Knowledge Creation in Higher Education Institutions: A Conceptual Model

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Abstract

Higher education institutions and the business world have some difficulty understanding the implication of knowledge management as a new model to support business processes. Knowledge management calls for an organization to share and disseminate its intellectual capital - knowledge. The main challenge lies in not being able to fully answer the question: "What is knowledge?" This paper attempts to define knowledge by introducing a new model that views the various parameters involved in knowledge creation collectively. The model emphasizes the importance of information systems as a major input factor in creating knowledge. Human creativity, innovation, experience and other intangible factors are included. The difference between explicit and tacit knowledge is discussed. Educational institutions and businesses alike can enhance their understanding of knowledge management.

Introduction And Problem Statement

Academics, experts and technology vendors agree that it is a fruitless attempt to find a ready made comprehensive definition of knowledge management, KM (Mann, 2002). Mann continues by stating that for an organization to succeed with knowledge management, it needs its own explanation and terms. With this simple but yet complex conclusion, every manager is required to participate in the process of defining knowledge. For managers to understand and foresee the importance of applying knowledge management, they need initially to realize the meaning of knowledge itself and the factors that play important roles in creating it. In the article "Definition of Knowledge: A Business Perspective," the author states:

> The word 'Knowledge' brings with it a set of semantic problems since it has many meanings depending upon the speaker and listener's interpretation of the context within which it is spoken and heard. Unlike other words whose different meanings can be inferred from their sentence context, 'Knowledge' is easily misunderstood despite the context.

By answering the questions below, we might be able to understand what is involved in knowledge creation and we might find a clear definition of knowledge. These questions include:

1. In the process of creating knowledge, what are the factors that contribute to its creation?
2. What are the relationships that exist between data, information, and knowledge?
3. Which factors are tangible and which are intangible?

4. After creating knowledge can knowledge workers or managers classify the end result as the same type, or do we have different types of knowledge?

Problem Background

This section is divided into two parts. The first part discusses the problem of information overflow and the difficulties associated with controlling such phenomena. The second part shows the limited number of applications of knowledge management and knowledge creation in academia or the business world.

For some years now, the complaint has been not the lack of information, but having so much of it. We are constantly looking to extract meaning from the massive amount of information. Rutherford D. Rogers states, "We are drowning in information and starving for knowledge." Skyrme (2002) notes that we need to consider the amount of information we gather every year. He notes that in the year 2000, the world has accumulated up to 22 exabytes ($22 * 10^{18}$) bytes. The author continues to state that every year, we add up to 4 exabytes. With a simple calculation, we can see that it will take us less than six years to double the amount of information in existence today. In a final note, Skyrme invites us to examine the fact that if we have a problem finding knowledge today, then with much more information to probe, we should anticipate a bigger problem in the future.

Managing such amounts of information becomes a tedious task. According to Abram (1997) "we are entering an era where competencies related to managing overabundance (information oceans) are key." Abram maintains his argument by noting that the activities of "filtering, selection, organizing, digesting, packaging," must be applied to simply deal with the massive informational overflow.

Obviously there is a need for sorting through much information to extract more meaning. Sjoerd Vogt in the article "Turning Data into Information into Knowledge," states that a survey was conducted by Ernst & Young. The number of subjects surveyed was 431 executives; 300 of them were from the US, and 131 were from the UK. There were 20 questions on how knowledge had been used. One important question was "What are the most strategically important issues?" The results showed that 87% of the executives believed that knowledge was very important in dealing with competition. Also 97% of the executives sought more "knowledge on customers." Eighty percent (80%)of the executives felt that they need more knowledge founded in "best practices/effective processes." Finally, 86% of the executives felt a need to understand "their own competencies and capabilities." Vogt continues to state that 44% of the executives felt that they were inadequate or very inadequate in disseminating knowledge to different parts of their business. Finally, only 12% believed they were "above average at leveraging" the existing knowledge.

Review of Literature

In the process of constructing a model that contributes to an environment rich in knowledge, it is necessary to define knowledge and knowledge management. There is a definition of the position of chief knowledge officer. The relation between information technology (IT) and KM as well as definition of the types of the knowledge is discussed. Since most of the applications of KM are found in the business world, this paper questions whether a consideration has been given to KM in higher education. Finally, some of the benefits and difficulties in applying KM are discussed.

Definition of Knowledge and Knowledge Management

There is a need to clarify the difference between the way epistemology looks at knowledge and the way knowledge management views knowledge or better yet knowledge creation. In response to a question posted by Yogesh (June 18, 1997) in www.brint.com by the title "Knowledge or Information? A 'Musical' Analogy," the author referred to Nonaka & Takeuchi who stated that there is a distinction between viewing knowledge from an epistemological standpoint and a knowledge management perspective. Epistemology focuses on the fixed, exact and nonhuman makeup of knowledge. On the other hand, in knowledge management, knowledge is dynamic, workable and lively. Finally the author concludes that, with that in mind, we focus on "knowledge creation" instead of on the idea of knowledge itself.

In the electronic dictionary "Free On-line Dictionary of Computing", FOLDOC, the author states, "knowledge differs from data or information in that new knowledge may be created from existing knowledge using logical inference. If information is data plus meaning then knowledge is information plus processing."

From the "Knowledge Management Forum, KM Forum Archives -- The Early Days," the author discusses Denham's research on knowledge and knowledge management. Denham defines knowledge as "full utilization of information and data, coupled with the potential of people's skills, competencies, ideas, intuitions, commitments and motivations." From the article "Definition of Knowledge: A Business Perspective," the author states that knowledge helps us to determine "who should act, what should be done, when it should happen, where work should be conducted, why it is important, and how to do it so that we can optimize our effectiveness." Further the article mentions that knowledge directs us as to how we should process data and information to achieve decisive end results.

A New Executive Position: Chief Knowledge Officer, CKO

As Chief Information Officer has been a title particular to an executive who leads an information systems department, a new title is given to those executives who lead knowledge management projects in an institution or an organization. Davenport (1996) discusses that a CKO's responsibilities should include "creating a knowledge management infrastructure, building a knowledge culture and making it all pay off economically." Davenport adds that to build a knowledge management infrastructure, information technology plays an important role.

Knowledge Management and Information Systems

There is no doubt that knowledge management is notably linked to information technology. To support this notion, McDowall (October 4, 2002) notes that knowledge management has been adopted partially to deal with changes within an organization as a result of using information technology. In discussion about how knowledge management as a business practice has impacted the way information specialists are handling information technology, Srinivas (2003) in his article "Types of Knowledge Management" states:

A knowledge architecture determines how everyone will communicate, how databases will be designed, how information will be structured and named, and how legacy information systems

will be integrated. This ensures that key business information is identified, categorized, and ranked according to its value. Increasingly, information resource specialists who used to spend their time searching for and forwarding documents and information are being asked to help categorize and catalog resources for access in a knowledge management system.

The website SearchCio.com which is powered by whatis.com relates knowledge clearly to information technology. The author states, "in information technology, knowledge is, to an enterprise or an individual, the possession of information or the ability to quickly locate it." In this respect, the author sees a definite link between information systems as a container that allows users to retrieve their needed information and the information itself.

There is clear evidence that information technology as an infrastructure is essential to support the implementation of various technological innovations to support knowledge creation. In an active survey in the website "www.metakm.com," 492 respondents (as of March 8, 2003) answered the question, "Which technology would like to implement for knowledge management systems?" The following results are listed:

1. Internet/intranet/Extranet	31.71%
2. Document Management	11.38%
3. Search/Index/Retrieval	6.10%
4. Data warehousing/Data Mining	6.71%
5. Groupware/Collaborative tools	14.63%
6. Enterprise Information Portal	20.33%
7. Business Intelligence	7.11%
8. Other	2.03%

Types of Knowledge

Tiwana (2000) states that there are two major categories of knowledge management. These are explicit knowledge and tacit knowledge.

> **Explicit knowledge**. By referring to Nonaka and Takuchi, Choo (2003) states explicit knowledge can be "expressed in words and numbers, and easily communicated and shared in the form of hard data, scientific formulae, codified procedures, or universal principles."
>
> **Tacit knowledge.** Tiwana (2000) states that knowledge that materializes in people's minds throughout their careers and their experiences which is not as easily recorded is called tacit knowledge.

Knowledge Management and Higher Education

Cronin (2000) referred to Cronin and Davenport who states that universities are ideal places for knowledge creation. Further, there is convincing evidence that theories and practices of knowledge management applied in the business world can as easily be applied to higher education.

Mann (2002) referred to a "joint venture between industry and the university sector." This collaboration will identify problems associated with knowledge as behavioral and organizational

instead of being a technological problem. Further, some of the problems that can be dealt with are:

1. Align information technology with social networks and dealings
2. Encourage and support the use of knowledge management
3. Allow knowledge transfer across different tasks
4. Apply knowledge to workers' management
5. Practice tacit (hidden in people minds) knowledge within your surroundings

Mann concludes that industry will profit from the research done by the university sector. Also the industry can benefit from "individual knowledge audits" and through communications with other businesses practicing knowledge management. Higher institutions can apply knowledge management practices with potential success in a variety of activities, including research, instruction, and community service (Kidwell, Vander & Johnson, 2001). Kidwell et al. add that knowledge management should not be looked upon as a drastic change, rather the concern should be to focus on smart implementation of knowledge management.

Benefits of Applying Knowledge Management

Srinivas (2003) by referring to an article researched by "Information Management & Economics, Inc.," states that by applying effective knowledge management, an organization can:

1. Connect people of different backgrounds. This will result in enhancing the work environment as a whole
2. Disseminate tacit knowledge more easily
3. Locate and identify any gap in knowledge and attempt to fill it
4. Implement new technological tools that assist in the sharing of knowledge

Srinivas continues by listing the benefits of applying the above points. These include:

1. Enhanced decision making
2. Preservation of corporate memory
3. "Increased innovation"
4. Ease and aid in the translation of information into knowledge.

Mann (2002) from the article "people.html" states that in implementing knowledge management, businesses can deal with issues that, up to now, have been ignored. The author lists "trust and privacy," eliminating obstacles to sharing, "ownership," applying incentives by encouraging, rewarding and identifying employees who share knowledge, and finally alliance with the business mission.

Difficulties in Managing Knowledge

Knowledge management is not an easy job. It requires planning and having a vision. Prusak (2001) discusses indirectly the idea of knowledge creation by stating that "strategy academics" and others see a firm as an organized assembly of competencies "somewhat bound by its own history." Also he adds that institution effectiveness is restricted by its present social and cognitive expertise. Even though there are "knowledge engineering methods and tools" that assist in finding knowledge assets in an organization, these tools don't provide help in managing the processes of managing knowledge (Macintosh, 2003). Macintosh continues by stating that regardless of the difficulties associated with finding "an efficient and cost-effective manner" to manage knowledge assets, an enterprise can:

1. Establish a common understanding as to what knowledge management is through the whole organization.
2. Recognize, "model and explicitly represent their knowledge."
3. Emphasize the sharing and the reuse of knowledge through different divisions and users.

Devlin (1999) discusses the difficulty associated with knowledge hoarding, since
there might an incentive for such an act. The author adds that people tend to do that as a way of protecting their jobs.

Purpose of the Study

The purpose of the study is to create a model that aids in understanding knowledge creation, by discussing all input factors such as perception, experience, judgment, innovation, data, and information to create knowledge. The administrator or manager will be able to question, examine and review all the steps in acquiring knowledge. By discussing and clarifying the difference between explicit knowledge and tacit knowledge, managers will be clear about not only the difference in the two types of knowledge, but they may understand when and why each type is applied to maximize their return.

The Model

The Theoretical Approach

The theoretical approach for the model is derived from the diagrammatic model (see Figure One) which depicts the three main elements in knowledge creation. These include data, information and knowledge and all the elements that affect each component in knowledge creation.

Data. Data are raw facts without meaning until they are processed into information.

In a business environment that depends on information technology, knowledge creation usually starts with data. Davenport (1998) states that there should be collaboration between data managers and knowledge managers who should rely on the involved models. The author adds that these models "on how data can be structured in the future were seldom realized."

Wallace and Riley (2001) discuss that for the last two decades universities have been collecting various types of data. Digitized data include "student record, personnel information, and financial data." Additional data are emailing, Internet access types, "market statistics," "course evaluation," "library catalogues," and data found in personal digital assistants and websites. In the model, as a first step in knowledge creation, data is considered as the initial input and it must go through processing or the set of rules that will convert it into information.

> **Information.** As seen from the model, information is the end result of processed data. Once a set of rules built into a processor or a program is applied to a set of data, information is produced. In other words, information is processed data. Also, different processors can be applied to the same data to generate different type of information.

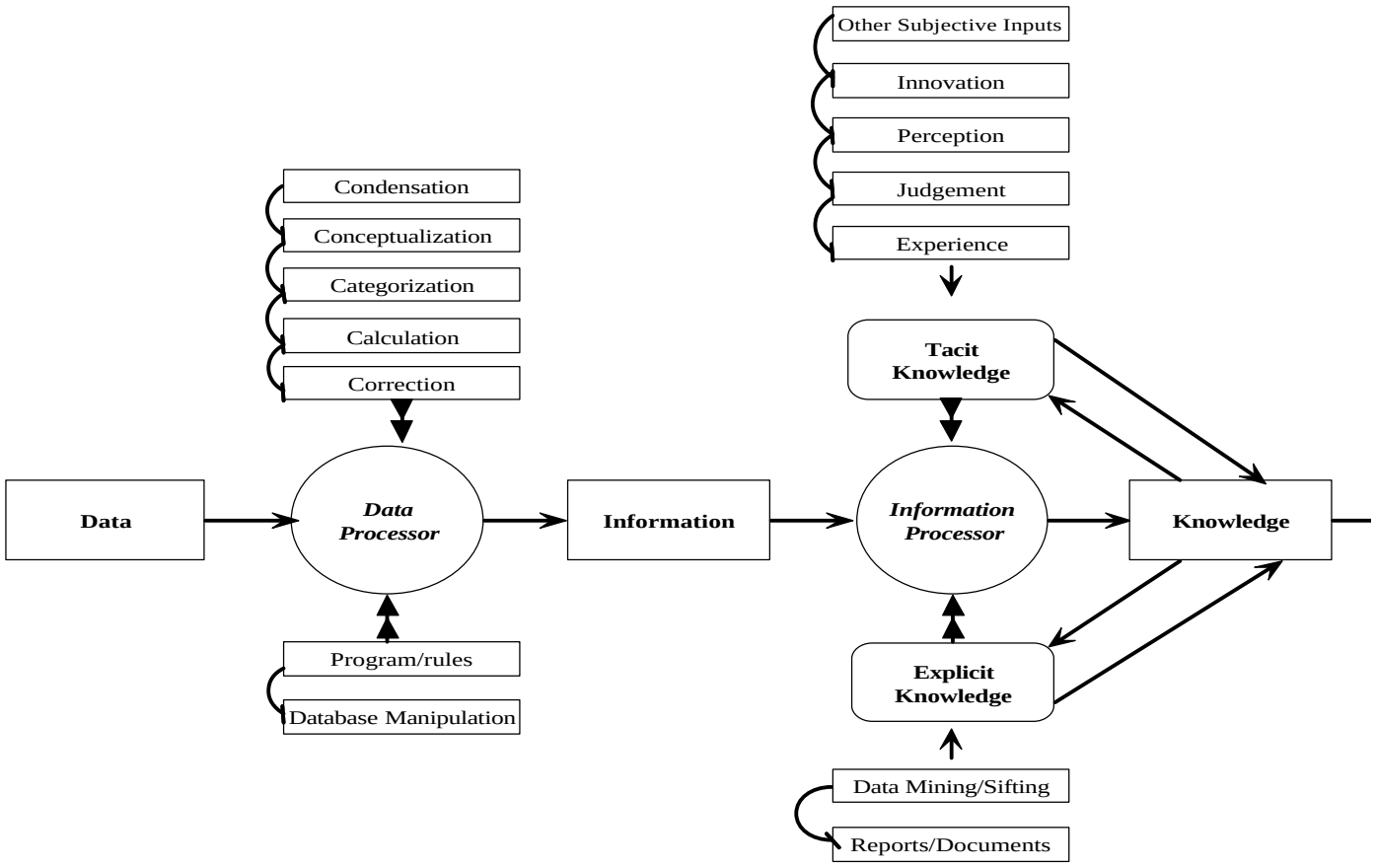
Wiegand and Waloszek stated "the structure of information is an important factor in understanding relationships among data." The model shows that data must go through a processor to be converted into information. What does the processor contain to convert data into information? The processor contains instructions or a set of rules that act on the raw facts to add a context.

In order to assist the reader to get a quick idea as to what it takes to add meaning to the data to achieve information, the model adopted Davenport and Prusak (2000) "five Cs.". The authors discuss that the person who creates information can add meaning to data. They concentrate on the following five processes to assist in making meaningful information:

1. "Contextualize" - the purpose of utilizing the data is known
2. "Categorize" - the part of data under analysis is determined
3. "Calculate" - using mathematical and statistical analysis
4. "Correct" - removing faulty data
5. "Condense" - summarize or view data in a tabular form.

The Diagrammatic Approach

Figure 1. Figure one depicts the links between all the factors that might produce knowledge. Also the figure shows how knowledge can be of two basic types, mainly tacit and explicit.



These methods add meaning to the raw facts found in data. The model also reminds us of the rules found in the application software or the database to convert data into meaningful information. A database software is conceptually no different from any program that contains those rules that will allow the manipulation of data. Database software stores, sorts, retrieves, queries (asks questions based on certain criteria), and generates reports. Administrators in higher education institutions are concerned with generated reports that help in making sound decisions.

Knowledge. After acquiring information from the previous step in the model, information goes through the information processor. The information process is influenced by two factors. These are tacit knowledge and explicit knowledge and the elements that influence each of them.

First we will discuss tacit knowledge. According to Skyrme (2002), 70 percent of any organizational "vital knowledge" comes directly from tacit knowledge. This is what employees carry in their heads. Skyrme continues by saying that with such high dependency on tacit knowledge, most organizations focus their attention on explicit knowledge and information retrieval only. However, there is a definite need to shift our attention to how we capture, record, and disseminate the important asset of tacit knowledge.

As mentioned earlier, tacit knowledge is found in people's heads; therefore it is considered an intangible component in the knowledge creation process. The model shows how profoundly tacit knowledge impacts the process of knowledge creation. It doesn't get its feedback only from the resultant knowledge, but is enriched by other non-quantitative inputs. Although there are many factors that influence tacit knowledge, primarily the model focuses only on four intangible factors including innovation, perception, judgment, experience. Some other subjective and qualitative inputs will be discussed briefly.

1. Innovation. Knowledge creating and innovation are linked. Nonaka and Takeuchi (1995) state that innovation is a result of continuously creating knowledge, circulating and implementing it. Further, in the process of employing knowledge to create an innovative environment, this knowledge must be linked to new products, technology, and existing systems.

2. Perception. From extracts of Peter Drucker's work "Management: Tasks, Responsibilities, Practices," the commentator notes that "the connection between experience, perception, and concept formation -- that is, cognition -- is, we now know, infinitely subtler and richer than any earlier philosopher imagined." Further, the author states that to communicate anything to another person, it would be impossible to do so unless the other person applies the faculties of perception.

3. Judgment. As seen from the model, judgment is qualitative input in knowledge creation. Tiwana (2000) notes that knowledge includes judgment as a factor linked to it. From the article "Manage the 'Other Half' of your Knowledge, Kamoon Inc.," provided by www.kmworld.com, the author refers to the Delphi group by stating that "Up to 42% of the knowledge that professionals need to do their jobs comes from other people's brains—in the form of advice, opinions, judgment or answers."

4. Experience. According to Garvin (2000), experience is created from multiple cycles of previous results deposited as information. When we examine this information, experience becomes a learning tool. Further, the author states that regardless of the style of learning, we always end up with better understanding, improved skills, and enhanced ability to function.

5. Other qualitative factors. This paper will not attempt to count all the many factors that contribute to knowledge creation in an institution. In reference to knowledge creation and intangible factors, Tiwana (2000) discusses the fact that decision makers always integrate their "values, assumption and beliefs" in the nature of the organization. Further, to distinguish between information and knowledge, the author states that acquiring knowledge is a different process than acquiring information, since "knowledge acquisition is the process of development and creation of insights, skills, and relationship." (p. 72)

Second we will discuss explicit knowledge. Explicit knowledge can be codified. It is found in reports, procedures, and best practices. This section will briefly discuss data mining and stored reports and documents since they form main inputs to explicit knowledge.

1. Data Mining. Sifting or data mining is the act of going through massive amounts of data to extract new knowledge. In defining "data mining", www.whatis.com (2003) shows that data mining is the process of data categorization to recognize "patterns" and creating "relationships." The definition discusses a list of parameters that impact data mining:

a) "Association" – attempt to find patterns based on events and their connection to other events
b) "Sequence or path analysis" – attempt to find a connection between a later event that was caused by an earlier one
c) "Classification" – attempt to look for new patterns
d) "Clustering" – attempt to find new and previously unknown facts and documenting them visually
e) "Forecasting" – attempt to make responsible future forecasting based on discovered patterns

2. Report and Documents. Administrators and/or managements can reexamine old reports and documents to find any information that can add value and understanding to a current problem. Archived reports and documents can contain invaluable input to the information processor to add more competence to the produced knowledge.

It should be noted from the above that neither tacit knowledge nor explicit knowledge is considered static by nature. Human experience shows that knowledge is not a static issue; rather it is dynamic and ever evolving. This notion is supported by Peter Drucker who states, "Knowledge changes incredibly fast and today's knowledge is tomorrow's ignorance," from an interview by Information Outlook (February 8, 2002). For that reason, the model emphasizes the need to examine the circular relationship between all the elements that create knowledge.

Finally, we must keep in mind that the resulting knowledge has no value unless an action follows. In other words, all knowledge creation must be followed by an action to make the whole process of knowledge creation valuable. Pfeffer and Sutton (2000) warned business leaders of

the millions of dollars spent every year on learning and training without any benefits. One main reason for this "knowing-doing gap" is not being able to turn knowledge into action.

The Importance of the Study

This study will contribute to the literature of knowledge creation in general. The most notable contribution of this study is the relationships between data, information and knowledge. This study assesses various parameters that lead to producing information. Also, the model relates several factors to provide the reader with an understanding of knowledge creation. The main benefit of the study is to see data, information and knowledge as interrelated concepts but with different contributions and purposes as inputs to knowledge creation.

Conclusion

This study attempts to answer the question, "What is knowledge?" and what factors add to the knowledge creation. The study includes a review of literature that covers topics including data, information, knowledge, knowledge management, and knowledge creation. A graphical model is designed to depict all the elements included in knowledge creation. The paper discusses in detail all depicted symbols found in the graphical model, creating a conceptual model of knowledge creation in higher education institutions or in any business application.

As a final thought, there is a need to emphasize that higher education and businesses alike are not using knowledge creation adequately. As seen from the review of literature, knowledge creation can enhance decision-making regardless of the business operation. Although knowledge management applications are not easily practiced, academia can greatly benefit from knowledge creation processes. There is no doubt that higher education institutions can increase their social and cognitive skills by applying knowledge management.

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