

# INTEGRATION OF KNOWLEDGE MANAGEMENT AND E-LEARNING MANAGEMENT FOR CONSTRUCTION COMPANIES

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**Keywords:** Knowledge Management, e-learning, construction companies.

**Abstract:** Knowledge and learning are the basis for the development of whatever business activity. There are plenty of knowledge management tools and also e-learning management tools. Basically, they are separated initiatives and their approach is specific to the targets of each particular area. The main problem is the inexistence of a common language which difficults the exchange of experiences and information. This paper describes the background and methodology to integrate a Knowledge Management Strategy (KMS) for a construction company and an e-learning management system. Two central objectives structure this Paper:

1. To identify categories of important information generated and shared between knowledge management and e-learning;
2. To integrate vast amounts of contents from diverse repositories created in several KM systems as well as e-learning platforms by implementing "Concept Indexes" for tagging contents.

## 1 INTRODUCTION

Currently there are a lot of projects concerning architecture and e-learning. In addition to these projects, universities, companies and other parties have created databases for architectural content and have, in some instances, started to enrich them with metadata.

Despite the numerous e-learning platforms, there are still some gaps to fill in.

On the other hand, construction companies need that they employees are aware of the new methodologies, new materials, new techniques, and sometimes use e-learning to foster these objectives. Moreover, what companies really need is to share and exchange the day to day knowledge.

Knowledge Management (KM) is not a new concept but there are still many problems to solve.

Experience shows that there are not only difficulties in capturing, storing, sharing and re-using knowledge in the construction sector, assuming that it exists, but much of it is never "produced", since no mechanisms or processes exist to foster the social interaction required to give any shape or form to it. (Shelbourn et al, 2006).

## 2 OBJECTIVE

This paper describes the background and methodology to integrate a Knowledge Management Strategy (KMS) for a construction company and an e-learning management system.

Two central objectives structure this Paper:

- To identify categories of important information generated and shared between knowledge management and e-learning,
- To integrate vast amounts of contents from diverse repositories created in several KM systems as well as e-learning platforms by implementing "Concept Indexes" for tagging contents.

This paper aims to give a general and conceptual vision of the importance of the knowledge in the new business and technological scenarios and to provide means to apply systematically, knowledge methods and procedures to guarantee its creation, storage and distribution.

### 3 APPROACH AND METHODS

The current literature on KM and e-learning allowed the authors to formulate a method for achieving their research objectives:

- A thorough and critical review of the literature on KM systems for construction projects was conducted.
- A thorough and critical review of the literature on e-learning tools for construction was conducted.
- A methodology to integrate vast amounts of contents from both systems was defined.

### 4 KNOWLEDGE MANAGEMENT

Managing construction knowledge not only contributes to increased safety and improved stability but also saves time spent in design and construction and provides scope for innovation.

Time can be saved, for example, by reducing the number of design cycles or by reducing the time used for searching for knowledge. Therefore, there is a need for an approach that facilitates knowledge sharing within the construction industry (Al-Ghassani, 2006).

#### 4.1 Limitations of Current KM Approaches

The main limitations of the current approaches managing knowledge are:

- A lot of important knowledge in the construction sector resides in the minds of the individuals (Al-Ghassani, 2006).
- People don't find necessary to share their knowledge.
- Employees are drowned with the day to day work and don't have time to store and index knowledge.
- Many decisions are often not recorded or documented.
- Construction knowledge takes many forms, for example: experiences, best practices, lessons learned, drawings, documents, etc.
- The knowledge is often poorly organised. Then, it's difficult to disseminate it.
- People frequently move from one project to another, and when looking for a piece of information is difficult to track people who were involved in a recorded decision.
- Competitiveness is the basis of the majority of the companies so they want to improve their internal benefits by improving KM but they don't want to share knowledge or information with other companies.

New approaches to the management of knowledge within companies imply major changes in individual roles and organisational processes.

There are many approaches to KM. The approach taken by Demarest (1997) argues that knowledge is embedded within the organization not just through individual actors or explicit programmes, but also through social interchange.

The main challenge of KM still lies within the lack of a standardized methodology to create and transmit information and the inefficiency of the information flow from different sources.

Organizations therefore need a tool that helps tracking KM and a strategy that helps employees believe in knowledge sharing and exchanging.

The suggested remedy for this inefficiency and the aim of this paper is to create a tool to improve KM in construction companies.

Therefore, it is important that construction professionals give meanings to fragments of speech or writing that are impenetrable to outsiders for reasons that go beyond a lack of understanding of technical terminology (Shelbourn et al, 2006).

### 5 E-LEARNING

Many research projects and many education programs are currently being developed.

A study of e-learning in continuing vocational training, particularly at the workplace, with emphasis on Small and Medium Enterprises (SMEs) (Directorate general for Education and Culture, 2005) concluded that it is hard to find representative information on e-learning in SMEs. The conclusion was that learning at SMEs is informal by nature rather than formal.

Developing the own training materials would be the best solution to integrate KM in the learning paths. However, the normal method and the most economical way of accessing courses is to pay to an external company for this service (European Centre for the Development of Vocational Training, 2006).

#### 5.1 Limitations of Current e-Learning Approaches

The main limitations of the current e-learning approaches for SMEs are:

- There is still low level of IT skills.
- Broadband is still not available to all the population via a land line.
- There is no link between different authoring tools and management systems.

## 6 INTEGRATION

A combination between KM and e-learning is the key to approach knowledge sharing within the construction industry.

Educational offers in a company should be based on the real and necessary knowledge of the firm i.e. the knowledge created by the other employees of the company. The other basic training can be obtained from external courses.

## 7 PROTOTYPE DEVELOPMENT

With the aim to improve the management of information, knowledge and learning methodologies a system is defined.

The system will be based on a European Project called Web-based Intelligent Design and Tutoring System (WINDS, 2005).

The aim of the proposed system is to take advantage of WINDS system and improve it to be used for the KM of construction companies.

System prototype.

To define the learning necessities of each employee, necessary skills and knowledge should be defined and related to the learning strategy.

The high level layer are all the employees,

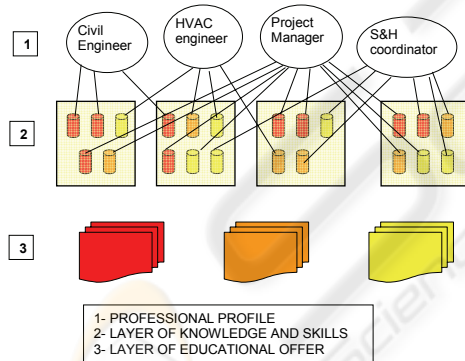


Figure 1: Shows how and from where to create this learning paths.

whatever its position and location, who should create the company's knowledge.

What is really important in this KM system is to define all the relations between the different layers, from the professional profiles, through the competences and skills to the educational offer.

In some specific areas an employee would be the creator of information and in some other areas he would be the student who will use the information material.

The system is based on contents which are made up of information units (IU) which are the basic learning objects (LO). An IU is made up of text and iconic objects (pictures, animations, videos).

LO have to fulfil several purposes.

- to be the basis for a consistent content generation by authors/users
- to allow reusability of LO
- to allow for a maximum of flexibility for the dynamic generation of online information

The system will allow users to be as much active in the e-learning content production and the implementation of a content editing chain.

It will also allow learning in a semantically controlled environment and support concept creation and meaning construction through concept embedding and concept space navigation, the "Concept Index". By defining relations between LO and content descriptors (i.e. concepts) it is possible to combine these two levels of description.

The Concept Index will automatically create the course index when the knowledge is created, and it will automatically index files that are uploaded, as far as automatically indexing is possible.

A graphical concept map will allow the navigation of the information concept space.

Between all LO basic relations can be specified by the authors/users. These will include prerequisite relations, is\_part\_of, and is\_related\_to relations between course units, learning units, and learning elements.

## 8 RESULTS

This system is still being developed but in the near future a prototype will be created and evaluated in a Spanish construction company.

It is expected that this system will improve not only the KM of the company but also the willingness of all the employees to have at their disposal a system for continuous training for exchanging knowledge created by/for their colleagues.

The integration of KM and e-learning systems is expected to:

- Improve and facilitate the processes of creation and divulgation of knowledge.
- Identify who has the knowledge and/or the experience.
- Analyse how to manage the property of this knowledge and/or experience.
- Promote the flow of knowledge and experiences.
- Analyse the types of knowledge or information that should be shared and define the methods to be used to share this information.

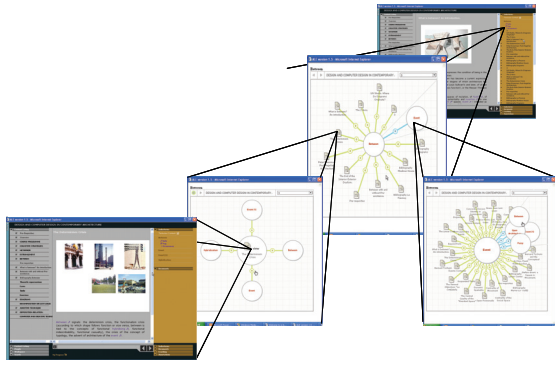


Figure 2: Examples of interrelation between the “Concept Index” and different e-learning screens. Source: WINDS prototype.

- Define the areas and information of the company susceptible to include in the KM and e-learning system.
- Avoid creating existing knowledge.
- Define criteria to store, search and organisation of knowledge depending on their interrelations.
- Provide a tool to find the information easily and with as much detail as possible.
- Define the necessary knowledge of a company. The necessary knowledge of a company might not be same for another one.
- Identify the areas and processes of a company where the implantation of a KM system might provide a continuous improvement.
- Provide a dynamic system with the final objective of searching improvement actions.
- Make possible the interrelation and application of KM with other systems such as Information Management, Document Management, Quality Management, etc.

## 9 CONCLUSIONS

KM and e-learning are closely related. The integration of a “Concept Index” for knowledge and e-learning management can improve both areas.

In this e-learning and KM system, the creator of the information/knowledge is also the user/student, depending on the type of information/knowledge he already has and the need of information/knowledge. This duality promotes the involvement of all employees of a company in creating knowledge.

Currently, the majority of the knowledge is shared in face-to-face interactions but what is intended with this system is that it can be converted into codified knowledge to give access to the whole employees with the aim to achieve the objectives of the company: increasing benefits.

Concluding, it is necessary to codify the basic knowledge which currently exists because it is stored in different sources such as persons, project stories, documentation, etc. All employees should spend much time capturing knowledge and the whole management of the company should focus on giving incentives to all the employees who generate knowledge and codify it.

Moreover, the individuals and organisational culture should change. Employees should have the willingness to share knowledge and time for that. On the other hand, organisations should change their processes to allow employees have time for that and give rewards to the employees for generating knowledge.

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