6-1-2012

The relationship between knowledge management and innovation: empirical study on AUC and Mansoura University

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THE RELATIONSHIP BETWEEN KNOWLEDGE MANAGEMENT AND INNOVATION:

EMPIRICAL STUDY ON AUC AND MANSOURA UNIVERSITY

A Thesis submitted to

Public Policy and Administration Department

In partial fulfillment of the requirements for

The Degree of Master of Public Policy and Administration

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KNOWLEDGE IS THE LIGHT OF LIFE

Dr. Ahmed Zuwail

Dedication

To the soul of my mother, I would not be what I'm now or what I will be in the future without your sincere encouragement and support when I was young

To my great family, my father, brother, and wife, your efforts with me were really incredible.

To my son, your great smile is the candle that lights up my life

Acknowledgment

I would like to express my deepest gratitude to my supervisor, Dr. Laila El Baradei for her patience and constructive support throughout the planning and development of this thesis.

I would like also to thank the committee members, Dr. Hamid Ali and Dr. Ghada Barsoum for your fruitful suggestions.

Finally, I should thank Dr. Jennifer Bremer, the Chair of the Department of Public Policy and Administration for her guidance from my first entry to the program till the end.

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Abstract

The purpose of this research is to examine the relationship between knowledge Management (KM) and innovation capability in two universities. They are the American University in Cairo and Mansoura University. Given the scarcity of studies that investigated these variables within the higher education context, we borrowed gold et al model that links KM to performance effectiveness in business sector and adapted it to the higher education context. According to this model, KM is seen as KM infrastructure (Culture, structure, and technology), and KM processes (k-acquisition, k-conversion, k-application, and k-protection). The findings show that AUC supersedes Mansoura University in terms of KM infrastructure, KM processes, and innovation. Also, results show that there is a significant and positive relationship between KM infrastructure, KM processes, and Innovation.

Content

I. Introduction

1.1 Background

Universities are considered to be among the oldest organizations in the world where their main activities are education and research (Laine and others, 2008). The role that universities play in any society is of extreme importance. The world now has witnessed the emergence of knowledge economy where knowledge is considered the main driver for economic development. In other words, the mechanism by which organizations acquire, share and use knowledge would determine the potential for economic success (Sahail and Duad, 2009). This has resulted in knowledge societies (I.e. "those that create share and use knowledge for the prosperity and well-being of its people" (Laine and others, 2008) over the past two decades have made this role more critical (Kende and others, 2007). It is recognized that higher education institutions are the cornerstone of any knowledge society (Kearney, 2009). Knowledge societies are demanding universities to be more innovative. In order for them to reach that aim, they should use more than the traditional managerial approaches and move to what is called "Knowledge Management" (KM). KM is referred to be the holistic systematic effort done by the organization that includes planning, controlling, and deploying of the organizational resources for the purpose of identifying, creating, storing, and disseminating knowledge for learning across the organization (Gill, 2009)

Knowledge is currently seen as a factor of production along with lands, capital, and labor. Moreover, it is seen as the most critical resource any organization has (Sohail and Duad, 2009) and (Adhikari, 2010). Taken from this perspective, knowledge is an item that could and should be managed. Knowledge Management (KM) is concerned with the management of knowledge acquisition, knowledge assimilation, and knowledge development (Ho, 2007). To understand the value of KM, Baruch (2000) compared the market and book values of Satandard& Poor (S&P) corporations and found that their market-to book ratio is $6. This means that for every six dollars in the market value, one dollar represents corporations fixed and current assets. The five dollars difference between the market and book value actually represents the intangible assets or what we call knowledge.

Conceptually, many authors have considered the relationship between KM and innovation. KM involves effectively managing the organization existing knowledge and developing new knowledge, while innovation involves the creation of new knowledge and ideas to facilitate new outcomes. So, there is integration between KM and innovation. In other words, if an organization has a strong knowledge base, this in turn means a better ability to focus innovative efforts efficiently. Higher Education institutions are no exception.

It is widely recognized that the most crucial element in developing any nation is the higher education. In other words, any developing country that aims to be ranked among developed countries should pay considerable attention to improving education process on general and higher education in particular (World Bank, 2008).

1.2 The current status of higher education in Egypt

It is widely recognized that higher education in Egypt really suffers from the lack of quality (Belal and Springuel, 2007). For instance, Egyptian graduates are believed that they do not have the knowledge, skills, and abilities required by the labor market (OCDE report, 2010) . Before 1950s, Egyptian universities, namely Cairo and Alexandria universities, were ranked among the top world's universities in science and research (Belal and Springuel, 2007). However, since 1952 revolution, the quality of Egyptian higher education began to deteriorate. The reasons for that deterioration are the lack of funding that is sufficient to provide high quality education to the massive number of students, the decline in the number of qualified teaching staff, the increasing number of new universities (Belal and Springuel, 2007), and the regime control and restrictions on the freedoms of teaching staff and students (Holmes, 2008)

The lack of higher education quality was clear in 2005 when it was reported that there is no Egyptian university included in the list of the best 500 universities all over the world (Belal and Springuel, 2007).

After the Egyptian revolution in January, 2011, all Egyptians have dreams and ambitions for Egypt to be ranked among developed countries. Because of that, the purpose of this research is to shed light on knowledge management and innovation in public and non-for profit higher education institutions within Egypt. Out of these institutions, the researcher will pick two universities. They are Mansoura University and

the American University in Cairo (AUC). Mansoura University is an example of an Egyptian public university. It was established in 1972 in the city of Mansoura and it has 17 faculties. AUC is an American accredited non-profit university which was found in 1919, and it has 6 schools.. More precisely, the aim of this study is to explore the concepts of KM and innovation and to examine the relationships between their dimensions at these universities.

II. Research Problem and Questions

In the majority of higher education institutions, there are no knowledge management systems that govern the systematic use of organizational knowledge. In addition to that, there is little awareness of the benefits that could be realized from developing such system (Serban & Luan, 2002). Consequently, this study aims to develop knowledge management framework that would make universities more innovative and consequently more capable of coping with the constantly changing environment. Moreover, given the scarcity in literature that investigated KM and innovation in higher education institutions in general and in Egyptian higher education institutions in particular, the aim of this study is to fill this theoretical gap by importing the experience of business sector in applying KM and adapting it to the university context.

In light of the above, the researcher has developed the following general research question:

What is the relationship between KM and innovation in higher education institutions in Egypt?

Applying this general research question to our selected universities (Mansoura University and AUC) yielded the following specific research questions

- *To what extent KM has been applied in both the American University in Cairo (AUC) and Mansoura University?*
- *To what extent AUC and Mansoura University are innovative?*
- *What is the relationship between knowledge management and innovation in AUC and Mansoura University?*

The rest of this study will be organized as follows:

III. Literature Review

IV. Conceptual framework

V. Research Methodology

VI. Data Analysis

VII. Discussion and Conclusion

III. Literature review

Most higher education institutions in Egypt are public universities that do not aim for profit. Given that most KM and innovation literature focus on for profit organizations and non-profit organizations, the researcher think it will be appropriate to look at KM and innovation in public and nonprofit organizations and that will be the first section of literature review. The second will be knowledge management and innovation in higher education.

3.1 Literature about Knowledge Management and innovation in public and non-profit organizations

Given the scarcity of literature that focused on KM in higher education and the fact that most higher education institutions in Egypt are non-profit organizations, it is worthwhile to shed the light on the differences between for-profit and non-profit organizations in terms of KM and innovation. In an attempt to compare the adoption of Knowledge Management in public and private sectors, there was a study by McAdam and Reid (2000) that made this comparison and found that:

- Public sector organizations supersedes private sector in knowledge construction, knowledge embodiment, knowledge dissemination, and knowledge use.

On the other hand, Hull and Lio (2006) found that non-profit organizations differ from profit or business organizations in terms of the following points:

- **Rigid responsibility structure of non-profit organizations**. Non-profit organizations face endless demands for their services by clients, supporters,

employees, board, in addition to the need for compliance with charter and other legal and political mandates. Therefore, there are various measures for success that non-profit organizations have to meet. On the other hand, for-profit or business organizations are mainly responsible to shareholders and applicable laws.

- **Motivations and compensations of employees**. Non-profits are typically run by volunteers and employees who receive a lower pay and benefits compared to others working in business organizations.
- **Overall goals of the organization.** Non-profit organization must carefully balance providing quality services to their clients with the increasing number of people whom they can serve. On the other hand, for-profit organizations are expected to maximize profits to their shareholders.

Current literature about KM shows case studies work in different contexts and each time focusing on different correlations between KM and other managerial variables like efficiency, effectiveness, employee productivity and satisfaction, and costs. For instance, in case study analysis by Littieri, Borga, and Savoldelli (2004), it was found that adopting ad-hoc KM solutions by the Italian NPOs can achieve high degrees of efficiency and effectiveness. Another case study investigated by Blackman and Kennedy (2009) found that Knowledge Management will result in effective governance and successful strategy in an Australian University. Shaw, Hall, Edwards, and Baker (2007) argued that focusing on KM is one of the most critical factors for achieving corporate goals and meeting or satisfying the needs and expectations stakeholders. Zurbushen (1998) argues that adopting effective KM has positive effects on knowledge sharing, collective knowledge

growth, satisfaction and productivity of employees. .With regards to the relationship between KM, overall productivity, and cost, Feng, Chen, and Liou (2005) found that firms that applied KM systems significantly reduced administrative costs and contributed to improvement in productivity

Importance of KM in public sector

There are five reasons that highlight the importance of innovation in public sector (Potts and Castell, 2010). First is the size of public sector organizations; "the public sector in OECD countries comprises 20% - 50% of GDP" (Potts and Castell, 2010). Second is that public sector organizations have certain objectives that can be achieved through new pathways. Third is that public sector organizations need to establish benchmarks and other measures that guide their efforts toward achieving their societal goals(Potts and Castell, 2010). Fourth is the evolving economy with technological and institutional change stresses that public organizations must adopt innovation policies (Potts and Castell, 2010).

Regarding innovation, Sumita (2008) argues that globalization and the real knowledge economy are causing innovation to be more substantial for corporate profits and economic growth. Johansson and Olsen (2009) argued that innovation is the primary source of sustainable competitive advantage in knowledge economy.

Relationship between KM and Innovation

Regarding the relationship between KM and innovation, Lundval and Nielsen (2007) found that Knowledge Management plays a key role in improving innovation

performance. Huang and Li (2008) have proved that there is a positive relationship between KM and administrative and technical innovation performance. In addition to that, KM mediates the relationship between social interaction and innovation performance. Plessis (2007) went a step forward and found that KM plays this role in innovation performance in ten ways.

- First, KM, through its tools, helps in creating tacit knowledge. This, by the way, would increase Knowledge sharing which is strongly correlated with innovation performance.
- Second, KM helps in transferring tacit knowledge to explicit knowledge. Therefore, this can provide both the platforms and processes to ensure that tacit knowledge became explicit.
- Third, KM allows for cooperation between various departments within the organizations through online collaboration forums as well as organizational tools and platforms such as intranets and extranets.
- Fourth, KM ensures the availability and accessibility of both tacit and explicit knowledge used in the innovation process through using "knowledge organization and retrieval skills and tools".
- Fifth, KM keeps a smooth flow of knowledge and information used in the innovation process.
- Sixths, KM provides tools, processes, and platforms to ensure integration of an organization's knowledge base. And that is through KM structures.
- Seventh, KM helps in identifying any gaps in the knowledge base and provides processes to fill the gaps in order to promote innovation.

- Eighth, KM assists in building capacities and competencies that are required for the innovation process.
- Ninth, KM provides organizational context to the body of knowledge in the organization and assists in steady growth of the knowledge base through gathering and capturing of explicit and tacit knowledge.
- Tenth, KM provides a knowledge-oriented culture through which innovation can happen. Organizations that have knowledge management capability will use the resources more effectively and consequently will be more innovative and perform better than those organizations without KM capability (Darroch, 2005)

Svetlik and Costea (2007) argues that Human Resource Management (HRM) and KM are interrelated; they are both share the common activities and goals like inter-departmental cooperation, communication flows, and networks inside the organization and beyond its boundaries. Chen, Huang, and Hsiao (2010) found that the effects of KM on innovation performance is positively moderated by supportive climate and decentralized and less formalized managerial structure.

There is a comprehensive model that is used to improve organizational performance through KM capability. It was developed by Gold et al (2001). According to this model, the effectiveness of organizational performance is dependent on KM infrastructure (prerequisites for KM and includes culture, structure, and technology) and KM processes (k-acquisition, k-conversion, k-application, and k-sharing). In other words, Gold et al (2001) argues that effectiveness of KM infrastructure and KM processes will

lead to improvements in indicators of organizational performance. One of these performance indicators is innovation performance.

3.2 Literature about Knowledge Management and innovation in higher education

Although higher education institutions are recognized as knowledge intensive organizations (Goddard, 1998), the literature about knowledge management and/or innovation in higher education institutions is characterized by scarcity. The core business of higher education institutions is mainly creating and disseminating information and knowledge (Rowley, 2000) and (Keeley, 2004). But unfortunately, higher education institutions are considered by many researchers lagging behind private sector in knowledge management (Keeley, 2004).

In fact, higher education institutions are, by their nature, an appropriate place for applying KM principles and approaches. Sharing and disseminating knowledge are the main functions of universities' teaching staff. This characterizes the atmosphere of higher education institutions with a relatively higher degree of trust than what might be found in business organizations (Mikulecka and Mikulecky, 2008). In other words, employees in business organizations mostly favor keeping knowledge in their minds in order to maintain their competitive advantage while in universities contexts, the idea of sharing information and knowledge is a norm rather than an exception and is definitely related to any university's mission.

The following studies show some examples of KM applications in the university context. In fact, there are many areas where knowledge management could be applied in higher education institutions. For example, a study did by Gue (2010) discussed the construction and application of KM in the universities digital libraries. He argued that for universities digital libraries to meet the diverse demands of the users, they should effectively create, store, organize, and deliver knowledge. He described that applying KM in the digital libraries will lead to improvement in the service delivered and the management method in them, and also will lead to making digital libraries more adaptive to the constantly changing environment.

Another study by Zhou and others (2011) focused on the scientific research in higher education institutions in china. They argued that applying knowledge management on scientific research would positively contribute not only to enhancing the university ability to do research that is more responsive to the external environment, but also to improving the sustainable development of the scientific research ability. Also, Keeley, (2004) found that the existence of a formal KM program in the scientific research in higher education institutions is positively correlated with organizational learning and innovation. Serban and luan (2002) argue that effective application of KM in higher education institutions will lead to an enhancement in the quality of curricula.

Literature summary

Reviewing literature shows that KM is mostly applied in for-profit organizations. On the other hand, there is poor application of KM in public and non-for-profit organizations in general and in higher education in particular. In the literature we described what is KM and highlighted the difference between for-profit, non-for-profit, and public organizations in terms of KM. Then, we discussed the importance and motivations for applying KM. Also, literature emphasized the potential role of KM in maintaining and improving the organizational innovation performance.

After that we discussed KM within higher education institutions. We have showed some KM applications in university level. In this part, literature has shown that KM was a key factor in improving the performance of digital libraries and scientific research and making them more capable of coping with challenges posed by globalization. In addition to that, it was shown that sound KM system would yield improvements in curriculums' design.

This research is a step toward filling the gap in literature in KM within the university context by examining the relationship between KM dimensions, KM sub-dimensions, and innovation. On the other side, it will help higher education policy makers who are interested in reforming higher education in Egypt to make Egyptian universities more innovative through adopting KM approach.

IV. Conceptual Framework

In this section, the researcher will refer to the dimensions and elements of both KM and Innovative performance in higher education organizations that he will go through in this study. Actually, there are many views about KM and Innovation, however; the researcher will pick views that are mostly relevant to the purpose of this study.

According to Gold et al (2001), knowledge Management is composed of two main dimensions. They are knowledge Management infrastructure and Knowledge Management processes. Large segment of knowledge Management literature has focused on knowledge management processes. For instance, Hault, (2003) defined knowledge as "the organized and systematic process of generating and disseminating information, and selecting, distilling, and deploying explicit and tacit knowledge to create unique value that can be used to achieve a competitive advantage in the organizational environment". One definition of Knowledge Management that resulted from synthesizing explanations of Knowledge Management is (Yang & Wan, 2004) "the process of collecting and identifying useful information (i.e. knowledge acquisition), transferring tacit knowledge to explicit knowledge (i.e. knowledge creation or transfer), storing the knowledge in the repository (i.e. organizational memory), disseminating it through the whole organization (i.e. knowledge sharing), enabling employees to easily retrieve it (i.e. knowledge retrieval) and exploiting and usefully applying knowledge (i.e. knowledge leverage). This explanation highlights the interrelated pillars of Knowledge Management. They are

1) Knowledge acquisition

2) Knowledge creation

3) Knowledge storing

4) Knowledge dissemination

5) Knowledge retrieval, and

6) Knowledge application.

(Gold et al, 2001) argued that knowledge management processes capabilities are composed of

- Knowledge acquisition
- Knowledge conversion
- Knowledge application
- Knowledge protection

However, before the application of Knowledge Management processes, there are some organizational factors or prerequisites that may be referred to as the KM infrastructure that might affect the organization- i.e. public and non-profit organizations- ability to successfully apply Knowledge Management. These factors might be grouped into 1) Organizational Culture, 2) Organizational structure, 3) Technology, and 4) Human resources (Shariffuddin & Rowland, 2004). (Gold et al, 2001) had argued that knowledge management KM infrastructure is composed of three key dimensions

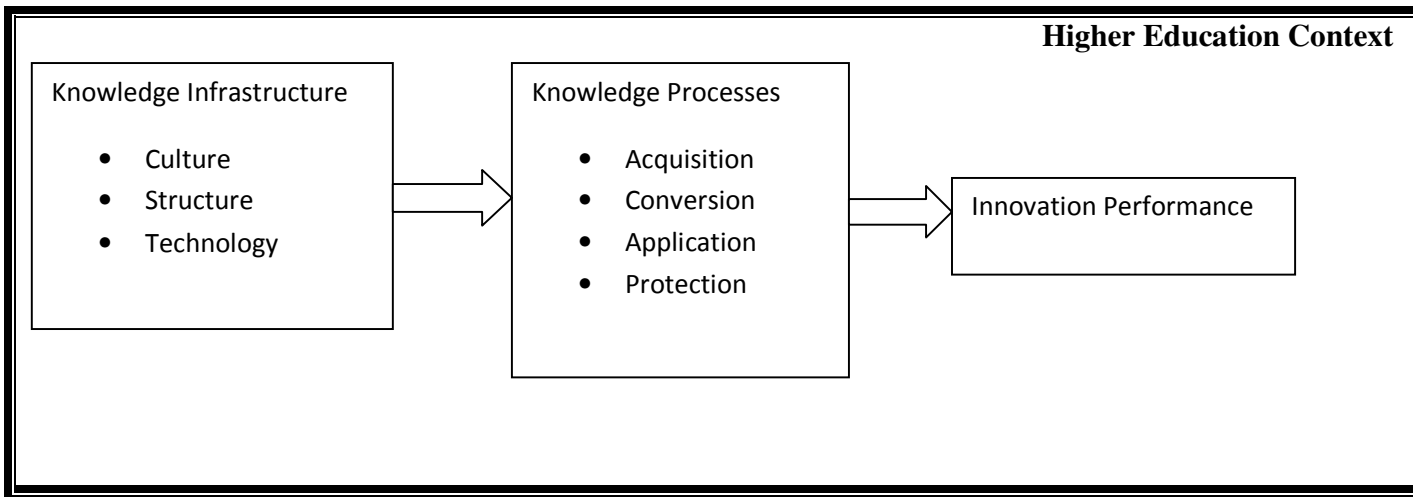
1. Cultural infrastructure

2. Structural infrastructure
3. Technological infrastructure

We assume in this study that KM is important to the innovation processes, which, in turn, help higher education institutions to benefit from the opportunities provided by the environment.

In light of the above, the study conceptual model is as follows:

Figure 1: Conceptual Framework



Knowledge infrastructure refers to "the capability to manage the infrastructures in the organization in order to support and facilitate organizational activities" (Paisittanand et al., 2007) and it is composed of the cultural, structural, and technological infrastructures.

Knowledge processes refers to "the capability of a process to transform knowledge that is stored in the organization's memory into valuable organizational knowledge, experience,

and expertise" (Paisittanand et al., 2007,) and it is composed of knowledge acquisition, knowledge conversion, knowledge application, and knowledge protection.

Innovation performance refers to "the creation of new knowledge and ideas to facilitate new outcomes" (Chen and others, 2010).

Based on that conceptual framework and the study research questions, the following research hypotheses has been formulated as follows:

For research question 1: To what extent KM has been applied in both the American University in Cairo (AUC) and Mansoura University?

In order to answer this research question, two hypotheses will be tested:

H1: There is a significant difference between Mansoura University and the AUC in terms of knowledge infrastructure

H2: There is a significant difference between Mansoura University and the AUC in terms of knowledge processes

For research Question 2: To what extent Mansoura University and AUC are innovative?

In order to answer this research question, the following hypothesis will be tested:

H3: There is a significant difference between Mansoura University and AUC in terms of innovation

For research question 3: What is the relationship between knowledge management and innovation in AUC and Mansoura University?

In order to answer this research question, two hypotheses will be tested

H4: There is a positive relationship between KM infrastructure capabilities and KM process capabilities in both AUC and Mansoura University.

H5: There is a positive relationship between KM process capabilities and innovation performance in both AUC and Mansoura University.

V. Research Methodology

In order to answer the previously mentioned research questions, the researcher realized that the qualitative approach could not provide us with the needed representation of faculties/schools. Moreover, conducting in-depth interviews with teaching staff in both universities was actually impractical. It is argued that the quantitative research approach is the most appropriate to examine the relationships between relatively large number of variables (Rudestam and Newton, 2001). Therefore, the researcher decided to adopt a quantitative approach through implementing a survey as explained below.

Population and sample

The population of this study will be all faculties and schools in Mansoura University and the American University in Cairo (AUC). Ideally, the most appropriate sampling method in this study is the random sampling. However, because of time and cost constraints, it would be too hard to adopt a random sampling method to get a random sample out of this population. Therefore, the researcher adopted a convenient sampling method in which the researcher selects the sample based on the relative ease of access to the sampling frame.

The survey used in this study was based on the model used by Gold et al (2001) and was adapted to the context of higher education. As some of the teaching staff in Mansoura University are not too familiar with English language, the survey was also translated into Arabic. It was optional for those who agreed to answer it to choose the Arabic or English version. The survey was distributed to teaching staff in different

faculties within the two universities. The main criterion for distributing the survey was the number of students. In other words, the percentage of surveys distributed in each university is based on the relative number of students enrolled in each one.

Pilot study

Pilot study was undertaken through distributing the surveys to a small group of university teaching staff in and letting them make comments on how to make it more comprehensible. Surveys that are distributed to the pilot group were not included in the analysis. Many respondents have recommended changes certain statements in order to make them valid to measure the intended variable. The comments of the pilot group were really fruitful and were used to improve the comprehensibility of the survey, especially in the Arabic one. In fact, the pilot study has really improved the validity of the survey questionnaire.

Survey

The final survey actually consisted mainly of two parts :-

The first part contained questions about knowledge infrastructure, knowledge processes, and innovation. As knowledge infrastructure consisted of three dimensions – cultural, structural, and technological infrastructure, and knowledge processes consisted of k-

acquisition, k-conversion, k-application, and k-protection, there were 56 statements that were formulated to measure these dimensions and sub dimensions. These statements were modelled to a five-point Likert scale (from 1= strongly disagree to 5= strongly agree). A likert scale allows us to codify responses and therefore, the collected data can be easily compared and manipulated.

The second part consisted of questions about the characteristics of the respondent. More specifically, they were about the respondent's university, faculty, and his/her academic position.

Research Limitations

First, we will not be able to generalize our findings because the sampling method was a non-probability sampling. That is the sample has not a perfect representation of the faculties / schools in the AUC and Mansoura University. Also, the study was conducted on only two universities in Egypt. That is also hinders our ability to generalize results to all public and non-profit universities in Egypt. However, it will provide us with indications for knowledge management and innovation within these universities.

Second, the data collected in this study represent the perceptions of the respondents regarding the existence of knowledge infrastructure, knowledge processes, and innovation in their faculties/schools. Therefore, these data represent subjective rather than objective measure of these variables.

Third, the survey was translated to Arabic language. Any translation from one language to another is affected by differences in the cultures. Therefore, this must be kept in mind when analyzing the validity and reliability of the survey.

Fourth, as highlighted in the research methodology, the survey will be distributed only to the teaching staff in the universities. Administrative employees will not be covered in this study. Therefore, the focus of this study is on the teaching and research function, not on the managerial functions.

Fifth, as some of the respondents refused to answer the survey and due to omitting the surveys that are answered with negligence, the final respondents were not proportionate as the initial targeted sample.

Sixth, the majority of Mansoura University sample was teaching assistants and lecturers, while the majority of AUC sample was assistant professors, associate professors, and professors. This should be kept in mind when analyzing the differences between the two universities.

Ethical Assurance

As all studies that are to be done by AUC need to get an approval from the International Review Board (IRB), an application was sent to get its approval on this study. The IRB has studied the consent form, the methodology, and the questionnaire. The final approval was obtained on Feb 21, 2012. Immediately after getting the IRB approval, the survey questionnaire was distributed to our sample in Mansoura University and AUC (see appendix 3)

VI. Data Analysis

Statistical Package for Social Sciences (SPSS) was used to analyze the data collected through the survey. Data is analyzed through two analysis methods:

- *Descriptive Analysis, and*
- *Inferential Analysis.*

Descriptive Analysis is mainly adopted to know the characteristics of the respondents that are related to the research topic. More specifically, this analysis is used to gain understanding of the respondents profile and the profile of faculties/schools represented by them.

Inferential analysis is mainly used to answer the research questions and to reject or accept the research hypothesis. Before going over the data analysis, we should answer two questions:

- How the data was collected?
- What is the reliability of the research instrument (i.e. survey)?

Data Collection

350 questionnaires distributed (230 to Mansoura University and 120 to AUC).The collected surveys were 96 from Mansoura University representing a response rate of nearly 42% and 72 from AUC representing a response rate of 60%. The response rates from the two universities are considered acceptable.

Descriptive analysis

In this part, we will shed the light on the sample characteristics and the profile of faculties/schools they represent. Descriptive analysis is mainly based on the second part of the survey questionnaire. In this part, respondents were asked to identify their university, faculty/school, and academic position. Although descriptive analysis is not directly related to our research questions, it really helps us to better understand the context from which our sample is drawn. The sample of 168 teaching staff comprised of 96 respondents from Mansoura University and 72 respondents from AUC. The following tables (tables 1&2) show how the faculties/schools represented by the sample drawn from each university.

Table 1: Number of respondents per faculty in Mansoura University

Faculty	**Number of respondents**
Commerce	24
Medicine	11
Dentistry	14
Computer Science	18
Law	9
Agriculture	12
Science	8

Table 2: Number of respondents per school in AUC

school	Number of respondents
Business	13
Humanities and Social Science	13
Global Affairs and Public Policy	11
Sciences and Engineering	12
Continuing Education	11
Education	12

In the representation of schools/faculties in this study, the researcher tried to make a fair representation of both social and applied science schools/faculties in both Mansoura University and AUC. The aim of that attempt was to control for the differences in schools/faculties represented in the sample, so that any difference is attributed to the factors that are investigated in this study.

With regard to the academic positions represented by the sample from each university is showed in the following tables (tables 3 &4)

Table 3: Number of Respondents per academic position in Mansoura University

Academic position	Number of respondents	Percentage
Teaching Assistants	26	27.08%

Lecturers	24	25%
Senior Lecturers	23	24%
Assistant professors	4	4.2%
Associate professors	12	12.5%
Professors	7	7.29%

Table 4: Number of Respondents per academic position in AUC

Academic position	Number of respondents	Percentage
Teaching Assistants	5	6.94%
Instructors	5	6.94%
Senior instructors	11	15.28%
Assistant professors	23	31.94%
Associate professors	18	25%
Professors	10	13.89%

Reliability Test

In order to measure the reliability of the survey questionnaire, Cronbach's Alpha test was used for knowledge infrastructure sub-dimensions (cultural, structural, and technological infrastructures) , knowledge processes sub-dimensions (k-acquisition- k-conversion, k-application- and k- protection), and innovation. In addition to that, the reliability of each statement was measured using item-to-total correlations where statements with low item-to-total correlations score are omitted from the analysis. Table 5 is a summary of the output of SPSS analysis for the reliability of the above mentioned sub-dimensions and innovation. Detailed SPSS output for reliability tests are in appendix 2.

Table 5: Reliability test for all variables

Sub-dimensions	*No. of items*	*Conbach's Alpha*
Cultural infrastructure	10	0.901
Structural infrastructure	7	0.776
Technological infrastructure	7	0.864
k-acquisition	6	0.822
k-conversion	8	0.842
k-application	7	0.817
k-protection	7	0.893
Innovation	4	0.904

Regarding knowledge infrastructure, its three sub-dimensions (cultural, structural, and technological infrastructure) gained Cronbach's Alpha score of 0.901, 0.776, 0.864 respectively. Regarding knowledge processes, its four sub-dimensions (k-acquisition, k-

conversion, k-application, and k-protection) gained Cronbach's Alpha score of 0.822, 0.842, 0.817, 0.893 respectively. One statement was omitted from k-acquisition sub-dimension because of its the very low item-to-correlation score. This statement was the fourth under k-acquisition. With regard to innovation, it gained 0.904 Cronbach's Alpha score. Since all Cronbach's Alpha score are above 0.7, the questions are considered reliable and will be further analyzed.

Inferential Analysis

In this part of the study, the researcher will use inferential analysis to answer the research questions and to accept or reject the research hypothesis.

Research question 1: To what extent KM has been applied in both the American University in Cairo (AUC) and Mansoura University?

H1: There is a significant difference between Mansoura University and the AUC in terms of knowledge infrastructure

In order to test this hypothesis, the average score for the three sub-dimensions of knowledge infrastructure (cultural, structural, and technological infrastructure is calculated for each university. Then, the mean scores are compared using T-test in order to see whether or not the differences in means are significant between Mansoura University and AUC. Table 6 shows the means scores for knowledge infrastructure capabilities for the two universities. Since the questions were measured using Likert five-points scale, we can assume that the cut point is the score 3. In other words, the mean

scores below 3 indicate poor knowledge infrastructure, and the mean score above 3 indicate good knowledge infrastructure. Therefore, we can argue that AUC supersedes Mansoura University in terms of all KM infrastructure sub-dimensions.

Table 6: Mean scores for knowledge infrastructure

	Mansoura	***AUC***
Cultural Infrastructure	2.4667	3.3931
`Structural Infrastructure	2.1815	3.0754
Technological Infrastructure	2.2725	3.4884

H2: there is a significant difference between Mansoura University and AUC in terms of knowledge processes.

To test this hypothesis, we will do the same as in testing H1. Table 7 shows the average scores for KM processes sub-dimensions (k-acquisition, k-conversion, k-application, and k-protection). As shown, we can argue that AUC exceeds Mansoura University in terms of all KM processes sub-dimensions.

Table 7: Mean scores for knowledge processes.

	Mansoura	***AUC***
k- acquisition	2.1767	3.7301
k-conversion	2.0495	3.1510
k-application	2.0491	3.4067
k-protection	2.0357	3.3433

Research Question 2: To what extent Mansoura University and AUC are innovative?

H3: there is a significant difference between Mansoura University and AUC in terms of innovation.

The mean scores for innovations in both universities are calculated and are shown in table 8. AUC also exceeds AUC in terms of innovation capability.

Table 8: Mean scores for innovation

	Mansoura	***AUC***
Innovation	2.1318	3.7326

Research question 3: What is the relationship between knowledge management and innovation in AUC and Mansoura University?

H4: There is a positive relationship between KM infrastructure capabilities and KM process capabilities in both AUC and Mansoura University.

Two steps are taken in order to test this hypothesis. First, correlation table was presented in order to see to what extent KM infrastructure capability and KM process capability are correlated. Second, in case there is a strong correlation, whether positive or negative correlation, regression analysis will be undertaken to examine how much of the variations in KM process capabilities are described by variations in KM infrastructure capability.

Table 9 shows the correlation matrix for KM infrastructure sub-dimensions (cultural, structural, and technological infrastructures) and KM processes sub-dimensions (k-acquisition, k-conversion, k- application, k- protection) in both Mansoura University and AUC. The results show very significant (0.01 level) and very positive (all correlation scores are above 0.5) correlations among all sub-dimensions. Also, the correlations between KM infrastructure sub-dimensions indicate that all of the four sub-dimensions are key components of KM infrastructure (They range from 0.54 to 0.697). In order to better analyze the relationship between these variables, KM processes sub-dimensions are averaged in one variable named KM processes. Then, another correlation matrix between KM processes and KM infrastructure sub-dimensions is shown in table 10 with all correlation scores are also significant and positive.

Since there is a strong correlation between KM infrastructure and KM processes, a regression analysis is done where KM processes is considered the dependant variable and KM infrastructure sub-dimensions are considered the independent variable. Table 11 shows the results of that regression analysis where R (square) is 0.788. Therefore, we can argue that change in KM infrastructure is responsible for 78.8% of the change in KM processes at 0.01 significance level. Table 12 shows that the coefficients for cultural, structural, and technological infrastructures are 0.302, 0.245, and 0.384 respectively. Since the coefficients for KM infrastructure sub-dimensions are so close to each other, we can argue that all of cultural, structural, and technological infrastructure has approximately the same level of importance in improving the overall KM processes capability.

Table 9: Correlation matrix between KM infrastructure capability and KM processes capability

		cultural	structural	technological	acquisition	conversion	application	Protection
cultural	Pearson Correlation	1	.697**	.671**	.694**	.693**	.739**	.744**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	168	168	168	168	168	168	168
structural	Pearson Correlation	.697**	1	.540**	.716**	.618**	.564**	.650**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	168	168	168	168	168	168	168
technological	Pearson Correlation	.671**	.540**	1	.685**	.708**	.739**	.731**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	168	168	168	168	168	168	168
acquisition	Pearson Correlation	.694**	.716**	.685**	1	.755**	.680**	.744**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	168	168	168	168	168	168	168
conversion	Pearson Correlation	.693**	.618**	.708**	.755**	1	.770**	.737**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	168	168	168	168	168	168	168
application	Pearson Correlation	.739**	.564**	.739**	.680**	.770**	1	.791**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	168	168	168	168	168	168	168
protection	Pearson Correlation	.744**	.650**	.731**	.744**	.737**	.791**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	168	168	168	168	168	168	168

**. Correlation is significant at the 0.01 level (2-tailed).

Table 10: Correlation matrix between KM infrastructure sub-dimensions and KM processes

		cultural	structural	technological	Processes
cultural	Pearson Correlation	1	.697**	.671**	.799**
	Sig. (2-tailed)		.000	.000	.000
	N	168	168	168	168
structural	Pearson Correlation	.697**	1	.540**	.706**
	Sig. (2-tailed)	.000		.000	.000
	N	168	168	168	168
technological	Pearson Correlation	.671**	.540**	1	.796**
	Sig. (2-tailed)	.000	.000		.000
	N	168	168	168	168
processes	Pearson Correlation	.799**	.706**	.796**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	168	168	168	168

**. Correlation is significant at the 0.01 level (2-tailed).

Table 11: Model Summary for KM infrastructure and KM processes

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.888[a]	.788	.784	.43890

a. Predictors: (Constant), technological, structural, cultural

Table 12: Coefficients for KM infrastructure

		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.050	.112		.446	.657
	cultural	.302	.051	.341	5.926	.000
	structural	.245	.054	.230	4.536	.000
	technological	.384	.042	.444	9.054	.000

H5: There is a positive relationship between KM process capabilities and innovation performance in both AUC and Mansoura University.

To test this hypothesis, the same steps taken in testing H4 are taken. Table 13 shows the correlation matrix between KM processes and innovation capability in both Mansoura University and AUC. The correlation scores ranges from 0.7 to 0.865 indicating strongly positive and significant correlation (at 0.01 significance level). Conducting a regression analysis to see the causal effect of KM processes on innovation in both universities reveals R (square) 0.801. This indicates that the change in KM processes is responsible for about 80% of the change in innovation level in both universities (table 14). The coefficients of KM processes sub-dimensions (k-acquisition, k-conversion, k- application, and k-protection) are 0.074, 0.116, 0.611, 0.370 respectively (table 15). As appear in the coefficients for KM processes sub-dimensions, the coefficient

for k-application has a stronger positive effect on innovation rather than the other KM sub-dimensions. This is expected because k-application involves applying knowledge learned from mistakes and experiences to get new knowledge and/or ideas that are innovative.

Table 13: Correlations between KM processes sub-dimensions and Innovation

		acquisition	conversion	application	protection	innovation
acquisition	Pearson Correlation	1	.755**	.680**	.744**	.700**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	168	168	168	168	168
conversion	Pearson Correlation	.755**	1	.770**	.737**	.751**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	168	168	168	168	168
application	Pearson Correlation	.680**	.770**	1	.791**	.865**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	168	168	168	168	168
protection	Pearson Correlation	.744**	.737**	.791**	1	.817**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	168	168	168	168	168
innovation	Pearson Correlation	.700**	.751**	.865**	.817**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	168	168	168	168	168

**. Correlation is significant at the 0.01 level (2-tailed).

Table 14: Model Summary for KM processes and innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.895[a]	.801	.796	.59636

a. Predictors: (Constant), protection, conversion, acquisition, application

Table 15: Coefficients for KM processes

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.237	.138		-1.712	.089
	acquisition	.074	.074	.059	1.002	.318
	conversion	.116	.088	.083	1.311	.192
	application	.611	.074	.529	8.280	.000
	protection	.370	.082	.293	4.526	.000

a. Dependent Variable: innovation

VII. Discussion and Conclusion

The main aim of this study is to shed the light on the relationship between KM infrastructure, KM processes, and innovation within the context of higher education. This was empirically examined in two universities in Egypt. The results showed in the previous section are mostly consistent with results of other studies in literature (Chen and others, 2000), (Darroch,2005), (Feng and others, 2005), and (Huang and Li, 2009). Moreover, the degree of correlations among these variables are generally more than or stronger than what is found in knowledge management literature within for-profit organizations. I argue that this might be true and expected because the main functions of higher education institutions are knowledge acquisition and knowledge dissemination. Therefore, KM initiatives are expected to produce more positive results than in any other types of organizations.

The results of this study provide policy makers in higher education with a comprehensive framework to make universities more innovative and more capable of responding to the needs of the constantly changing environment. To reach that aim, knowledge management program should be adopted. Adoption of a comprehensive KM program is not an easy task. In other words, it needs a radical infrastructural reform in terms of organizational culture, structure, and technology. Without the required infrastructural change, the KM initiative will mostly fail to achieve the intended outcomes.

There is a common mistake that is frequently thought by policy makers. When they want to better manage knowledge, they merely focus on getting KM technologies. Although it is a significant component in KM infrastructure capability, technology alone is not sufficient. It should be accompanied by change managerial culture and structure. In other words, the organizational culture should have values and beliefs that are supportive to knowledge sharing environment. Besides that, the organizational structure of higher education institutions should promote and support the cooperation between various departments (i.e. departments should not operate in islands isolated from one another).

In this study, I argue that Mansoura University is less innovative compared to AUC because it has a lower KM infrastructure which leads to lower KM processes. An indication for the poor KM practices within Mansoura University is the unavailability of a single source for information about the published research by different schools. In other words, in order to get information about articles published in Mansoura University, you have to go to each school individually and get data about research published by its researchers. The lack of sound KM infrastructure is much related to the general problem faced by higher education in Egypt. It is the finance. Enough budget is a prerequisite for KM infrastructure. It is much related to the three KM infrastructure sub-dimensions. In other words, changing the culture, improving the structure, and/or acquiring technologies cannot take place without having the needed fund. Although Egyptian government spends on higher education an amount that is mostly similar to other OECD countries, it is spend less in terms of expenditures per students (Fahim and Sami, 2011). Moreover, most of expenditures on higher education in Egypt are current rather than capital expenditures. That is, most of the expenditures go to wages and salaries instead of long term

expenditures (Fahim and Sami, 2011). In addition to that, most of these wages are not directed to the teaching staff (El Baradie, 2004). This implies that the teaching staffs have less incentive to change their culture and make it more knowledge supportive.

Also, the higher education system in Egypt lacks the structure the promote knowledge sharing. Unfortunately, it is a centralized system where the Ministry of Higher Education is the sole governmental body that is responsible for Egyptian public universities. This hinders Egyptian universities' abilities to cooperate and collaborate with other universities or business organizations to improve their knowledge bases.

Another mistake that is commonly thought by policy makers is that knowledge management is just about knowledge acquisition. K-acquisition is a key component of KM processes, but it is not all about KM processes. In addition to k-acquisition, knowledge should be converted to other people (k-conversion), should be applied to get value out of this knowledge (k-application), and should be protected from unauthorized uses (k-protection). All of these components are seen as significant components of KM processes.

Suggestions for future research

In this study, we went through knowledge management and innovation within the context of higher education institutions in Egypt. We focused on the teaching staff. Future research might investigate the KM and performance focusing on administrative staff. We also might investigate the differences between private and public universities in

Egypt with regards to knowledge management and innovation and the drivers of the differences, if found. In addition to that, future research might investigate KM differences between faculties within a specific university. Another topic that I think will be interesting is linking KM effectiveness to other measures of universities performance, like international ranking and/or accreditation status.

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Appendix 1: Research Survey

THE AMERICAN UNIVERSITY IN CAIRO

Documentation of Informed Consent for Participation in Research Study

Project Title: [*The Relationship Between Knowledge Management and Innovation: Empirical Study on Higher Education Institutions in Egypt*]

Principal Investigator: [*Ashraf Mohamed Numair*]

*You are being asked to participate in a research study. The purpose of the research is to examine the extent to which knowledge management is correlated with innovation performance in Egyptian non-profit universities, and the findings may be published and/or presented. The expected duration of your participation is about five minutes maximum.

*There will be no direct benefits to you from this research.

*The information you provide for purposes of this research is anonymous

*Participation in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or the loss of benefits to which you are otherwise entitled.

Signature _____

Printed Name _____

Date _____

Questionnaire

Please indicate to what extent you agree or disagree with each of the following statements (1= strongly agree to 5= strongly disagree)

Cultural Infrastructure

In my faculty/school:	**1**	**2**	**3**	**4**	**5**
My colleagues are aware of the importance of knowledge to the overall success of the faculty					
My colleagues are encouraged to explore and experiment.					
Training and learning are valued.					
staff are encouraged to ask others for assistance when needed					
staff are encouraged to interact with other groups					
Overall university/school vision is clearly stated.					
Overall university/school objectives are clearly stated.					
Knowledge is shared with other universities/schools					
The benefits of sharing knowledge outweigh the costs					
Senior management clearly supports the role of knowledge					

Structural Infrastructure

In my faculty/ school:	**1**	**2**	**3**	**4**	**5**

Structure facilitates the transfer of new knowledge across structural boundaries.

Managers frequently examine knowledge for errors/mistakes

Structure promotes collective rather than individualistic behavior

Structure facilitates the creation of new knowledge

There are a large number of strategic alliances with other universities/schools.

There is a standardized reward system for sharing knowledge.

Our performance is based on knowledge creation.

Technological Infrastructure

In my faculty/ school: **1 2 3 4 5**

There is technology that allows employees to collaborate with others inside the faculty.

There is technology that allows employees to collaborate with others outside the faculty.

There is technology that allows people in multiple locations to learn as a group from a *single* source or at a single point in time.

There is technology that allows people in multiple locations to learn as a group from *multiple* sources or at multiple points in time.

There is uses technology that allows searching for new

knowledge.

There is technology that allows mapping the location of specific types of knowledge (i.e., an individual, or database).

Knowledge Acquisition

In my faculty/ school:	**1**	**2**	**3**	**4**	**5**
There are processes for acquiring knowledge about our stakeholders					
There are processes for generating knowledge from existing knowledge.					
Feedback is used from projects to improve subsequent projects.					
There are processes for distributing knowledge throughout the faculty					
There are processes for benchmarking performance.					
There are teams devoted to identifying best practices.					
There are processes for exchanging knowledge between individuals.					

Knowledge Conversion

In my faculty/ school:	**1**	**2**	**3**	**4**	**5**
There are processes for converting knowledge into the design of new services					
There are processes for filtering knowledge.					

There are processes for transferring organizational knowledge to individuals

There are processes for absorbing knowledge from individuals into the faculty

There are processes for distributing knowledge throughout the faculty

There are processes for integrating different sources and types of knowledge.

There are processes for organizing knowledge.

There are processes for replacing outdated knowledge.

Knowledge Application

In my faculty/ school:	**1**	**2**	**3**	**4**	**5**
There are processes for applying knowledge learned from mistakes.					
There are processes for applying knowledge learned from experiences.					
There are processes for using knowledge to solve new problems..					
The sources of knowledge are matched to problems and challenges.					
Knowledge is used to improve efficiency.					
Knowledge is accessible to those who need it.					
There are advantages of new knowledge.					

Knowledge Protection

In my faculty/ school:	**1**	**2**	**3**	**4**	**5**
There are processes to protect knowledge from inappropriate use inside the faculty					
There are processes to protect knowledge from inappropriate use outside the faculty.					
There are incentives that encourage the protection of knowledge.					
There is technology that restricts access to some sources of knowledge.					
Values that protect knowledge embedded in individuals.					
The importance of protecting knowledge is clearly communicated					
There are extensive policies and procedures for protecting secrets.					

Innovation

my faculty/school:	**1**	**2**	**3**	**4**	**5**
Has recently produced new programs/courses					
Has recently improved existing programs/courses					
Has adopted new methods of teaching of programs/courses delivery					
Has improved existing methods of teaching of programs/courses delivery					

Personal Information

University : ……

School/ Faculty: ……..

Position Title : ……

Thank You

Appendix 2: Reliability Test Output

Table 1: Reliability test for cultural infrastructure

Cronbach's Alpha	N of Items
.901	10

Table 2: Item-Total Statistics for cultural infrastructure

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
my collegues are aware of the importance of knowledge	25.21	97.016	.462	.903
my collegues are encouraged to explore and experiment	25.50	91.725	.706	.887
training and learning are valued	25.48	91.952	.664	.890
staff encouraged to ask others for assisstance when needed	25.78	88.532	.766	.883
staff encouraged to interact with other groups	25.86	89.724	.782	.882
vision clearly stated	25.66	92.740	.649	.891
objectives clearly stated	25.86	91.812	.696	.888
knowledge is shared with other universities/schools	26.29	95.151	.655	.891

benefits of k-sharing outweigh the costs	25.99	95.587	.586	.895
senior management supports the role of knowledge	26.11	93.797	.572	.896

Table 3: Reliability Statistics for structural infrastructure

Cronbach's Alpha	N of Items
.776	7

Table 4: Item-Total Statistics for structural Infrastructure

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
structure facilitates the transfer of new knowledge	15.43	29.755	.469	.754
managers frequently examine knowledge for mistakes	15.45	31.458	.319	.784
steucture promotes collective rather than individualistic behavior	15.29	26.352	.726	.699
structure facilitates the creation of new knowledge	15.39	28.132	.603	.727
large number of strategic alliances with other universities	15.57	29.397	.517	.744
standardized reward system for k-sharing	15.39	30.023	.466	.754

Table 4: Item-Total Statistics for structural Infrastructure

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
structure facilitates the transfer of new knowledge	15.43	29.755	.469	.754
managers frequently examine knowledge for mistakes	15.45	31.458	.319	.784
steucture promotes collective rather than individualistic behavior	15.29	26.352	.726	.699
structure facilitates the creation of new knowledge	15.39	28.132	.603	.727
large number of strategic alliances with other universities	15.57	29.397	.517	.744
standardized reward system for k-sharing	15.39	30.023	.466	.754
performance based on k-creation	15.20	29.767	.419	.765

Table 5: Reliability Statistics for technological infrastructure

Cronbach's Alpha	N of Items
.864	7

Table 6: Item-Total Statistics for technological infrastructure

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
performance based on k-creation	16.88	43.010	.585	.851
technology allows for internal cooperation	16.90	41.544	.693	.836
technology allows for external cooperation	16.93	42.726	.638	.844
technology allows people in multiple locations to learn from single source at one point in time	16.87	39.141	.769	.824
technology allows people in multiple locations to learn from multiple sources at multiple points in time	17.05	42.998	.631	.845
technology allows searching for new knowledge	16.56	41.638	.643	.843
technology allows mapping the locations of specific tpes of knowledge	16.67	44.636	.485	.865

Table 7: Reliability Statistics for k-acquisition

Cronbach's Alpha	N of Items
.822	6

Table 8: Item-Total Statistics for k-acquisition

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
processes for acquiring knowledge about our stakeholders	13.58	31.030	.484	.813
processes for generating knowledge from existing knowledge	13.55	26.740	.672	.774
feedback is used from projects to improve susequent projects	13.61	29.515	.452	.824
processes for benchmarking performance	13.52	27.319	.666	.776
there are teams devoted to identifying best practices	13.85	28.248	.652	.780
processes for exchanging knowledge between individuals	13.72	28.596	.618	.787

Table 9: Reliability Statistics for k-conversion

Cronbach's Alpha	N of Items
.842	8

Table 10: Item-Total Statistics for k-conversion

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
processes for converting knowledge into the design of new services	17.74	45.464	.612	.819
processes for filtering knowledge	17.70	44.414	.652	.814
processes for transferring organizational knowledge to individuals	17.61	43.891	.666	.812
processes for absorbing knowledge from individuals into the faculty	17.67	47.577	.499	.832
processes for distributing knowledge throughout the faculty	17.50	47.102	.332	.862
processes for integrating different sources and types of knowledge	17.63	45.600	.606	.820
processes for organizing knowledge	17.57	44.594	.616	.818
processes for replacing outdated knowledge	17.79	43.423	.701	.807

Table 11: Reliability Statistics for k-application

Cronbach's Alpha	N of Items
.817	7

Table 12: Item-Total Statistics for k-application

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
processes for applying knowledge learned from mistakes	15.93	49.013	.661	.778
processes for applying knowledge learned from experience	16.04	50.699	.599	.789
processes for using knowledge to solve problems	15.67	47.816	.739	.767
sources of knowledge are matched to problems and challenges	15.95	48.554	.757	.767
knowledge is used to improve efficiency	15.93	52.337	.542	.798
knowledge is accessible to those who need it	15.79	51.675	.576	.793
there are advantages of new knowledge	15.19	40.694	.426	.871

Table 13: Reliability Statistics for k-protection

Cronbach's Alpha	N of Items
.893	7

Table 14: Item-Total Statistics for k-protection

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
processes to protect knowledge from inappropriate use inside the faculty	15.45	42.141	.592	.889
processes to protect knowledge from inappropriate use outside the faculty	15.60	39.295	.751	.870
incentives that encourage the protection of knowledge	15.65	39.391	.731	.873
technology that restricts access to some sources of knowledge	15.55	39.543	.707	.876
values that protect knowledge embedded in individuals	15.66	39.806	.768	.869
importance of protecting knowledge is clearly communicated	15.59	41.321	.657	.882
extensive policies and procedures for protecting secrets	15.54	40.405	.641	.884

Table 15: Reliability Statistics for innovation

Cronbach's Alpha	N of Items
.904	4

Table 16: Item-Total Statistics for innovation

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
produced new programs / courses	8.33	16.319	.756	.886
improved existing programs /courses	8.55	16.009	.831	.859
adopted new methods of teaching of programs/courses delivery	8.40	16.505	.770	.880
improved existing methods of teaching of programs/courses delivery	8.57	16.055	.780	.877

Appendix 3: IRB approval

2011-2012, case #78

THE AMERICAN UNIVERSITY IN CAIRO
OFFICE OF THE ASSOCIATE PROVOST FOR RESEARCH ADMINISTRATION

To: Ashraf Numair (PPAD student)
cc: Laila El Baradei (PPAD); enas_20@aucegypt.edu
From: Graham Harman, Associate Provost for Research Administration, Chair of the IRB
Date: February 15, 2012
Re: approval of study

This is to inform you that I reviewed your revised research proposal entitled "The Relationship Between Knowledge Management and Innovation: Empirical Study on Higher Education Institutions in Egypt," and determined that it required consultation with the IRB under the "expedited" heading. As you are aware, the members of the IRB suggested certain revisions to the original proposal, but your new version addresses these concerns successfully.

Thank you and good luck.

Graham Harman