

Factors That Contribute To the Success of Knowledge Management: An Empirical Investigation of Secondary Activities of the Knowledge Chain Model

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Abstract

It is often claimed that knowledge management (KM) initiatives are important, even essential, to advance organizational performance. The main goal of such improvement is to make an organization more competitive in delivering values to its stakeholders. However, KM initiatives are of little value without a concrete plan that link KM activities to organizational performance. The Knowledge Chain model has been advanced as basis for understanding factors that contribute to the success of KM initiatives. This model identifies five primary and four secondary KM activities as focal points for an organization's competitiveness. This paper uses the Knowledge Chain model as the theoretical base for an empirical study of the linkage between secondary activities and four approaches to competitiveness. It finds that, except Knowledge Measurement, every one of the secondary KM activities can be performed in ways that improve organizational competitiveness in any of four ways: enhanced productivity, agility, innovation, and reputation.

Keywords: *competitiveness, innovation, knowledge management, knowledge, productivity, reputation, secondary activities, survey research.*

1. Introduction

Knowledge management (KM) has been growing in importance and popularity as a research topic and business initiative since the mid-1990s. In an economy where the only certainty is uncertainty, one source of lasting competitive advantage is knowledge and its manipulation (Nonaka, 1995). Researchers in the field of sustainable competitive advantage have discovered that knowledge, which includes what the organization knows, how it uses what it knows, and how fast it can know something new, is the only thing that offers an organization a competitive edge (Prusak, 1996; Sharkie, 2003). Knowledge and its management are more powerful and valuable than natural resources, big factories, or fat bankrolls (O'Dell

and Hubert, 2011). Critical to our understanding of the value of knowledge management is its link to organizational performance outcomes (Kalling, 2003).

Many empirical studies such as those conducted by Delphi, Hughes Space and Communications Company, and Ford Motor Company support the assertion about competitiveness through KM. Ernst and Young Center for Business Innovation conducted a survey of 431 US and European organizations and reported “that more active management of knowledge is possible and advisable - indeed, that it is critical if a firm is to gain and sustain a competitive advantage” (Holsapple and Singh, 2005). In the same study, 875 of the respondents describe their businesses as knowledge-intensive, indicating knowledge and its management is critical to their competitiveness. User success stories via KM are reported in KM journals such as Knowledge Management Research and Practice, and Journal of Knowledge Management. In one survey conducted by the latter journal, over 90% of respondents perceived their organizations to be knowledge intensive (Holsapple & Singh, 2005). However, only 6% admitted that their organizations do enough to leverage knowledge very effectively to yield better performance. On the other end of the spectrum, unmanaged organizational knowledge led to failures such as those concerned with risk management at Barings Bank, Kidder Peabody, and Metallgesellschaft and insufficient knowledge management activity was a contributing factor to the 9/11 disaster (Simon & Gilgoff, 2003).

Since knowledge has become the core enabling asset, maximum leverage of this intellectual capital is imperative. Many organizations have felt the need to better utilize its intellectual assets and started to develop KM systems and foster a knowledge management culture. Hundreds of companies around the world are committed to KM principles and processes, including many of the Fortune 500 firms (O’Dell & Hubert, 2011). KM is certainly becoming part of corporate culture, diffused throughout organizations in the same fashion as safety consciousness. Holsapple et al. (2007) noted that there has been a phenomenal growth in interest and activity in KM, as seen in many new publications, conferences, IT products, and job advertisements.

All businesses involve creation, dissemination, renewal, and application of knowledge toward organizational sustenance and survival in the face of increasingly discontinuous environment change (Turban et al., 2011). In order to systematically improve the leveraging of knowledge, it is essential to have a model that identifies the possible fulcrums. These fulcrums are the KM classes of activities that can yield competitive advantage if designed and executed better than those of other organizations. A key to understand KM and fully exploit its competitive potential is a model that identifies value-adding KM activities. Each can be a candidate for enhancements that add value to an organization. Practitioners could use the model to structure their consideration and evaluation of KM initiatives. Researchers could use the model to structure their exploration of connections between KM and competitiveness. Educators could use it to structure coverage of KM activities and impacts in their courses. These motivations, coupled with the absence of such a model in the literature, led to the creation of the Knowledge Chain (KC) model by Holsapple and Singh (2003). The KC model posits nine distinct, generic value activities that an organization performs in the course of managing its knowledge resources. It contends that these activities are focal points for achieving competitiveness through knowledge management, in the sense that an organization can perform one or more of them better than competitors in order to achieve a competitive advantage. The nine KM value activities are divided into five *primary* activities that an organization can perform in manipulating knowledge resources, plus four *secondary* activities that support and guide performance of the primary activities. Anecdotal evidence has been reported that illustrates the direct role

of each of the nine KC activities in adding value to an organization and increasing its competitiveness (Holsapple and Singh, 2003).

This paper takes a step beyond the anecdotal evidence by further substantiating the KC model via an empirical investigation. Specifically, it investigates the relationship between each *secondary* activity in the KC model and the organizational performance achieved through four approaches of competitiveness: Productivity, Agility, Innovation, and Reputation. The study uses the perceptions of chief knowledge officers and other leaders of KM initiatives from different industries. We intend to investigate and report the empirical evidence in support of the five *primary* activities in a subsequent paper at a later date.

We begin with a background examination of the KC model as theoretical basis for our investigation of the four *secondary* KM activity classes. Next, we discuss the research methodology employed in the study, and followed by the presentation of the results and findings. Finally, the concluding section points out the strengths and limitations of this study, along with directions for future research.

2. The Knowledge Chain Model

Knowledge management aims to ensure that the right knowledge is available in the right representation to the right processors (human or machines) at the right time for the right cost (Turban et al., 2011). To achieve this objective, KM activities are undertaken that involves a landscape of knowledge flows and processing within a knowledge-based organization. In many cases, the manipulation activities and the flows that connect them can be performed, enabled, or facilitated with computer support. We contend that one key to more fully exploit the competitive potential of knowledge management is to develop a model that identifies key value-adding KM activities (Holsapple & Singh 2003). We advanced one such model called the Knowledge Chain model that identifies and characterizes KM activities an organization can focus on to achieve competitiveness. The Knowledge Chain (KC) model is based on a KM ontology developed via a Delphi-study involving an international panel of prominent KM practitioners and academicians (Joshi, 1998). The model is analogous to Porter's value chain. It is comprised of five primary activities that an organization's knowledge processors perform in manipulating knowledge resources, plus four secondary activities that support and guide their performances. Table 1 and Table 2 provide a summary of the primary and secondary activities.(Table 1 & 2)

Competitiveness due to KM practices can manifest itself in such ways as increasing profits and bolstering an organization's reputation, employee's creativity, productivity, efficiency, flexibility, and innovation. Analysis of the extensive anecdotal evidence from the KM literature has revealed that KC activities can yield four important approaches to high performance: productivity, agility, innovation, and reputation (Holsapple & Singh, 2003). Accordingly, as illustrated in Figure 1, the KC model claims that various combinations and implementations of primary and secondary activities lead to four organizational performance implications: performance, agility, innovation, and reputation. Referred to as the PAIR approaches to competitiveness, the competitive role of each KM activity in the Knowledge Chain is examined in terms of one or more of these PAIR approaches. (Fig 1)

Productivity is the rate at which goods and services are produced per unit cost. Although it is commonly defined in terms of labor, it can also be seen as the value people contribute to business. Due to the increasing dynamism of the global market, the competitive advantage provided by *agility* has emerged as an important priority. Agility manifests itself as greater organizational flexibility, adaptability, and rapid responsiveness to change. *Innovation* is the means whereby organizations exploit change as an opportunity for a different business or a different service, and it is capable of being learned and practiced

(Drucker, 1993). The innovation process can be defined as bringing ideas to market. Now and in the future, more than at any time in history, the secret to competitive advantage is innovation (O'Dell & Hubert, 2011). Jeffrey Brown from Opinion Research Corporations states that: "Think of your *reputation* as a reservoir of goodwill. You can only go to the well so often before it dries up. Protect your reputation whenever you can" (Garone, 1998). Reputation derives from the interpretation by a public of a particular set of knowledge cues emanating from an organization; thus, an organization's conduct of KM activity impacts its reputation.

3. Research Study

Anecdotal evidence can be complemented usefully by a survey that studies perceptions of KM leaders toward the connection between KM activity and organizational performance. Accordingly, we conducted a study to ascertain answers to the following questions with regard to each of the nine KC activities. Does the activity contribute to a competitive advantage by:

- a. Improving productivity (e.g., lower cost, greater speed)?
- b. Enhancing organizational agility (e.g., more alertness, rapid response ability, greater flexibility and adaptability)?
- c. Fostering innovation (e.g., inventing new products, services, processes)?
- d. Enhancing reputation (e.g., better quality, dependability, brand differentiation)?

3.1 Survey Instrument

The research methodology chosen is a field survey involving one instrument. The instrument begins with brief instruction to respondents. Next, a two-page quick reference guide is provided including an overview of the KC model and brief description of its value activities. Next, we ask the following question using a Likert-type scale for each of the nine activities (for demonstration purposes, in the sample question below, we use the general phrase *Knowledge Activity* and this generic name is substituted with the actual name of the specific activity under consideration (e.g., Knowledge Leadership) on the survey distributed to respondents):

1. **In your organization, to what degree is *Knowledge Activity* performed in a way that is instrumental in achieving a competitive advantage?**

Not At All				Moderately			Extensively
1	2	3	4	5	6	7	

The next question on the survey deals with understanding in more depth how the performance of the knowledge activity contributes to competitive advantage.

2. **Your organization's approach to Knowledge Activity contributes to a competitive advantage by:**

- a. **Improving *productivity* (e.g., lower cost, greater speed)**

Not At All				Moderately			Extensively
1	2	3	4	5	6	7	

- b. **Enhancing organizational *agility* (e.g., greater flexibility, rapid responsiveness; adaptability)**

	Not At All			Moderately			Extensively
	1	2	3	4	5	6	7
c.	Fostering <i>innovation</i> (e.g., learning; new products, services, processes)						
	Not At All			Moderately			Extensively
	1	2	3	4	5	6	7
d.	Enhancing <i>reputation</i> (e.g., better quality, dependability; brand differentiation)						
	Not At All			Moderately			Extensively
	1	2	3	4	5	6	7

The evaluative characterizations for the Likert-type scale responses are: Not At All (1); Moderately (4); and, Extensively (7). Characterizations of the remaining scale levels (i.e., 2, 3, 5, and 6) are not explicitly defined on the questionnaire. The survey concludes with general demographic questions. A cover letter and survey instrument were mailed to each of the potential respondents in the sample.

3.2 Pilot Testing

For the validation of the survey items, the survey instrument was pilot tested with two academics and two experienced practitioners in the KM area. All pilot test candidates were sent a cover letter inviting them to participate in pilot testing, a model cover letter to be used during the actual survey, and the questionnaire itself. The testers' comments and suggestions were used to refine, extend, and correct the questionnaire as needed.

3.3 Identification of Potential Respondents

In this study, we are solely interested in organizations with ongoing KM initiatives. We set the qualification of a potential survey respondent to be someone in the leadership position for a KM initiative within an organization. Candidates should hold positions such as CKO (Chief Knowledge Officer), CLO (Chief Learning Officer), Director of KM, Knowledge Officer, and so forth. Based on these criteria, we searched a variety of online and printed sources to get a mailing list for leaders in the KM initiatives. Consequently, the survey instrument was sent to 102 candidates worldwide with readily available mailing lists, out of which thirty two had responded for a response rate of 31.4%.

3.4 Analysis Approach

For expository convenience, we define some qualifiers that are used in the ensuing data analysis and discussion. For analyzing and explaining the empirical evidence, we aggregate the degrees of contribution into three categories as shown in Table 3: Weak, Moderate, and Strong, with the latter two being referred to as Substantial. (Table 3)

3.4.1 Existence Criterion

The rationale for doing empirical study is to search for evidence that supports the *inclusion* of each KM activity in the KC model. The inclusion of an activity in the model means there are indeed ways in which the activity is performed that result in competitive advantage. The key criterion for assessing if a specific KM activity is appropriate to include in the KC model is the existence of cases where it is instrumental in achieving a competitive advantage. For example, looking at an extreme case, if no respondents perceive the way in which a given KM activity is performed contributes to competitive advantage, then inclusion of that activity in the KC model would be highly questionable.

In another scenario, if there is just one seemingly isolated case whereby the performance of the KM activity is perceived as contributing strongly to competitive advantage, then several possible reasons could exist: (a) Perhaps the respondent is mistaken about the connection between the activity and its benefits; or (b) it is perhaps a rare or capricious situation; or (c) the respondent's organization is extremely innovative and is a pioneer in achieving competitive advantage through such an activity.

Existence of the phenomenon of achieving competitive advantage through an activity may be established when "appreciable" proportion of respondents may regard it as being so. A question in this connection then is what proportion should be sufficient to overcome the concerns listed in (a), (b), and (c) above. Methodologically, there is no magic dividing line. However, for the purpose of this study, we use 25% as a rule of thumb. If one quarter of the subjects recognize an activity as being a **strong** (i.e., 5 through 7 on the Likert scale) contributor to competitive advantage, then we contend that this is compelling evidence to include this activity in the KC model. We recognize that 25% is quite arbitrary. It is true that the higher the percentage is, the greater the comfort level. It could well be that this phenomenon does exist for an activity even though it is not so widely experienced (e.g., 10%). We believe that this cutoff of 25% is fairly a high hurdle to pass. Some observers may argue for a number lower than 25% and others for a higher number. They are free to do so. In this research, we report the actual percentages given by empirical evidence so others can use the threshold figure that they deem proper.

3.4.2 Pervasiveness Criterion

Existence of each KM activity is the main objective of our study because it is the key to inclusion of these activities in the KC model. Using empirical evidence, we also study the *pervasiveness* with which KM activities are performed in organizations in ways yielding competitive advantage. Existence of an activity does *not* necessarily mean that it is commonly executed in organizations. It is conceivable that 25% of the respondents may regard an activity as strongly contributing towards a competitive advantage, but the other 75% may have rated it on the low end of the Likert scale. The scenario may present evidence for the existence of competitive advantage through the practice of the said KM activity in an organization, but it does not fundamentally mean that this result is commonplace across organizations. One way to get some insight into the pervasiveness phenomenon is by looking at the relative frequency graphs of each KM activity. Relative frequency is a simple effective method of organizing and presenting data so that one can get an overall picture of where measurements are concentrated and how spread out the measurements are.

A more formal way to examine the pervasiveness is by testing the mean values of the participants' responses to question 1 for each KM activity. For each KM activity, the null and alternative hypotheses were stated as follows (the phrase *Secondary Activity* should be replaced by a specific secondary KM activity under consideration such as Knowledge Leadership):

H₀: On average, *Secondary Activity* as it is performed in knowledge-based organizations today does not contribute substantially to achieving a competitive advantage.

H₁: On average, *Secondary Activity* as it is performed in knowledge-based organizations today does contribute substantially to achieving a competitive advantage.

This hypothesis was operationalized as:

μ = The mean of the responses to question number 1 for a secondary activity.

μ_0 = The tested Likert scale value (3).

H₀: $\mu \leq \mu_0$ (where $\mu_0 = 3$)

H₁: $\mu > \mu_0$

We predict that, on average, a given secondary activity as it is performed in an organization today contributes **substantially** to achieving a competitive advantage. As indicated in Table 3, the Likert scale of 3 is the cut-off between *substantial* and *not substantial*. Accordingly a test value of 3 was used (In a similar way, “substantial” could be replaced by “strong” with a test value of 4). This prediction of pervasiveness of an activity could be confirmed if the null hypothesis can be statistically rejected. The t-test is performed to examine the analysis with a sample size exceeding 30 in every test.

The same approach is followed to examine the pervasiveness of the four approaches of competitive advantage (i.e., PAIR) in survey question number 2. For example, for each of the four secondary activities, the null and alternative hypotheses for improving *productivity* are stated as follows (the phrase *Secondary Activity* should be replaced by a specific secondary activity under consideration such as Knowledge Leadership):

H_{0-p}: **On average, organization’s approach to *Secondary Activity* does not contribute substantially to achieving a competitive advantage by improving *productivity***

H_{1-p}: **On average, organization’s approach to *Secondary Activity* contributes substantially to achieving a competitive advantage by improving *productivity***

In a similar fashion, we can formulate the hypothesis statements for the other three organizational performance implications (i.e., agility, innovation, and reputation) for each of the secondary KM activities by replacing the word productivity in the above hypothesis statements with the terms agility, innovation, and reputation respectively.

4. Results and Discussions

This section discusses the empirical evidence in support of the KC model with respect to the model’s four *secondary* KM activities: Knowledge Leadership, Knowledge Coordination, Knowledge Control, and Knowledge Measurement. In particular, it explores, in a respondent’s organization, to what degree each secondary KM activity is performed in a way that is instrumental in achieving a competitive advantage. On the survey instrument, this investigation is reflected in question number one for each secondary activity (see Section 3.1). In other words, question number one studies the *overall* contribution of each secondary activity’s role towards competitive advantage.

A competitive advantage may be achieved by means of improving productivity, enhancing organizational agility, fostering innovation, and enhancing reputation. Thus, this section also explores to what degree a respondent’s approach to each secondary activity contributes to a competitive advantage via these four criteria. On the survey instrument, this investigation is reflected in question number 2 (parts a, b, c, and d) for each secondary activity (see Section 3.1).

4.1 Empirical Evidence Specific to Existence of Secondary Activities

As mentioned in Section 3.4, for the purpose of analyzing and explaining the empirical evidence, we aggregate the degrees of contribution of each KM activity as shown in Table 3. As discussed in Section 3.4.1, to assess the extent of empirical evidence in support of *inclusion* for each secondary activity in the KC model, we decided to use the 25% existence criterion for “strong contribution.” Applying the 25% cut-off that selected a threshold Likert scale of 5 or greater for survey question number 1, the order of strong contribution from the highest to the lowest is found to be:

Leadership → Control → Coordination → Measurement
50.0% 44.8% 31.0% 28.6%

Every one of the four secondary activities exceeds our cut-off figure of 25%. In terms of current practices, Leadership at 50.0% exhibits strong contributions to competitive advantage followed by Control (44.8%) and Coordination (31.0%). Measurement, interestingly, occupies the lowest position. Of the four secondary activities, Leadership is noted to be the main. The evidence indicates that the execution and cultivation of Leadership in respondents' organizations is carried out in such a way that it contributes strongly to achieving a competitive advantage. Control and Coordination are both helping leaders of the organizations to ensure that needed knowledge resources are available in sufficient quality and quantity, and, also with helping to harmonize activities by ensuring that proper resources are brought to bear at appropriate times and that they adequately relate to each other during the conduct of activities. In other words, Control and Coordination are the pillars that support a leader in an organization. Organizations are able to either produce or acquire quality knowledge in sufficient quantity that other companies don't have, and they make use of that knowledge via Leadership to achieve a competitive advantage.

Measurement is the weakest secondary activity reported in our survey. It is conceivable that the unfeasibility of measuring knowledge resources in organizations is not providing a competitive edge to our respondents. For example, one of our respondents is a pioneer in knowledge Measurement and published the world's first audit of intangible assets. However, the difficulty of this endeavor is reflected in their response to question number 1 on our survey. The response was only 4 ("moderate") in terms of current practices. Some respondents replied on the questionnaire "We are still working on this." On the other hand, Control and Coordination are activities that are more unique to an organization's style of management and are more amenable to providing a competitive advantage via Leadership.

Except for Measurement, more than one-thirds of the surveyed respondents currently regard secondary knowledge activities are performed in a way to contribute strongly towards a competitive advantage in their organizations. Even though the percentage for Measurement is 28.6%, it is higher than our cut-off of 25%. Therefore, at such a response rating, the evidence for these activities is compelling enough to include them in the knowledge chain model. When planning and administrating KM initiatives in organizations, Chief knowledge officers and other concerned officials should pay careful attention to these activities. Not to do so, would result in a competitive disadvantage.

4.2 Empirical Evidence Specific to Existence of Four Approaches to Competitive Advantage

Next, for each of the secondary KM activity, we examine the four approaches (PAIR) of achieving competitive advantage. The percentages of "strong contribution" for the PAIR dimensions are shown in Table 4. (Table 4)

From the figure, some reservations are detected in terms of current practices. Range of percentages of strong contributions for these four approaches is Productivity (25.0% - 50.0%), Reputation (21.4% - 42.9%), Agility (20.7% - 44.4%), and Innovation (20.7% - 51.9%). If an organization has selected any one of these four approaches as competitive strategy, they might as well pay attention to what other organizations, which have explicitly launched the KM initiatives, are doing in this regard. The data in Table 4 can provide them with benchmarking data in terms of each secondary activity.

Looking at Leadership, the strongest approach to achieving competitive advantage comes from improving productivity at 50.0%. Empirical evidence suggests that the approach to knowledge Leadership is such that it effectively manages organizational knowledge resources and associated knowledge manipulation skills thus lowering costs and reducing cycle times in respondents' organizations. CEOs come to realize that they have to manage their organization's intellectual assets the same way they manage physical assets. This means finding, understanding, and reusing best practices in bringing products to market, cutting cycle time, and improving defect analysis and customer service better than their competitors. The contribution via Innovation is a close second at 46.4%. Anecdotes could be found in literature where good Leadership improves employees' morale and helps shape a coherent positive culture in organizations. This, in turn, could foster employees' creativity and innovation capabilities. The other two approaches Reputation and Agility are not far behind and are noted to contribute almost equally at about 43%.

As for Coordination, Innovation at 51.9% is the strongest means of achieving competitive advantage. As we know, Coordination refers to guiding the conduct of KM in an organization. Coordination techniques suggested and used include linking incentives to desired KM behaviors and outcomes. Anecdotes are found in the literature that suggest that where coordination activities such as establishing incentives for appropriate KM behaviors, determining appropriate communication channels for knowledge flows, and installing programs to encourage learning flourish, Innovation could follow. If these practices were conducted better than competitors, it would give the practicing organization a competitive edge. Empirical data by our respondents support this. Leadership and Coordination go in parallel in that both foster Innovation. This is understandable because one creates and shapes the culture/environment conducive to Innovation and the other manages dependencies and marshals sufficient skills for executing various activities. For Coordination, Reputation is the weakest contributor at about 30%. Obviously, respondents do not think that the way Coordination activity is carried out in their organizations contributes to competitive advantage via Reputation. Productivity is the second lowest at 33.3%.

As far as Control is concerned, respondents reported a range of about 20% to 28% for the four approaches. All the four approaches are equally low contributors. It is surprising to find that even though the activity of Control is reported to be a "strong" overall contributor by 44.8% of the respondents for question number 1 (second only to Leadership; see Section 4.1), all the four approaches by which Control contributes to competitive advantage are weak (20%-28%). It is conceivable that no one approach is outstanding in its contribution, rather it is some combination or interaction of these approaches that is giving Control a strong competitive edge overall.

Innovation and Agility are the winners at 31% each for Measurement. Indeed, only organizations that are creative and innovative would dare to venture into this difficult arena of knowledge measurement and beat the others. For example, Skandia uses a new innovative method of non-financial indicators to measure their processes and published the first annual result supplement on intellectual capital (Sveiby, 1997). By somehow quickly adapting themselves to this seemingly insurmountable challenge of measuring knowledge, firms like Skandia beat others to the game and gain a competitive lead through first mover's advantage.

The 25% existence criterion is passed by the four PAIR approaches for every one of the secondary activities.

4.3 Empirical Evidence Specific to Pervasiveness of Secondary Activities

One formal way to determine the pervasiveness is by testing the mean values of the participants' responses to survey question number 1. For each secondary KM activity, the null and alternative hypotheses stated in Section 3.4.2 were tested. The mean and median of responses to survey question number 1 for each KM activity is shown in Table 5. (Table 5)

We predict that, on average, a given secondary activity as it is performed in an organization today contributes substantially to achieving a competitive advantage. As indicated in Table 3, the Likert scale of 3 is the cut-off between "substantial" and "not substantial." Accordingly a test value of 3 is used. This prediction can be confirmed if the null hypothesis can be statically rejected. The t-test is performed to examine the analysis with a sample size of about 32 per test. Statisticians generally choose 30 as the dividing line between large and small samples (Ott and Hildebrand, 1983). Table 6 lists the results of the t-tests for the secondary activities. (Table 6)

In terms of current practices, in all cases except Measurement, the results show that t-values are highly significant at $\alpha = 0.01$ level and the null hypotheses are rejected. This empirical finding supports that, except Measurement, each one of the three remaining secondary KM activities as they are practiced today in the respondents' organizations does indeed contribute substantially to achieving a competitive advantage. On average, this supports the notion of the pervasiveness of these secondary KM activities in the respondents' organizations. Thus, these three secondary activities are not only included in the knowledge chain model on the basis existence test, but also there is evidence that each of the activity is fairly pervasive in contributing substantially to competitive advantage. As for Measurement, the p-value is 0.45 and the null hypothesis cannot be rejected. Therefore, the knowledge Measurement activity as it is performed in knowledge-based organizations today does not contribute substantially to achieving a competitive advantage. Hence, it can be assumed that this activity is not as pervasively applied as the other three secondary activities.

4.4 Empirical Evidence Specific to Pervasiveness of Four Approaches to Competitiveness

In a similar vein, for each of the secondary activity, we can examine the pervasiveness of the four approaches to achieve a competitive advantage (i.e., Productivity, Agility, Innovation, and Reputation) in terms of each secondary KM activity. Please see Section 3.4.2 for the corresponding hypothesis statements. Table 7 lists the results of the t-tests for the PAIR dimensions for each secondary activity. (Table 7)

As expected, the t-values for Measurement are not significant at either $\alpha = 0.01$ level or $\alpha = 0.05$ level. Therefore, the null hypotheses in these cases cannot be rejected and the four approaches are not commonplace in providing competitive advantage in the case of Measurement. With regard to Control, the performance measures Productivity and Reputation are significant at $\alpha = 0.01$ level, and Agility and Innovation are significant at $\alpha = 0.05$ level. For Coordination, Reputation is significant at $\alpha = 0.05$, and the other three approaches are all highly significant at $\alpha = 0.01$ level. Leadership is significant at $\alpha = 0.01$ level. Summing up, with the exception of Measurement, all other secondary activities are significant in that they can be used to achieve competitive advantage via these approaches. Using Measurement to achieve competitive advantage through these four approaches does not seem to be commonplace.

5. Conclusion

A major contribution of this research study is that rather than just saying KM in general is essential for competitiveness, we empirically show that each specific secondary activity of the Knowledge Chain model is a candidate for improving organizational performance via any of four approaches. Among organizations having dynamic KM initiatives, we have found compelling evidence for including Leadership, Control, and Coordination in the knowledge chain model with Leadership activity leading the pack. Furthermore, we have also found that it is commonplace for these organizations to perform each activity in a way that yields substantial competitive advantage. Empirical evidence suggests that Leadership is strongly associated with the productivity way of achieving competitive advantage and Coordination with Innovation. Leadership is also found to promote Reputation, Agility, and Innovation. Unfortunately, one of the secondary activities, Measurement, does not pass the litmus test of existence and pervasiveness with flying colors. However, some respondents, through their insights and written comments on the survey, agree to the importance of this elusive KM activity. On the other extreme, knowledge Measurement appears to be anathema to some people. For example, a respondent quotes that “a focus on measurement stifles innovation and creativity. I support validation of opinions and testing of prototypes but not measurements of knowledge”.

Nevertheless, based on their expectations for the future (e.g. five years down the line), a majority of the respondents generally agree that knowledge Measurement is going to play a crucial role in the conduct of knowledge management. After all, knowledge Measurement is a basis for evaluation of Leadership, Control, and Coordination (Joshi, 1998). Without some form of measurement, a manager would be hard pressed to evaluate the impacts of an organization’s knowledge management initiatives on bottom-line performance.

The KC model is descriptive in nature. The intent is to identify KM activities that researchers and practitioners need to consider in managing knowledge to achieve competitiveness. Therefore, future research should focus on providing practitioners with such prescriptive guidance as identifying “best methodologies” and “best technologies” for contributing to competitiveness via the PAIR approaches. Future research could also focus on the technological aspect of KM. Using the KC model as the basis, the linkage between KM technology and competitive advantage could be investigated. This could, perhaps, pioneer new KM products and approaches that fuel the current knowledge economy.

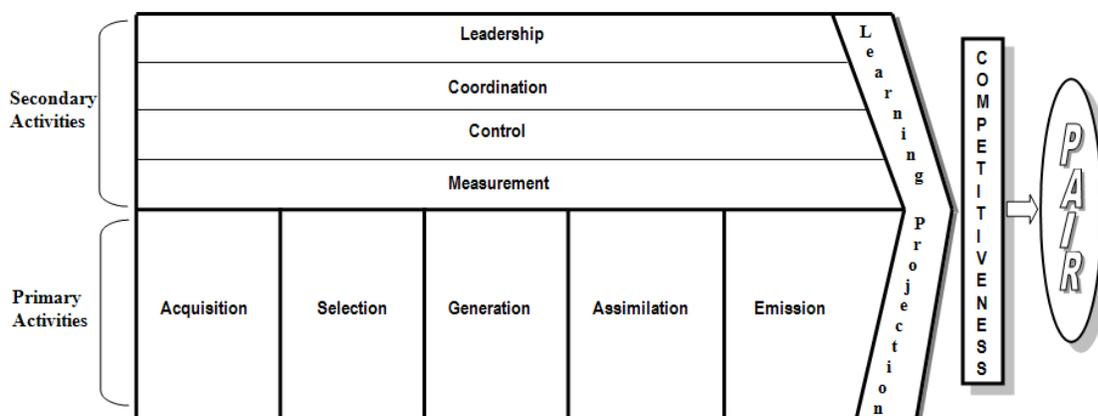


Figure 1: The Knowledge Chain Model

Knowledge Acquisition	Acquiring knowledge from external sources and making it suitable for subsequent use
Knowledge Selection	Selecting needed knowledge from internal sources and making it suitable for subsequent use
Knowledge Generation	Producing knowledge by either discovery or derivation from existing knowledge
Knowledge Assimilation	Altering the state of an organization's knowledge resources by distributing and storing acquired selected or generated
Knowledge Emission	Embedding knowledge into organizational outputs for release into the environment

Table 1: Primary KM Activities in the Knowledge Chain Model

Knowledge Leadership	Establishing conditions that enable and facilitate fruitful conduct of KM
Knowledge Coordination	Managing dependencies among KM activities to ensure that proper processes and resources are brought to bear adequately at
Knowledge Control	Ensuring that needed knowledge processors and resources are available in sufficient quality and quality subject to security
Knowledge Measurement	Assessing values of knowledge resources, knowledge processors and their deployment

Table 2: Secondary KM Activities in the Knowledge Chain Model

	Degree of Contribution		
	Not Substantial	Substantial	
	Weak	Moderate	Strong
Likert Scale	1 to 3	4	5 to 7

Table 3: Degree of Contribution for Each KM Activity for Competitiveness

Secondary Activity	Productivity	Agility	Innovation	Reputation
Leadership	50.0	42.9	46.4	42.9
Coordination	33.3	44.4	51.9	29.6
Control	27.6	20.7	20.7	27.6
Measurement	25.0	32.1	32.1	21.4

Table 4: Percentages of "Strong Contribution" Responses for PAIR Dimensions

Secondary Activity	Mean	Median
Leadership	4.79	6.00
Coordination	3.93	5.57
Control	4.10	5.17
Measurement	3.04	4.32

Table 5: Mean and Median of Responses for Each Secondary Activity

Secondary Activity	Test Value = 3	
	t-value	p-value
Leadership	0.12	0.45
Coordination	3.56	0.00
Control	3.10	0.00
Measurement	5.92	0.00

Table 6: t-Test Results of the Means of Responses for Each Secondary Activity

Secondary Activity	Test Value = 3	
	t-value	p-value
LEADERSHIP		
Productivity	4.93	0.00
Agility	5.34	0.00
Innovation	4.56	0.00
Reputation	4.58	0.00
COORDINATION		
Productivity	2.56	0.01
Agility	1.84	0.04
Innovation	3.05	0.00
Reputation	2.82	0.00
CONTROL		
Productivity	3.56	0.00
Agility	2.39	0.01
Innovation	1.98	0.03
Reputation	1.71	0.05
MEASUREMENT		
Productivity	-0.81	0.79
Agility	-1.04	0.85
Innovation	-0.22	0.59
Reputation	-0.40	0.66

Table 7: t-Test Results of the Means of Responses for PAIR Dimensions

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