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E-LEARNING AS A KNOWLEDGE MANAGEMENT APPROACH FOR INTELLECTUAL CAPITAL UTILIZATION

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ABSTRACT

This paper addresses human resources utilization at the university environment. We address the design issues of e-learning courses that can capture the teacher knowledge. The underlying objective is that e-learning is a key knowledge and major resources for many universities. Therefore, the design of e-learning should be an important part of the university knowledge management process. Teachers' knowledge in any important topic or field should be managed in a way that the university can benefit from it in case of teacher leaving or retired. Hence, intellectual personal knowledge management will be explored through the development of e-learning systems. Some concepts from the Artificial Intelligence field can be used in developing such systems.

The potential for utilizing human knowledge in the university environment will optimize the resources and can be of cost effective and quality assurance factors and provide the university with a sustainable competitive advantage.

Assuring the proper knowledge management within the university environment is a more complex issue. This is due to the diverse of topics in one hand and the behavior of the student and the lecturers on the other hand. Effective implementation and success requires a lot of efforts that will guarantee the utilization of the intellectual capital within the university environment.

Keywords: **E-learning, Knowledge Management; Intellectual Capital; Knowledge Based Systems; Knowledge Engineering; Knowledge Elicitation; Tacit Knowledge.**

INTRODUCTION

The concept of treating organizational knowledge as a valuable strategic asset has been popularized by leading management and organization theorists (Nonaka 1994, J. B. Quinn 1996). Organizations are being advised that to remain competitive, they must efficiently and effectively create, locate, capture, and share their organization's knowledge and expertise, and have the ability to bring that knowledge to bear on problems and opportunities.

Firms are showing a tremendous interest in implementing knowledge management processes and technologies, and are even beginning to adopt knowledge management as part of their overall business strategy.

Although knowledge management is becoming widely accepted, few organizations today are fully capable of developing and leveraging critical organizational knowledge to improve their performance. Many organizations have become so complex that their knowledge is fragmented, difficult to locate and share, and therefore redundant, inconsistent or not used at all. In today's environment of rapid change and technological discontinuity, even knowledge and expertise that can be shared is often quickly made obsolete. Universities can be identified as one of the major organizations that have difficulties in managing their knowledge. However, while the popular press calls for effectively managing knowledge, almost no research has been done regarding *how* to do it.

This paper focuses on how to configure a firm's resources and capabilities to leverage its codified knowledge. We refer to this broadly as knowledge *management architecture*. The research on which the framework is based was motivated by several questions. What are the characteristics of explicitly codified knowledge and how should universities think about managing it? What role should information technology play? How are institutional capabilities and information technology best integrated and applied to managing knowledge? What lessons have universities learned in these endeavors?

To address these questions, we first describe the characteristics of explicit knowledge and its relationship to competitive advantage. Building on research and knowledge about the design of e-learning products, we introduce architecture for managing explicit knowledge.

What Is Knowledge?

Knowledge is commonly distinguished from data and information. Data represent observations or facts out of context, and therefore not directly meaningful. Information results from placing data within some meaningful context, often in the form of a message. Knowledge is that which we come to believe and value based on the meaningfully organized accumulation of information (messages) through experience, communication or inference. Knowledge can be viewed both as a *thing* to be stored and manipulated and as a *process* of simultaneously knowing and acting - that is, applying expertise. As a practical matter, universities need to manage knowledge both as object *and* process.

Knowledge can be *tacit* or *explicit*. Tacit knowledge is subconsciously understood and applied, difficult to articulate, developed from direct experience and action, and usually shared through highly interactive conversation, story-telling and shared experience. Explicit knowledge, in contrast, can be more precisely and formally articulated. Therefore, although more abstract, it can be more easily codified, documented, transferred or shared. Explicit knowledge is playing an increasingly large role in organizations, and it is considered by some to be the most important factor of production in the knowledge economy. Imagine an organization without procedure manuals, product literature, or computer software.

Knowledge may be of several types, each of which may be made explicit. Knowledge *about* something is called declarative knowledge. A shared, explicit understanding of concepts, categories, and descriptors lays the foundation for effective communication and knowledge sharing in organizations. Knowledge of *how* something occurs or is performed is called procedural knowledge. Shared explicit procedural knowledge lays a foundation for efficiently coordinated action in organizations.

Knowledge *why* something occurs is called causal knowledge
Shared explicit causal knowledge, often in the form of organizational stories, enables organizations to coordinate strategy for achieving goals or outcomes.

Knowledge in a university environment, specially the academic knowledge, can take the above three types of knowledge, and therefore make it hard for the universities to manage it properly.

Knowledge also may range from general to specific (R. M. Grant 1996). General knowledge is broad, often publicly available, and independent of particular events. Specific knowledge, in contrast, is context-specific. General knowledge, its context commonly shared, can be more easily and meaningfully codified and exchanged, especially among different knowledge or practice communities. Codifying specific knowledge so as to be meaningful across a university requires its context to be described along with the focal knowledge. This, in turn, requires explicitly defining contextual categories and relationships that are meaningful across knowledge communities.

To see how difficult (and important) this may be, ask lecturers and students from different faculties of your organization to define a student requirements, a course topic, or even the major lines of business in a university, and see how much the responses vary.

Explicating Knowledge
Effective performance and growth in knowledge-intensive organizations requires integrating and sharing highly distributed knowledge. Although tacit knowledge develops naturally as a by-product of action, it is more easily exchanged, distributed, or combined among communities of practice by being made explicit. However, appropriately, explicating tacit knowledge so it can be efficiently and meaningfully shared and reapplied, especially outside the originating community, is one of the least understood aspects of knowledge management. Yet organizations must not shy away from attempting to explicate, share and leverage tacit, specific knowledge. This suggests a more fundamental challenge, namely, determining which knowledge *should* be made explicit and which left tacit. The issue is important, as the balance struck between tacit and explicit knowledge can affect competitive performance.
Knowledge may be inherently tacit or may appear so because it has not yet been articulated, usually because of social constraints. Articulating particular types of knowledge may not be culturally legitimate, challenging what the firm knows may not be socially or politically correct, or the organization may be unable to see beyond its customary habits and practices. And of course, making private knowledge public and accessible may result in a redistribution of power that may be strongly resisted in particular organizational cultures. Knowledge also may remain unarticulated because of intellectual constraints in cases where organizations have no formal language or model for its articulation.

What Is Intellectual Capital?
OECD (1999) defines intellectual capital as the economic value of two categories of intangible assets of a company: organizational ("structural") capital; and human capital. Structural capital refers to things like proprietary software systems, distribution networks, and supply chains. Human capital includes human resources within the organization and also customers and suppliers of the organization. Often, the term "intellectual capital" is treated as being synonymous with "intangible assets"

or "knowledge assets." However, OECD considers 'intellectual capital' as a subset of overall 'knowledge assets' and this study propose an identical perspective.

(Stewart 1997) defines intellectual capital (IC) as "the intellectual material -- knowledge, information, intellectual property, experience - that can be put to use to create wealth". Alternative definitions (at firm level) interpret IC as the difference between the firm's market value and the cost of replacing its assets. Existing conceptualizations of IC and its various models share some common overall characteristics while maintaining substantive differences in details of implementation (Malhotra 2003c). Some of the more popular measurement frameworks and models used for assessing firm level and national knowledge assets are discussed later. The differences between the current models arise from their effort at managing the complexity of measuring the intangibles. Some models focus primarily on financial metrics and offer a restricted notion of knowledge assets. Others take a more holistic view but require subjective judgment in determining a composite index that may be used for objective comparisons.

UNIVERSITY KNOWLEDGE

This paper is based on a project for developing e-learning systems at Philadelphia University under the umbrella of Avicenna project funded by the UNESCO. This project open the opportunities for the university to think seriously in utilizing the staff knowledge in some topics for the purpose of managing the human resources and performs research on strategy and evaluation of a better tools for e-learning, expert systems and knowledge management.

The field of Knowledge Management (KM) has rapidly gained popularity both in academia and in industry. From practical point of view, KM encompasses processes and techniques for the creation, collection, indexing, organization, distribution, access to and evaluation of institutional knowledge for *reuse.*

An important feature of KM is to show and highlight the importance of the *tacit knowledge*. This is one of the main objectives of this research paper. Since Knowledge is the core asset of any university, we will focus on the "*Intellectual Capital-IC*" that is the knowledge embedded within the university academic environments. Figure: 1 shows a module of IC utilization at the university environment.

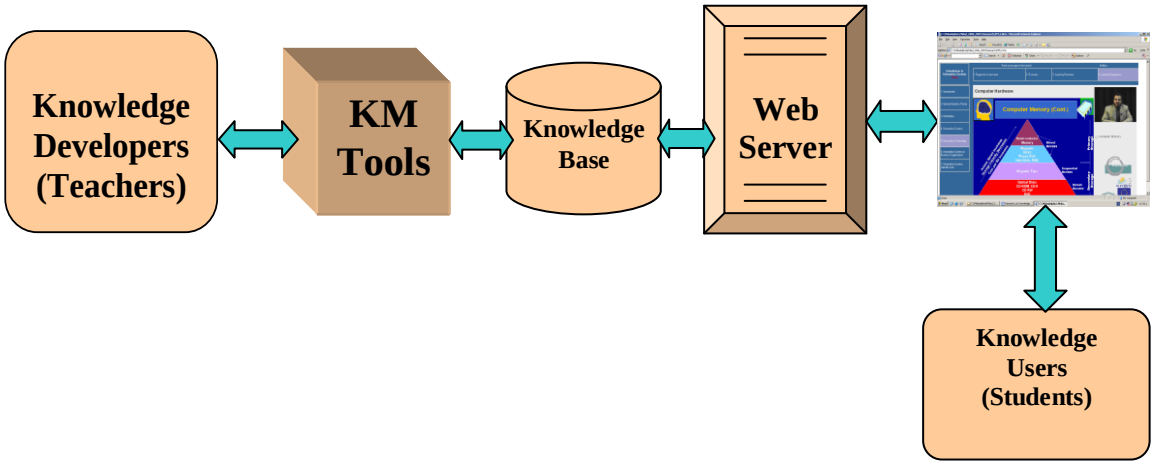

Figure: 1
Intellectual Capital Utilization

To develop the knowledge management process in academic institutions that includes all these aspects, it is important to consider cultural and human resource issues as well as intelligent systems that facilitate IC knowledge (teachers) to perform their teaching duties. With regard to such systems, current practice concentrate on e-learning systems that extensively depends on search engines and database techniques, and hence looking forward to adopts the potential benefits that Artificial Intelligence (AI) techniques (Russell & Norvig, 2003) might deliver for core knowledge management activities like knowledge discovery, indexing, organization, and knowledge fusion. In order to address the above priorities, e-learning systems that can be developed under the umbrella of Knowledge Based Systems (KBS) aims to address the use of AI techniques in any KM processes. Many approaches were used to find a solution for this problem. Below are some of themes:

- **Knowledge integration processes using Intranets/Extranets**
- **Intelligent Agents for Knowledge Discovery and Sharing**
- **Intelligent indexing mechanisms for multi-media**
- **Framework for measuring the benefits of KM**
- **Natural language understanding for context management**
- **Human Computer Interaction processes in KM**

To develop e-learning systems, *Knowledge Engineering (KE)* is the way that aims for the processes involved in building e-learning systems: planning, knowledge acquisition, system implementation, system installation, and system evolution. For systems that embedded academic material, KE involves the following steps.

KNOWLEDGE ACQUISITION (KA)

Obtaining knowledge for use in the knowledge base of an expert system requires many steps. More over, some sort of continuous activities must continue to dominate the life cycle of IC and KM namely; create, capture, refine, store, manage, distribute and maintain. For e-learning systems the identifying sources of knowledge mostly from:

- **Documents: textbooks, references, scientific journals, technical reports, computer based knowledge material, case studies, etc.**
- **University Teachers (Human Experts): This is the most important source in our case. He/She will play the role of both the Know-how expert (Domain Expert) and KE.**

KNOWLEDE ANALYSIS

The knowledge engineer uses the knowledge from the domain knowledge (teacher) sessions to build a good *model for the expertise (teacher).* That is a model the teachers are using to present and teach the subject matter. This may rely heavily on developing a *prototype* version of the expected system.

KNOWLEDGE ELICITATION

It is the most important branch of KA. It involves obtaining knowledge from a human expert (or human experts) for use in an expert system. In university teaching, knowledge elicitation is *difficult*. This is the principle reason why expert systems have not become more widespread - the *knowledge elicitation bottleneck.*

It is necessary to find out what the teacher(s) know, and how they use their knowledge. There are several ways to capture this knowledge:

- **Find the suitable teacher first (the domain expert).**
- **Organize meeting and tapping his/her knowledge via the appropriate tools and procedures. *Rapid Prototyping* plays an important role during this phase.**
- **Auditing knowledge using suitable tools such as semantic networks, decision trees.**
- **Knowledge codification.**
- **Implementation.**
- **User testing and acceptance.**
- **Certification.**
- **Evolution.**

The *Expert knowledge* includes:

- **Contextual knowledge**
- **Prerequisite**
- **Home works**
- **Examinations and evaluations**

The *knowledge elicitation* (and analysis) task involves:

- **Finding at least one expert in the domain who (normally, such expert is the university teacher):**
  - ***is willing* to provide his/her knowledge;**
  - ***has the time* to provide his/her knowledge;**
  - ***is able* to provide his/her knowledge.**
- **Repeated interviews with the expert(s), plus task analysis, concept sorting, etc,**
- **Knowledge structuring: converting the raw data (the lectures and related materials. Taken from the teacher) into *intermediate representations*, prior to building a working e-learning system. This will improve the knowledge engineer's understanding of the subject;**
- **This provides easily-accessible knowledge for future knowledge engineers to work from *(knowledge archiving).***
- **Building a model of the knowledge derived from the teacher, for the teacher to criticize. From then on, the development proceeds by stepwise refinement.**
- **One major obstacle to knowledge elicitation: experts can not easily describe all they know about their subject.**
- **They do not necessarily have much insight into the methods they use to solve problems.**
- **Their knowledge is "compiled" (a compiled computer program is fast and efficient, but unreadable).**

Figure: 2 show a model for knowledge transformation within the university environment.

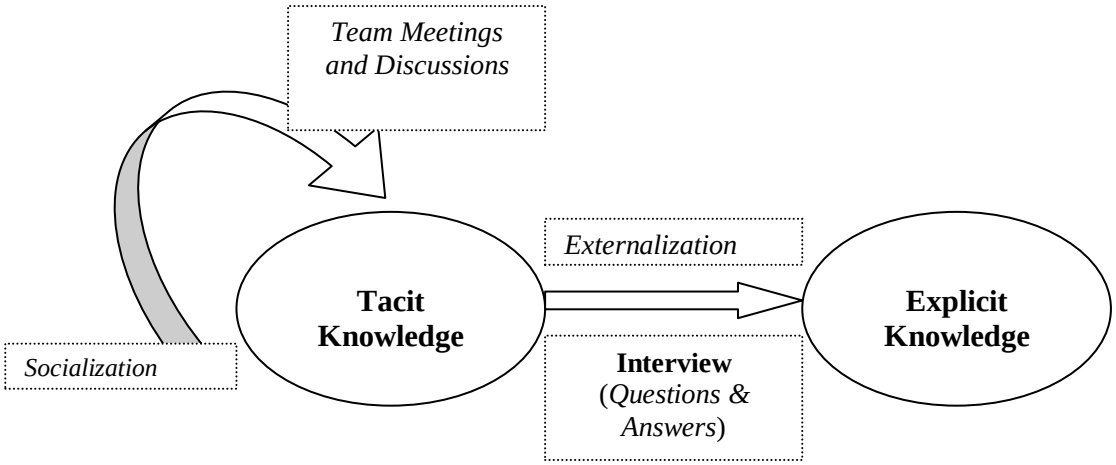

Figure: 2
Knowledge Transformation Model

SOME OF THE TECHNIQUES USED IN KNOWLEDGE ELICITATION

- **Various different forms of interview:**
  - **Unstructured: A general discussion of the domain, designed to provide a list of topics and concepts.**
  - **Problem-solving: The expert is provided with a real-life problem, of a kind that they deal with during their working life, and asked to solve it. As they do so, they are required to describe each step, and their reasons for doing what they do. The transcript of their verbal account is called a *protocol*.**
  - **Think-aloud: As above, but the expert merely imagines that they are solving the problem presented to them, rather than actually doing it. Once again, they describe the steps involved in solving the problem.**
  - **Dialogue: The expert interacts with a client, in the way that they would normally do during their normal work routine.**
  - **Review: The KE and DE examine the record of one of the sessions described above, together.**
- **Sample lecture preparation: The expert prepares a lecture, and the KE analyses its content.**
- **Concept sorting ("card sort").**
- **Questionnaires: Especially useful when the knowledge is to be elicited from several different teachers.**
- **Repertory grid (particularly the "laddered grid" technique).**

It is standard practice to tape record KE sessions. However, KEs should be aware of the costs this involves, in time and money.

COMPUTERIZED KNOWLEDGE ELICITATION

The state of the art in AI (especially natural language processing: NLP) is not sufficiently advanced to permit fully-automated knowledge elicitation.

However, "knowledge elicitation workbenches", or "knowledge engineering environments", are commercially available. Their principle use is to simplify the task of converting a protocol into frames, rules, etc., and inserting these structures into an expert system shell as soon as they are formulated.
Many problems can occur when using several experts to build a knowledge base in a particular domain:

- **Different experts may use different discriminations to arrive at the same conclusion.**
- **Therefore, they are likely to produce different rules (or objects), and these are liable to conflict.**
- **One way round this problem: get one teacher to provide the knowledge in the prototype, and get others to refine it.**

SHORTAGES of SPECIAL TEACHERS

The unexpected changing of specialized teachers at the universities creates a big problem for the academic administration. There is no statistics in Jordan to figure out the number of teachers required to fill the impose gap. This critical and unpredictable personnel shortage is particularly significant when considering the shortage of special topics at some universities.

Development and production of new teachers is inadequate to meet projected universities needs in certain subjects. This means that new teachers will need enter the profession with significant staff development needs.

In response to the growing need for staff development among university teachers, the universities needs to think seriously to develop a methodology for staff development on topics of high national concern. The building of e-learning courses for such topics might allow the universities to a better utilize the teacher knowledge which is the Intellectual Capital of the university.
The topics would be developed using the Expert Systems (Hayes-Roth *et al.*, 1984) approach presented above. The developed topics must include the following features:

- **rich in content,**
- **accessible anywhere anytime,**
- **utilize multimedia facilities,**
- **friendly interactive with users**

Therefore, a prerequisite to developing e-learning topics needs to identify which topics are representative of nationally perceived needs. It was apparent that if only five e-learning topics were to be developed (may be due to limitation of resources), it was essential to select topics that were of national importance.

It is evident now that e-learning resources will increasingly be distributed to an unprecedented extent among universities. This is surely positive and we require from the stockholders to go with the flow.
However much of the organizational, personal, and best practices get disrupted. There will always be proprietary and public learning resources and opportunities – and there will be a business and work in enhancing e-learning, and conversely, there will always be interesting developments in sharing knowledge– developing, the "new commodities" of the knowledge society.

Williams (R. Williams, 2003) treated the university knowledge from just–in-context knowledge. He cited that:

- **Knowledge, which is both a *thing* and a *flow* or a *process*.**
- **From key heuristics: "knowledge can only be volunteered" and "we only know what we know when we want to know it'**
- **The value of narrative knowledge is thus embedded in relationships and context, and little of it is amenable to co modification and categorization in a database, no matter how sophisticated.**
- **Most of it is situated in the spaces of the relationships between human beings and narratives come back to take up their place alongside algorithms.**
- **This is similar to the notion that knowledge is essentially *strategic*, and information is essentially *procedural* knowledge subsumes and includes content as well as complex procedural algorithms, but it is more akin to *intelligence* than information. It operates within a context, and is implemented or used by particular people in particular positions and contexts.**
- **Knowledge is a synthesis of the *how* and the *why* things get done, whereas information stops at the *how.* Knowledge is paradoxically more contextualized, and therefore less abstract than information, even though it operates at a meta-information level.**

After all, to manage knowledge one has to focus extensively on context and narrative, than on content. In relation to e-learning, it is important that we don't restrict learning to abstracted procedural information. The point becomes clear if we substitute "intelligence" for "knowledge" and ask ourselves what is "intelligence management"?

DEVELOPEMENT METHODOLOGY

The first challenge was to determine an appropriate method for prioritizing the topics required to be developed for the university. This also requires the identification of the staff needed to such development.

On the national level, universities can jointly adopt a national strategy to determine the needs for the most representative topics they share.

At Philadelphia University, we started our task to develop the first four major topics in Information Technology, namely; Artificial Intelligence, Networking, Information Systems, and Software Engineering. This phase proved to be of a good success. A second phase was followed to implement a series of fundamental courses at the Faculty of Science.

Using this opportunity, the University standardized its main topics on one hand and utilized the intellectual capital of its staff members on the other hand.

It was noticed that, due to the high movement of staff members from university to university, Philadelphia University gains a lot of its staff capabilities by transforming their experience in certain field to an e-learning topics. Such transformation of knowledge also helps in setting up a standard template for its e-learning subjects.

Such approach can be more beneficial if we can expand it on the national level through the participation of other universities in Jordan to develop more e-learning topics.

Developing e-learning courses need to be created by specialist teachers with in-depth knowledge of their fields of specialty.

In the same way, multimedia experts need to be involved in course development and production. Too often course materials are prepared by teachers or course developers. These people may have great knowledge in the material itself, but have a little or no skills in presenting the material. The result is a great learning experience where the student is motivated and engaged but they may learns little of value because the overall course is simply not useful. The experience of utilizing intellectual capital at Philadelphia University was demonstrated through the establishment of Avicenna Knowledge Center. This center works at the national level in Jordan. Up to now, many e-learning courses were developed. As an example, we can select two of these courses. They are considered as part of the fundamental courses in the curriculum design of the faculty of information technology. These two courses:

- **"Fundamentals of Artificial Intelligence" (S.A. Mahdi & K. Khoualdi, 2006) (K. Khoualdi & S.A. Mahdi, 2006), and**
- **"Introduction to Information Systems", (I.M. Shehabat, 2006)**

have shown that utilizing intellectual knowledge of university teachers can be of great benefits to the University, specially when some teachers were actually left their job at the university. Such a case, make the continuity and the standard of teaching such courses for next semesters possible.

CONCLUSION

Knowledge utilization at university environment can be considered as one of the major aspects that must be taken in consideration. The knowledge we are concerned of is the intellectual knowledge held by the university lecturers. As a major tool for utilizing such knowledge, developing of an e-learning course can capitalize the university resources and make sure that lectures will continue with the same quality standard.

Also, developing the required learning courses for learners and teachers through using educational materials can be designed effectively in a way to facilitate the effective design of e-learning materials that relies on instructional design processes and reflect the absence of or reduction in a classroom instruction. This change in learning context is an important factor distinguishing online or e-learning from traditional instruction, and therefore requires different educational design considerations.

Many researchers and developers describe this emerging e-learning environment as one that is "adapted and developed for intellectual partnerships". They are suggesting that rich learning activities allow students to learn with computers rather than from computers.

We hope that the elements presented here will assist in clarifying the significant aspects of intellectual capital and the e-learning development, and enable a developing process that takes account of teachers' knowledge which is considered as the actual capital for the universities.

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