COOPERATIVE e-LEARNING APPROACH BASED ON CLOUD COMPUTING

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ABSTRACT

This paper proposes a cooperative approach for lifelong learning between academia and SMEs based on cloud computing meant to facilitate and to reduce costs related with operating, accessing, and also to alleviate the management of e-learning strategies, technologies and content. This approach should suit to the business of SMEs and should integrate the existing tools with the cloud.

KEY WORDS

operating e-learning systems, cloud computing, SME, student education

1. Introduction

E-learning refers to the support of modern communications and computer-based applications for two fundamental human-development processes, learning and teaching. In our paper, we want to emphasize the benefits of e-learning within small and medium enterprises (SMEs) from the novel context of cloud computing.

It is known that due to the recent economic recession, many SMEs are facing the challenge of shortage in new skilled labor, and in combination with this the inability to realize innovative technological developments. SMEs can tackle this and gain competitive advantages by improving their performance through the use of new e-learning methods. The problem is that most e-learning technologies, methods and strategies have been developed for the needs of large companies, and are not flexible enough to be adapted for the specific learning needs of SMEs operating in diverse economic sectors. Limited capital and know-how resources in SMEs, difficulties to precisely delineate what competences are lacking, and the need for having flexible and efficient learning strategies hinder their employees to achieve a better qualification that helps them to cope with the increased marked competition and client requirements. What SMEs need are flexible learning models enhanced by technology to "reduce training costs per learner in order to be able to train a greater number of employees without increasing spending on training" (cf. with First European e-learning Barometer 2011, available on-line at the address http://www.crossknowledge.com/en_GB/ page/media-center/publications.html?mictrl=cklgWhite paper/show&sid=survey-e-learning-europe), supporting

the development of creativity, facilitating adaptive learning on the job, the deepening of linkage with other knowledge resources within company. The learning processes in SMEs differ from those in schools and higher education because they have to be integrated in working processes, and learning systems have to be implemented into the SME's workflow.

"Today companies are looking for services that provide what they need while giving them the convenience of and time to concentrate more on their business. Not only does cloud computing offer more flexibility than traditional methods, but also gives a business the luxury of letting their employees gain access to information while they are mobile as well as at their desks" said Shuveb Hussain (Head of Cloud Computing and Virtualisation Research at K7 Computing Co.). Cloud computing will evolve from a futuristic technology into a viable alternative not only for business but also for lifelong learning (LLL) strategies which have to be integrated with the business ones.

This paper will present work in progress within a cooperation of the LLL study groups of the Institut Arbeit und Technik and the University of Craiova.

Section two of the paper presents first a model to build learning strategies, and then some learning strategies within European SMEs; section three describes benefits of cloud computing services in connection with social media to improve/substitute these strategies supporting personal, interactive and collaborative learning, and the last section enounces the future work steps.

2. Learning Strategies within European SMEs

E-learning within SMEs was the focus of two previous projects undertaken by the authors: ARIEL – Analyzing and Reporting the Implementation of E-Learning in Europe (http://www.ariel-eu.net/) [1] and SIMPEL – SMEs: Improving E-Learning Practices (http://www.simpel-net.eu/) [2]. ARIEL was an observatory EU e-learning project; it uncovered the widespread lack of successful take up of e-learning by European SMEs. In SIMPEL, an "optimal model" for the introduction of e-learning in an SME was developed and guidelines for all involved published. The SIMPEL

findings have been used for the development of a framework for an LLL strategy in SMEs.

This framework suggests measures to improve LLL readiness and steps to develop LLL strategies. It uses a combination of the trans-theoretical model which is a model for behavior change, and recommendations from the ARIEL, SIMPEL and eCASME - eCApture of SME's training needs and specification (http://ecasme.amt.ul.ie/) projects. It uses a top-down and bottom-up approach targeting both the individual and the organization. It aims first to raise awareness of the potential benefit of LLL to the individual and the organization. It aims to change the attitude and behavior of individuals and companies towards LLL. Last but not least the framework should help companies to implement sustainable LLL strategies.

All three projects mentioned earlier – ARIEL, SIMPEL, eCASME, required SMEs to adopt some organizational and technological measures. These measures correspond to the planning, action and maintenance stages in building a LLL strategy by using the trans-theoretical model for organizational behavior change. This is illustrated in Figure 1. At each stage we mention the electronic tools that may contribute to master the stage effectively.

2.1 Company Situation and Necessary Qualifications

The first step for an SME is to analyze its own business goals, the company situation, and also the difficulties encountered by the company in achieving these goals.

Once the analysis has reached a conclusion, the SME will be able to determine what qualifications are needed by the staff to overpass the identified difficulties. Some methods used to achieve such qualifications include LLL strategy, e-learning, short term qualifications, etc.

The electronic tool useful for gathering documents in various versions and making them available throughout the company (either for everyone or in base of differentiated access rights) is a Wiki portal (either on its own or as part of a Learning Management System – LMS, such as the open-source projects Moodle – http://www.moodle.org/ or Sakai – http://www.sakaiproject.org/). Additionally, a forum for discussions may found itself useful, again either stand-alone or as part of an LMS.

2.2 Concept

The next step is finding suitable offers and services for the qualification needs required by the work tasks. This implies determination of learning contents, forms and media used for the LLL strategy, and also identification of relevant knowledge and data flows.

For the internal communication and gathering of information, the wiki and/or the forum mentioned previously may still be used. Feedback sheets and/or databases such as provided in LMS (e.g. Moodle, Sakai, etc.) help gather the information even more precisely.

To find suitable offers, SMEs may use web searching, and particularly, social networks such as Xing, Facebook probably also being useful.
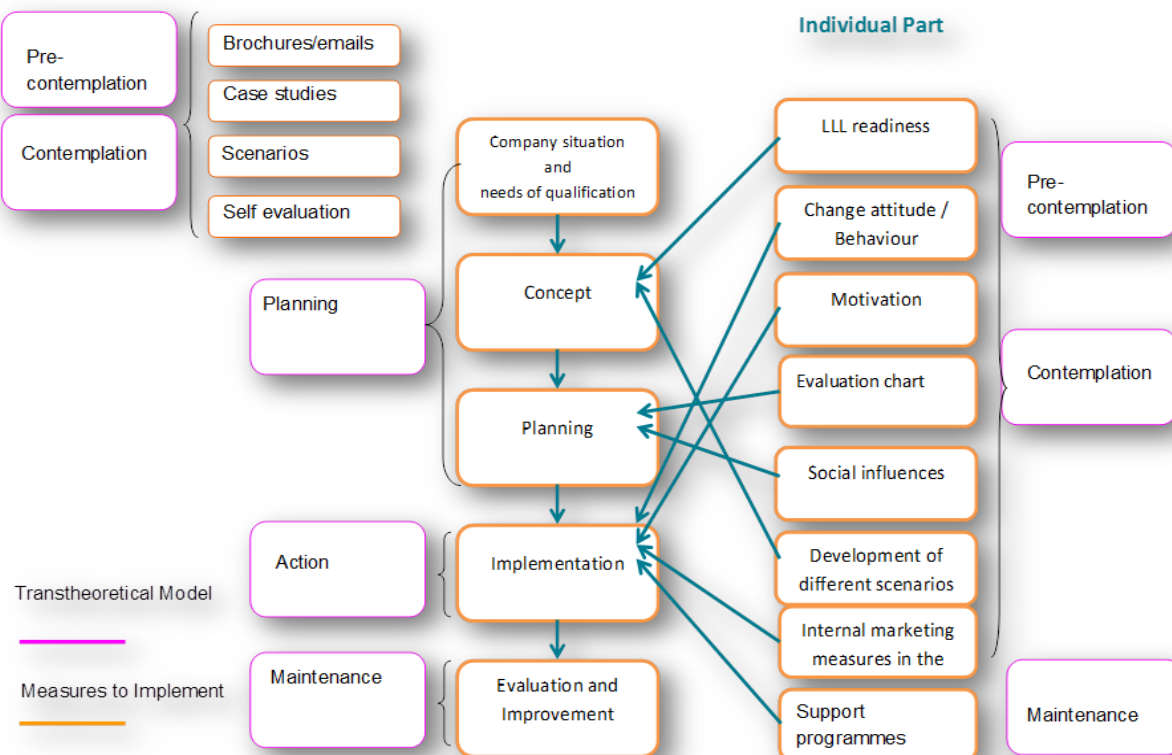

Figure 1. The trans-theoretical model

2.3 Planning

This step implies specifying LLL measures as well as the time, the actors, the technological and organizational infrastructure, and the tools needed for an efficient realization of these measures. This is followed by the preparation of a financial (business) part of the LLL model providing a framework for the economical dimension of the LLL strategy in the company, linking the planning with the process level of the implementation.

Here, an excellent planning instrument for SMEs is for example MindManager (http://www.mindjet.com), linking mind maps with basic project management features. For the financial planning it is necessary to draw on the data of business or enterprise management software (depending on the size of the company, this may range from simple spreadsheets up to very specific enterprise planning resource planning packages, which vary greatly according to size, branch and needs of the companies concerned (http://en.wikipedia.org/wiki/List_of_ERP_software_packages).

2.4 Implementation

In this stage, LLL solutions that correspond to the learning culture of the company will be produced (or purchased and customized) and put in use. This may cover the whole range: from buying standard learning software packages to subscribing to podcasts and other web-based offerings, to running a CoP (community of practices), and using/running an LMS with self-developed learning contents. For SMEs, it may be useful to gang together or to make use of offerings through professional associations in order to minimize costs.

A further step may involve tests and certifications. In all likelihood, SMEs will not go further than running online quizzes for testing knowledge. Certification will most likely be taken out of offerings by craft chambers and other officially recognized certification agencies (including universities).

2.5 Evaluation and Improvement

SMEs will certainly want to estimate how effective and financially efficient the training was. A complete evaluation concerns human and financial resources, developed measures, participation, improved knowledge, behavior, competences and expectations of the participants to the LLL trainings, and the observable changes in the company.

This raises the issues of quality control of e-learning and return on investment (ROI). Here it is not possible to point to one or two tools that do it all. Many different parameters may play a role into this [6]. It is important not to follow a narrow, purely economic frame in this evaluation.

3. LLL Strategies for SMEs

In the following, we will briefly present some of the LLL strategies used for example by German SMEs ([3], [4], [4]), and we will then propose a new approach in which cloud computing can be employed by SMEs in their LLL processes.
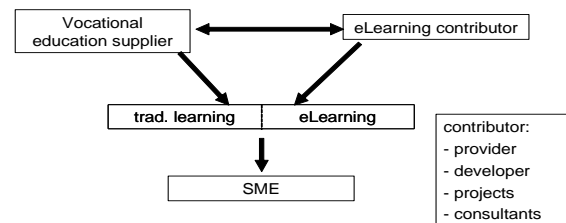
Figure 2. Cooperation with vocational education suppliers

In Figure 2, SMEs which are consumers of learning related products and services including e-learning, cooperate with vocational education suppliers to disseminate these, and to achieve their qualification needs.

Figure 3 exemplifies another strategy in which distributors of learning programs offer their services as a subscription. The point to be emphasized here is the distribution manner.
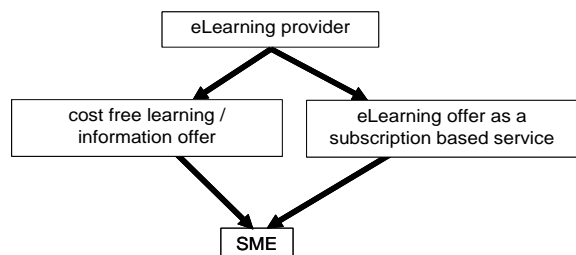
Figure 3. Subscription based services

The distributor in this business model gives first a trial offer or a free of charge basic information or learning offer. So clients know the services or products and request the suitable services for a fee.
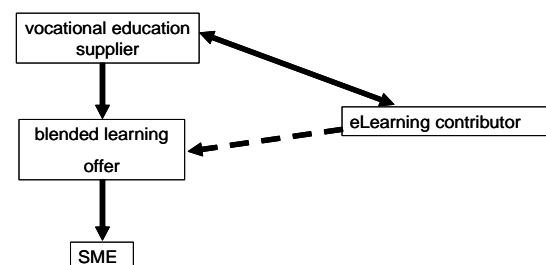
Figure 4. Refining of face-to-face courses

In Figure 4, the providers of learning services offer their services to the providers of traditional vocational education helping thus SMEs to build an integrated LLL strategy.
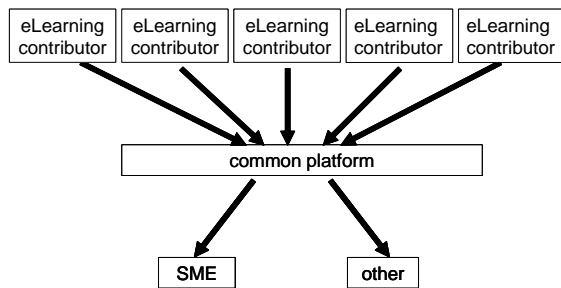

Figure 5. Content syndication model

It is a common practice to have different e-learning distributors pooling their contents on a common platform as depicted in Figure 5. This enables a common marketing and common standards (for certifications for example). The common platform can be established as a brand, after a while. The clients SMEs have then the possibility to access one platform for all courses. The content syndication model is designed mainly for smaller and niche/topic-oriented providers of learning content.

Another LLL strategy is that illustrated in Figure 6, where a franchisor offers a complete package of services to his franchisees.

SMEs from one sector work together, in informal or formal ways, e.g. in associations, to develop and to use e-learning applications, contents, platforms or courses together (as seen in Figure 7).
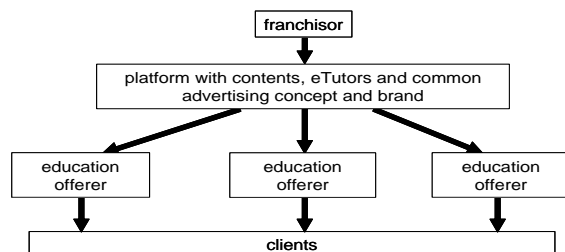

Figure 6. Franchising of e-learning

Among the LLL strategies presented so far, the two most used in the German SMEs community are subscription-based services and content syndication model.
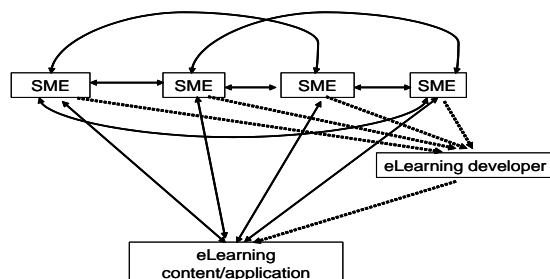

Figure 7. Sector courses developed by collaboration between SME

3.1 Cloud Computing Benefits

Cloud computing is a novel interpretation of sharing resources over Internet, on-demand and on a pay-per-use paradigm. These resources are diverse, ranging from software applications to data to computing and internetworking infrastructures. The cloud is seen as a natural evolution since it does not alter fundamentally the existing technologies; rather, it is growing on a successful collaboration/combination of them. Computing as a service and not as a product represents in fact the next public utility. SMEs could drastically reduce the costs pertaining to their LLL strategies and processes by adopting the cloud.

A first application of cloud computing is in the operation of the trans-theoretical model (see Figure 1). This model has been developed within the EU Leonardo da Vinci programme ReadiSME project by using the approach presented in section 2 and completed with an individual part. This individual part describes some attitudes and behaviours of SMEs employees and measures to motivate the personnel to use the model. Some of the IT support or the entire one within the stages of the model can be moved into the cloud. Each stage as we have mentioned is using a certain number of software tools and these tools are better off in the cloud. The cloud can be seen in three major service-based classes: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). IaaS is a complete virtual machine running a specific operating system, in most of the cases acting as a server. PaaS is is an extension of the IaaS to accommodate the middleware and to improve the performance in using it. It may be for example a web-based e-learning development platform containing the web/application server, the integrated development environment, the associated database and all additional utilities for development and testing. PaaS offers SMEs the possibility of acquiring on-demand usage-time for different types of software services. This includes a wide range of applications: office tools, graphic utilities, data storage facilities, etc. SaaS is dynamically scalable, device independent, and most of the applications are collaborative, allowing thus multiple users to share documents and work on them concurrently. Adding social media services through SaaS can only enhance this collaboration.

The deployment models for the cloud range from private cloud (an extension of the enterprise Intranet), to community-based cloud (the participants to this model are various organizations with a common mission or the same business goals), to public cloud (the cloud computing service provider – CSP – makes available its services to any customer via Internet), up to the hybrid cloud (actually an intersection between the previous deployment variants).

For our investigation, it is clear that SaaS and PaaS are the most suited categories for SMEs since the supporting IT instruments are out-sourced and need no longer be managed in-house. Security risks associated with the sensitive e-learning content and the related access control will be handled by the CSPs.

For the subscription-based services, SMEs and e learning providers benefit financially by moving the learning offer into a SaaS-like cloud service instead of buying a product (such as for example, the supporting software applications that need to be hosted and administered on the SMEs hardware/network). The same applies for the shared platform within the content syndication model.

We will detail now some of the aforementioned benefits of the cloud for the generic instruments used by the SMEs – the Learning Management Systems (LMS). Well-known brands of LMS include Moodle, Sakai, Dokeos, Ilias, etc. Their typical associated management and operating problems concern data back-up, minimum down-time during scheduled educational session business continuation and disaster recovery planning, an efficient alerting system, scalability and flexibility planning.

Last year, a new trend has developed in the field of CSP: managed cloud services. This not only ensures the typical cloud services, but also adds wrapped management services for customers. It is in fact a slow transition from the traditional hosting world to the cloud based world. This concerns data back-ups, management at the OS level and also at the application level of the rented virtual servers, monitoring and technical guidance. With this approach it becomes easier to ensure that the LMS platform is running as expected. The CSP may be delegated with monitoring the built-in (or custom developed) performance tracking tools, the consistency of the LMS modules, and the alert system of the hosted LMS. Furthermore, the business continuation and disaster recovery planning of the LMS owner and users are facilitated by the CSP's own business continuity and disaster recovery plans.

From our experience with LMSs, we know that during peak time intervals, the platforms tend to perform slower. This is especially painful for those critical tests in which a certain response time limit is enforced in the quizzes. Users will become frustrated if the system seemed to slow down their throughput by slowly posting the responses to the servers and getting new questions in. Such a situation is easily avoided if the LMS was hosted in the cloud. Problems such as bandwidth, hosting space and speed would be delegated to the CSP which is bound through the Service Level Agreement (SLA) to ensure that even during peak hours, the quality of the service will hold. Added to this, SMEs will surely be interested in the pay-per-use approach since the only moments in which they need to care about the LMS platform and the quality of the provided e-learning service are during the classes and during the test/quizzes associated to these classes.

The costs associated with hosting in-house a learning platform must be taken into account right from the beginning. This is rarely the case with the majority of the European SMEs for their business plans and long-term budgeting. Nevertheless, SMEs agree that long-life learning is a critical process for the long-term success of their businesses. That is why we believe that hosting LMS into the cloud would save two important things. No longer is a firm concerned with the accessibility and scaling up of the learning environment since the cloud reduces the SMEs costs associate with hardware and communication infrastructure on one side, and provides transparently and (almost) in real-time as much hardware and communication infrastructure as needed by their business requirements. Both SMEs and learning content providers are able to save money through this approach as they don't have to hire dedicated IT personnel, they don't have to worry about hosting and servers, there is no downtime for the business, and most importantly, they can focus on their core business that is e-learning, while leaving all the technical aspect to the cloud experts.

Cloud computing is supporting both vocational education within SMEs and further personal improvement of individuals. Statistics have shown that a large number of employees are following a personal education path, taking on-line courses on their own and paying for them by themselves (e.g. http://www.openuniversity.ac.uk, http://www.lynda.com, http://www.fernuniversitaet-hagen.de/, etc.). In a future cooperation with such distance education providers, it is intended to analyze and develop approaches for efficient use of cloud computing in their LMS. Costs associated with the management and developments of learning infrastructure are strongly reduced and consequently the consumers of distance learning would have reduced subscription fees. It is important to establish a sustainable cooperation between distance learning providers and CSP in what concerns issues like the ones mentioned earlier (e.g. quality of service, data back-up, disaster recovery, efficient alerting, scalability, flexibility, etc.).

4. Conclusion

This paper describes a work in progress related with our intent to incorporate cloud computing services for the referred two most used LLL strategies in two on-going projects, Netknowing 2.0 (http://www.netknowing.com) and ReadiSME (http://www.readisme.com). This means changing the technological paradigm for the current e-learning platforms and LLL strategies used by SMEs.

The goal is to investigate how much the cloud and social media are beneficial for both SMEs and e-learning providers, mainly in reducing costs and improving knowledge transfer. The next step is to describe and discuss scenarios with SMEs representatives about the proposed application in this paper, and to test them in 1-2 SMEs from project partner countries.

A guideline will be developed referring LLL in SMEs and cloud computing with precise indication how to use the cloud in different stages of a LLL strategy. Related security and privacy risks will also be addressed.

Acknowledgements

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