowledge officer (CKO), which is implemented by more and more organizations nowadays. The CKOs are responsible for the development and accomplishment of KM vision through introducing various metastructuring actions (Orikowski, 1992). For instance, they assign strategic values to KM initiatives and revise business policies/practice in adherence to KM goals. They may also be involved in creating the appropriate culture and gaining commitment from top executives (Davenport and Prusak, 1998; Earl and Scott, 1999; Manasco, 1998).

5. Conclusion and implications for future research

In this study, we propose a conceptual model on KM success that integrates the effects of IT with those of other KM infrastructural capabilities and in relation to KM process capabilities. We rely on the institutional theory (Orlikowski, 1992) and the theory of technology assimilation (Fichman and Kemerer, 1997) as theoretical foundation. To test the model, we conducted a survey study involving 191 KM professionals. Confirming the theory of technology assimilation (Fichman and Kemerer, 1997), our findings demonstrate that IT does not have any direct effect on KM success. Rather, the IT effect is fully mediated through KM process capabilities. In other words, IT capabilities cannot be fully leveraged to lead to KM success without being assimilated within KM processes. These result present important implications for research. Studies reporting direct effects of IT on KM success without considering the mediation role of KM processes should be interpreted carefully.

Our study also identifies KM strategy as the principal dimension of KM infrastructural capabilities driving KM success, followed by culture and leadership. In adopting KM programs, managers should therefore enforce the implementation of these capabilities to enhance the success of their efforts. The weights of these infrastructural capabilities provide useful guidance to KM practitioners for prioritizing KM activities.

Our research model can be extended in future research to consider the interrelationships among the infrastructural capabilities. Future research should also identify the main KM process capabilities and assess their significance and relative importance.

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