Enterprise portals in e-learning

Jari Järvelä, Juha Kareinen, Jyri Pötry, Stanley Fobugwe

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Preface

This report is an outcome of the project called "Eurostars Development Network in North Karelia". The project was funded by the Regional Cohesion and Competitiveness Programme (COCO) via the Joensuu Regional Development Company (JOSEK Ltd). The project aimed at the internationalisation of innovative SMEs. The goal was to develop a new e-learning concept based on open-source enterprise portal technology with web 2.0 features. As web technology has evolved rapidly in the last decade bringing different kinds of social applications and collaborative tools, those features have been only loosely adopted for online learning purposes. New technologies allow users flexible ways of communication and data distribution through the internet. These web 2.0 tools are already absorbed by large audiences, providing a great opportunity for utilisation in online learning. There is also a need for online learning material for operations management. Studies seem to point out that there are only few if any products online reserved for this theme.

As a result an operations management themed e-learning environment was built in co-operation between North Karelia University of Applied Sciences' (NKUAS) Operations Management Laboratory (Tulo) and the e-learning software vendor, Arcusys Ltd.

We are willing to express our gratitude to the financiers, partner companies and the innovative graphical and web designers, especially Kata Kähärä, Amy Järvisalo and Ilkka Kosunen.

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Jari Järvelä, Juha Kareinen, Jyri Pötry & Stanley Fobugwe

1 INTRODUCTION

This report summarises the joint development project of North Karelia University of Applied Sciences' (NKUAS) Operations Management Laboratory (Tulo) and Arcusys Ltd, where new web-portal based online communication and training concepts were developed and tested. This report describes the background, the pilot project, results and further development and business plans. The project aimed at finally creating e-learning technology and services for European markets. It was a part of a NKUAS's larger R&D project funded by the Regional Cohesion and Competitiveness Programme (COCO).

Arcusys Ltd. is an IT services company established in 2003 with its main branch located in Joensuu, Eastern Finland. The company specialises in expert IT services and information system solutions for the industrial and health care sectors as well as public administrations. Arcusys offers training services either as complementary to customer projects or as separate eLearning or contact teaching sessions.

North Karelia University of Applied Sciences offers education leading to a polytechnic degree (bachelor's and master's) for young and adult learners and takes actively part in regional development work and research and development activity. The **Tulo-laboratory** provides training and development services in the fields of production planning & control, product lifecycle management and related industrial IT systems. The laboratory provided the project the development platform and as well worked as a test case.

2 THE PROJECT'S BACKGROUND AND GOALS

Traditionally the services and solutions of digital learning are technologically based on learning management systems (LMS's) platform applications. Through these applications organisations can implement e-learning and consequently follow the training progress of their members. The problem lies in that the learning is isolated in a separate application and thus is not integrated into the organisations' or target groups' web infrastructures and processes. However, in the future e-learning can and should be built into everyday work. Figure 1 presents an example of this.
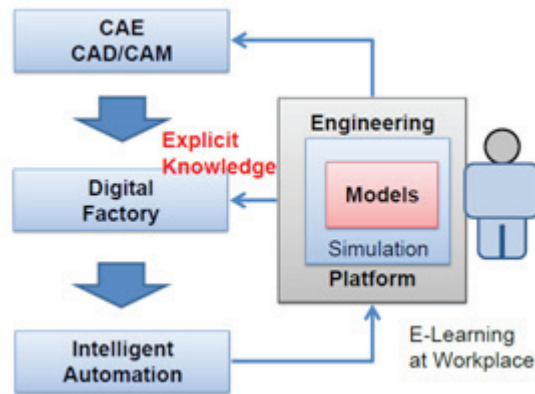
FIGURE 1. E-learning in the factories of the future [5]

The goal of the project was to develop and test a new e-learning concept for further development, productisation and marketing purposes. The concept was based on combining the developed enterprise portal technologies and learning processes, communications and e-service entities. The development and testing of the concept resulted in a pilot, where learning processes are supported by different web applications. The piloted concept as well as the new know-how remains available for educational use and further development. The concept will be finalised as a market product in the future.

The technological base for the project is an open source enterprise portal, named Liferay. The chosen technology includes equipped tools and operations for implementing a network service when the technology does not restrict the entities from development during the project. Liferay is the market leader of open source enterprise portals and has attracted the attention of an extensive global development community [7]. International visibility and new business possibilities can be reached through this community. As the Tulo-laboratory web environment was already based on Liferay, no additional investments for software were needed for the project.

The main objective of the joint development project was to develop a new learning concept, combining the methods of internet service solutions, communication and e-learning processes. The concept was expected to serve the development of know-how and communications. The following advantages were sought after by Tulo-laboratory – the test case of the project:

- Flexible and cost efficient support to the learning needs of the primary target groups, which are students and industrial R&D partners
- Pedagogically planned e-learning content in the fields of operations and product lifecycle management
- Diversifying laboratory services by utilising net communications and e-learning methods

- Increased interaction between the target and interest groups, e.g. collaboration between the expertise network and the target groups
- Creation of a meeting place for the operations management's professional network
- Support for operations management's development projects
- The target groups are easier to reach through one service channel
- Emergence of a new project and development ideas
- Marketing, demonstrations & promotion
  In addition, from Arcusys's point of view the advantages were to be:
- An online service concept
- Technical proof of concept
- Marketing, demonstrations & promotion
- A service prototype for final productisation and European market entry

3 TECHNOLOGY PREVIEW

An open source enterprise portal system, Liferay, was chosen as the basis for an e-learning platform. When compared to traditional online learning systems, enterprise portals can enhance web-based learning and create some new possibilities. The definition of an enterprise portal as well as what its main functions and features are described in following sections.

3.1 What is an Enterprise Portal?

"An enterprise portal can be defined as a single point of access (SPOA) for the pooling, organizing, interacting, and distributing of organizational knowledge" [1]. According to Raol "the strength of corporate portals lies in the ability to provide web-based access to enterprise information, applications and processes" [8]. This encapsulates the main function of an enterprise portal: its task is to put together corporate information and to provide easy access to it. This can bring eminent cost savings for companies. Because of centralization, the distribution of information becomes more efficient. It reduces actions where time is lost in searching for information, creating duplicate data or using out-dated information.

3.2 Functions and features of an Enterprise Portal

The basic function of an enterprise portal is that "they leverage existing information systems, data stores, networks, workstations, servers and applications as well as other knowledge bases to give each employee in every corporate site immediate access to an invaluable set of corporate data anytime, anywhere," [8] according to Raol. A role of an enterprise portal in corporate IT infrastructure is illustrated in Figure 2.
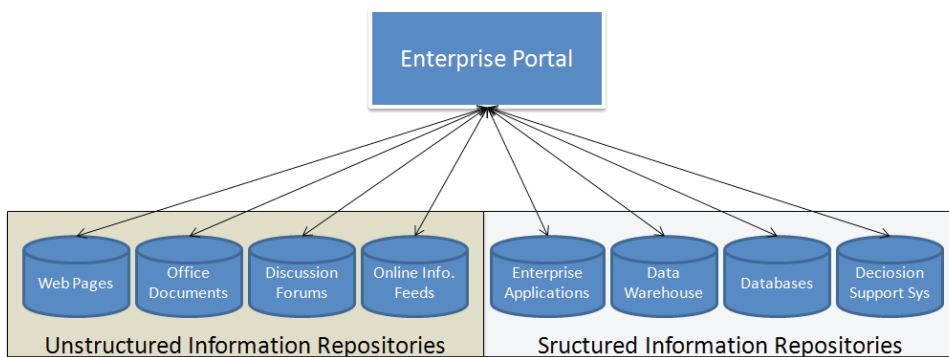
FIGURE 2. Various information repositories that need to be integrated through the corporate portal [4]

Managing an enterprise portal which provides all important functions, applications and information can be quite challenging. According to Aneja, easy expandability is essential for a portal system: "the portal framework needs to offer a plug-and-play capability that will allow additional functionality as the portal grows to meet future requirements" [1]. In modern enterprise portals this plug-and-play capability can be achieved with gadgets and portlets. "Gadgets are new application tools and services in the portal, provided via modular components. Gadgets provide the architectural construct to enable future extensibility without having to completely redevelop the portal" [1]. "Portlets are tiny applications that provide information and services from external systems" [2]. When background applications change, there is no need to change the platform system; only the portlets and gadgets need redeveloping.

According to Raol, an integration platform is a common use case for an enterprise portal: "common functions are the components that provide access to the range of disparate enterprise databases and information resources and the ease with which users can set up personalized access to enterprise and external information resources [8]. " Internal or external web content management or platform for collaborative working are other common use-cases for enterprise portals: "in most enterprise portals, these functions may include, but are not limited to security, network, administrative tools, search, content management, collaboration, personalization, extensibility, easy to use and scalability" [8].

3.3 Enterprise portal instead traditional learning management system

Enterprise portal technology can enhance online learning when compared to traditional learning management systems (LMS). Culatta characterises the problems of traditional LMS's as follows: "The traditional stand-alone learning management system (LMS) is built on an industrial age model. There are two specific problems with

this model: first it is monolithic within a learning institution and second it is generic across learning institutions" [4].

Traditional LMSs are massive all-in-one solutions which try to encapsulate all required functions and applications for online learning, but according to Culatta in most cases the outcome is that: "in the process of trying to do everything, they end up not doing a very good job at anything" [4]. The development of these kinds of systems becomes rather costly when all functions are built-in. This is because a whole platform may need development when one function needs to be changed. According to Bush, for LMS vendors it is not cost effective to provide tailored solutions for a customer [3]. In metaphor this means that one pair of shoes must fit everyone's feet: different organisations need to shape their online lecturing to a form that is determined by LMS.

Enterprise portal technology is designed for high scalability. Instead of being a massive standalone solution, it is a platform for collecting separated information and functions. With an enterprise portal it is possible to build a solution which consists of the best fitting tools and functionalities for everyone. Enterprise portal technology seems to be suitable as a solution for e-learning platforms: it provides the possibility to maintain online course content, but also includes collaborative tools and a plug-and-play capability to integrate external applications.

4 THE PROJECT

The project was implemented in four successive phases. In the first phase the background for the model to be developed was clarified and the fundamentals for the concept were planned. The second phase included creating a marketing plan for the developing concept. In addition, a market research was carried out as a separate student project. In the third phase the network environment was constructed according to the concept. Finally, in the fourth phase, an e-learning pilot for the environment was created.

4.1 Developing the concept

The project was preceded by a pre-study on the state of the art of Tulo-laboratory's online service concept, training contents and resources. In addition, current operations management related to public e-learning services was briefly studied. The pre-studies and mappings directed the planning of the concept.

On the basis of the pre-study and recent research, it could be concluded that there were needs for operations management know-how. For instance in the report "Experiences and discussion on methods and tools for production planning and scheduling: Prologi final report"[6] the following needs were outlined:

> • There is a need for production planning and scheduling know-how: Tools for plant level production planning and logistics need to be developed in most companies.

• Knowledge about comprehensive solutions instead of technology oriented sub-optimisation is especially important. This topic has only recently been noticed. Meanwhile different IT applications have emerged to the factory floors. The risk in these includes losing the overall view on the operations models and separate applications being interconnected or overlapping each other, spaghetti Integration and increase of manual work and sub-optimisation.

• In some cases manufacturing execution systems can be a part of the solution. However, the essential problem related to technology is the insufficient and disorganised knowledge of different technical solutions (e.g. so called system map) and the lack of systematic and continuous development.

• There are no perfect and ready solutions for all companies. Each company must build their own workable models instead.

The mapping phase also included finding the available online resources and methods of implementations for production planning. Following freely available online resources provided an example for them. The list is not exhaustive. A part of the materials are in Finnish.

TABLE 1. Examples of online resources

Public (social) sites	• YouTube –videos (in English). YouTube video service includes extensive range of video materials about operations management, pull production, lean, operative information systems etc. • LinkedIn communities
High quality academic sites with free contents, such as	• Aalto University's Noppa-portaali with course materials. The service is mainly for the University students, but there is a significant amount of free lecture materials. https://noppa.aalto.fi/noppa/kurssit/ • MIT Open courseware http://ocw.mit.edu/index.htm offers high class course materials in several formats, including a large video bank.
Associations and expert consortiums, providing services such as events and trainings mainly for the members e.g.	• Suomen tuotannonohjausyhdistys ry / The Finnish Production Planning & Control Association (http://www.sto-ry.com/) • Massaräätälit ry / The Mass Tailors (http://www.massaraatalit.fi) • Finnish Association of Purchasing and Logistics (LOGY) (http://www.logy.fi/www/en/index.php) • Suomen Lean-yhdistys / The Finnish Lean Association (http://www.leanyhdistys.fi/)
Training service providers, e.g.	• Aalto University (http://aaltopro.aalto.fi/en/) • Lappeenranta University of Technology (http:// http://developmentcentre.lut.fi/english.asp) • Tampere University of Technology (http://www.tut.fi/en/units/departments/edutech/)
Public R&D programs and projects such as	• Programmes funded by Tekes, the Finnish Funding Agency for Technology and Innovation (http://www.tekes.fi/en/community/Tekes%20programmes/362/Tekes%20programmes/1295) • Kainuun Etu Oy's Metapart –project (http://www.metapart.net/)

There are quite extensive sources and materials concerning operations management on the Internet. The substantial part of the field's materials is either in text or static presentation form. Interactive expert communities were fragmented and partly in an emerging state. However, there are a growing number of them such as ERP system related peer communities, different Lean communities, LinkedIn groups for almost everything etc. Still, only a few, if any, productised online services related to operations management were available (excluding productised contact lesson trainings).

4.1.1 Resulting guidelines

As a conclusion it can be stated that solutions utilising the online possibilities in the field of operations management are scarcely available. On the basis of the mapping the following objectives were set for the online service concept:

- The service must naturally support the needs of the target groups
  - Services should be productised and communications, training and cooperation oriented
  - Easy use and access for becoming a client or a member of the community
  - Combining all services, functions, cooperation and communications under the same environment

- Cost efficiency from both the service provider's and target groups' viewpoint

- Enabling continuous service development

- The environment can grow and develop through the members of the community

The following guidelines were deduced from the pre-study and objectives:

- **From web pages towards online services**: a change towards online service that utilises the possibilities of online working.

- **More effective communication and engagement with clients.** With the help of registration, clients can be engaged in the services. This enables the more effective sharing of information on services and cooperation possibilities.

- **Possibilities for new service products**, e.g. extensions for existing traditional services such as contact less learning or consulting projects.

- **Ongoing service.** With help from the web, clients can be served continuously and more comprehensively.

- **E-learning services.** With the help of the online service, trainings can be provided to a wider range of clients, even to those who are geographically scattered.

- **Founding a community for the experts of operations management.** A community that may give access to participants from different organisations.

4.1.2 Summary of the phase one

The work was launched by defining the feasible service models for the Tulo-laboratory. The idea was to plan an interactive online service connected with constant e-learning. The development of the model was started with a few pre-studies and a workshop between the participants. After the first meeting a survey regarding the model development was carried out. The types of existing operations management services were analysed. The plan was adjusted based on the results. During the planning phase the existing services and materials of the Tulo-laboratory were examined and the needed development issues were listed. As a result, the main frame for the service concept was created. This made it possible to continue executing the marketing plan and developing the technical solution.

4.2. Market study

The second phase consisted of a market study and creation of the marketing plan. This included a study of the business potentials of the new e-learning concept as well as comparable services or possible competitors. A review of the existing equivalent services and their strengths and weaknesses was carried out. The purpose of the marketing plan was to steer the project towards customer oriented productisation and in the long run market entry. The aim of the study was to find out what kind of marketing potential the developed concept has on the European markets. By concept we mean particularly services consisting of e-learning in open and partly free learning environment solutions based on Liferay enterprise portal technology. Most of the effort was put on examining the markets in Germany, Hungary and Poland.

According to the findings, e-learning market in general is rather well developed in North European countries with many actors in the market. However, in Eastern Europe, Hungary, Bulgaria or Poland for instance, the markets seem to be emerging and the recognition of the prospects of virtual learning is growing in educational institutions as well as in the industry. It was found that the e-learning service providers in the studied countries offer similar solutions as Arcusys Ltd.:

- Consulting services on e-learning solutions
- Training and supporting organisations

However, most of the service providers in these reviewed countirs offered tailor-made solutions (eLearning content and traditional LMS's) for the customers. No indications of utilising modern enterprise portal technologies, open source or know-how on the system integrations were found. The opportunities for new players and a business model can be substantiated by the fact that a portal technology based niche probably exists in these markets.

The study also indicated that the European Union (EU) is encouraging all its member countries to institute an electronic learning infrastructure in all sectors of the economy. Since 2001, the EU has planned to digitalise Europe particularly in the educational sector. Therefore, a wide market remains unexploited, especially in the new EU states. The EU therefore funds companies, organisations and individuals engaged in the promotion of e-learning technology. The EU Framework programmes give more details on how projects are funded. The information about R&D funding is found in the EU commission's websites.

4.3. Building the online services

The creation of the online environment was implemented according to the developed model. The information and process structures, tools and user management functionalities were developed on the Liferay-platform. In addition, the visual look for the online service was created. This step resulted in a service platform and new e-learning templates. The coming e-learning and concept pilots were all based on this. At first, the service platform was built on a test server environment and later on moved to the live operative environment.

The online service was constructed of the following main and sub components. These elements do not completely reflect the final structure of the online service but depict the included services and features.

1. Front page view
   a. Operates as an inducement for the services and operations management
      i. Having an element attracting more interest, so called "solution of the month, product or service presentation"
   b. Information rich but concise at once
   c. Fresh and visually appealing look
2. E-learning environment
   a. Information packages
      i. Provide answers to some of the basic questions relating to a few relevant fields
      ii. Include the essential information
      iii. Combine the sources available online
   b. Training and consultation
      i. Training information to the target groups
      ii. Management of the training processes
      iii. Consultation environment

3. Community for operations management
   a. Combines the operators and target groups, a "hub"
   b. Provides tools for cooperation
   c. Professional network
       i. Provides information on the specialists
       ii. Operates as an expert and company register
4. Registering for the services
   a. Engages the clients/ experts/ partners in cooperation
   b. Focused communication services, newsletters, course invitations and other active methods of sharing information
   c. Registering presumes participation in the operations

4.4 E-learning pilot

An e-learning pilot was implemented on the service platform. Tulo-laboratory's training services acted as a test case. The piloting included the selection of contents, improvements to the training contents, defining the learning objectives, adjusting the available learning processes and finally the implementation to the new online service environment.

The objective of the pilot was to find out in practice the applicability of Liferay enterprise portal in presenting online study materials and course contents. Secondly, enterprise portal enabled possibilities – especially combining different web applications – were tried in practice. The third idea was to demonstrate the services and development prospects and as well to get feedback from the target group. The pilot learning contents were a public course "Basics of Product Life Cycle Management" and a restricted, student-oriented "Operations Management". These were wide enough for piloting and secondly, the contents enabled utilisation of diversified multimedia and other web-based materials. The pilot is described in more detail in the coming section 5.

5 THE SERVICE PROTOTYPE

Laboratory and learning environment sites form a core of Tulo's online service. External web services are also utilised on portal to collect a professional network of production management and to use free teaching material from the internet. In addition to external services operative information systems are also used in the learning environment (Figure).
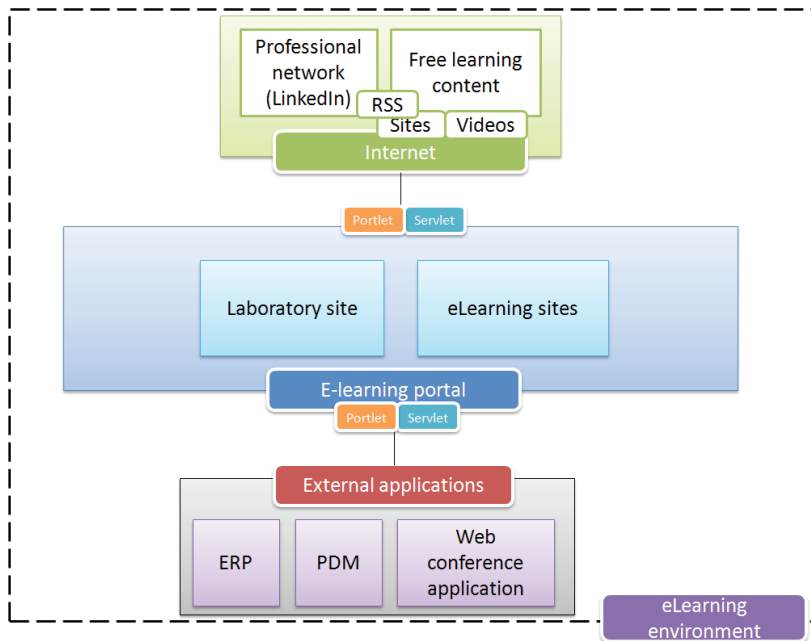
FIGURE 3. The portal environment

5.1 Laboratory-site

The public web pages of the Tulo-laboratory serve as a public relations channel between laboratory and the target audiences (students and companies). Pages will describe laboratory functions, available services and contact information. The site will also collect the most recent news and events in the theme of operations management.
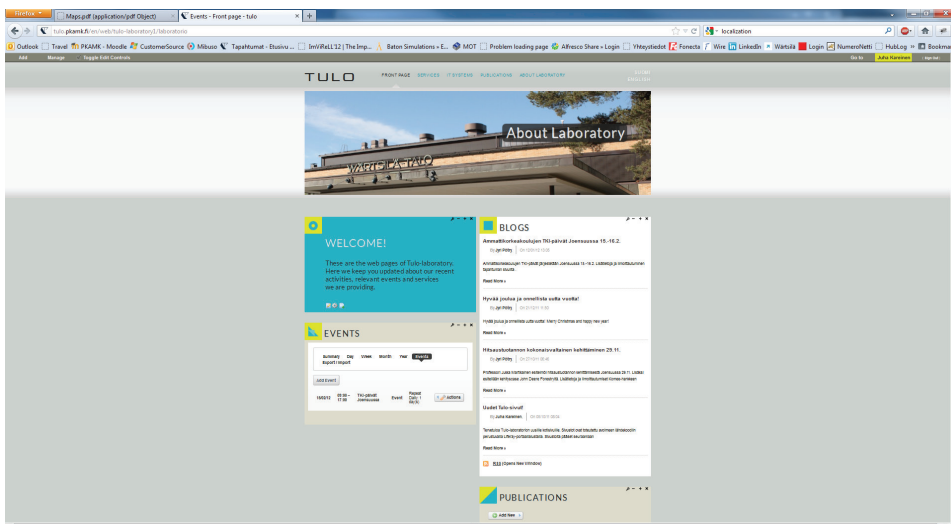

FIGURE 4. Laboratory-site

5.2. Professional network

Linkedin is a networking tool which is used to connect professionals all over the world. Laboratory's web service is using Linkedin to network professionals in the fields of logistics and production management. The service provides tools to manage networking profiles for users (including skills, interests, CV etc.), collaborative tools (blogs, work places) and different ways to organize users. In the Linkedin profile the specialists can describe their own expertise for peers and target audiences. Registered specialists can offer their expertise as consultants through services of the Tulo-laboratory. The service was used instead of Liferay's collaborative tools, because Linkedin includes all the necessary functions, and it is already widely used among professional communities.

5.3. Learning environment

The E-learning environment consists of a public site, course sites and different collaborative work places, as illustrated in Figure 5. The public site is an area which is open to everyone. It plays the role of a barker for the e-learning environment: a registration for the courses and common information about courses and course events can be found there. Each course has its own private site which is visible only for registered users. Each student also has his/her own site where it is possible to maintain one's own profile and communicate with other eLearning users. It is also possible to establish group sites for different tasks during courses. Group sites have their own collaborative tools for the group members.
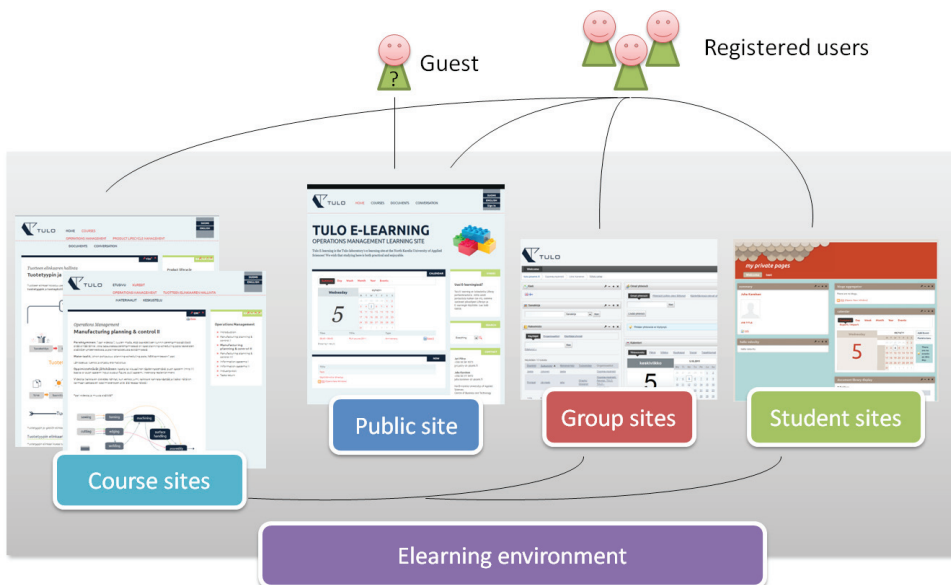

FIGURE 5. eLearning environment

In terms of Liferay this means that public site and course sites have their own organizations. As organizations they can host their own sites, contents, documents and users. Groups and students, on the other hand, have their own communities. In Liferay the communities can also have their own sites, contents, documents and users such as organizations, but they are more abstract: both organizations and users can belong to community. In Liferay a community can be seen as a group which shares common interests. In case of a learning environment this interest can be a group task, for example.

5.3.1 Public site

The public site is open for everyone. The purpose of this site is to inform users about the learning environment: what it is, how it can be used and what it provides. The public site also contains information about courses and topical events.
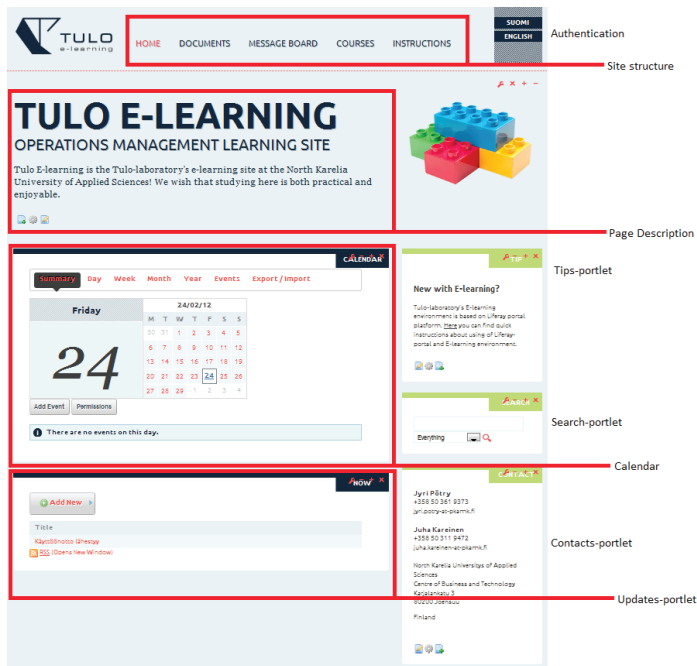

FIGURE 6. Public site

Each page consists of site navigation, page description and several functional portlets, such as a calendar, site search and web articles. How and which portlets are used is described below:

- The Calendar-portlet is used to maintain course events that are directed to the public, like course starting points and registration deadlines for example.

- The Asset Publisher - portlet is used to gather all topical updates on the site. The portlet is configured to filter all content (documents, web articles, message board) that contain tag 'news' on it. The aim is to make it easy to find all important updates, no matter the form in which they are represented.

- The Web Content Display – portlet is used in several places to display web articles. A web article is a common way to publish contents with Liferay. Articles can contain text, pictures, links and animations for example and they are easy to edit with the specific editor tool. On the site contents such as course descriptions, contact information and different news articles are generated as web articles.

- The Message Board – portlet is a complete application to host the message board on web pages. On the site the message board is used to give guests and students the possibility to ask about courses or about the site functionalities.
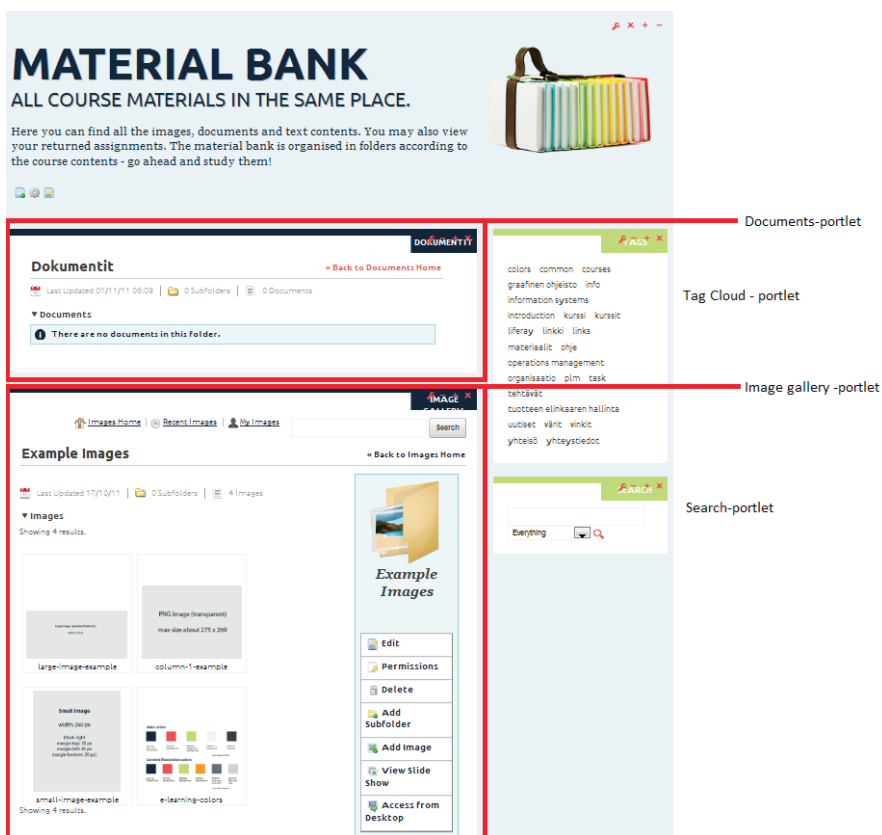

FIGURE 7. Contents and search – portlets

- The Document Library Viewer – portlet is a user interface for guests and students to access the portal's document bank. The portlet can be configured that way that the user can only see specific locations and documents from document bank.

- The image Gallery – portlet is as document library but it grants access to images on portal.

- The tag Cloud – portlet can be seen as some kind of quick search portlet. By clicking a tag it controls document library, image gallery and asset publisher on the same page to show contents with selected tag information.

- The Search-portlet can be used to search different content with one function. It can search contents from different kinds of objects (documents, articles, messages).

5.3.2 Content of a single course environment

A single course or an environment supporting learning is a separate organisation inside a learning environment. The courses are not open to the public and can only be accessed by logging in. The trainer or instructor of the course is responsible for signing the students for each course. This takes place by adding the students to members of the organisation. The students have the user rights and they can participate in forum discussions and send required materials. They are not allowed to update the teacher level contents.

A single course consists of topics (comparable e.g. with Moodle learning platform blocks) that are divided into inner components by each topic and study materials. Separate topics can be found on the top navigation bar, where the participant can move forward on the course. A separate topic or component may include several sub sections. The sub sections include the actual study materials and portlets which support the learning. The structure and presentation methods of a single course may remain quite free, but it is advised that the main structure remains the same for all courses.

FIGURE 8. Operations Management course

5.3.3 Content production in the learning environment

The Liferay portal platform enables several ways to produce contents. The contents can mainly be created with external tools and/or the Liferay editor. The contents produced with external tools are, for example, Flash animations, web videos, document files (Word, Excel, Pdf, etc.) or other file formats used on the web. The instructors can produce their contents with separate production tools and import them in different forms to the learning environment. Liferay includes its own editor that can be used for producing study materials to be shown on Liferay. Contents produced with the editor can also be exported in Open Office, Pdf and Word forms and they can be printed with Liferay's printing button.

FIGURE 9. Liferay's text editor
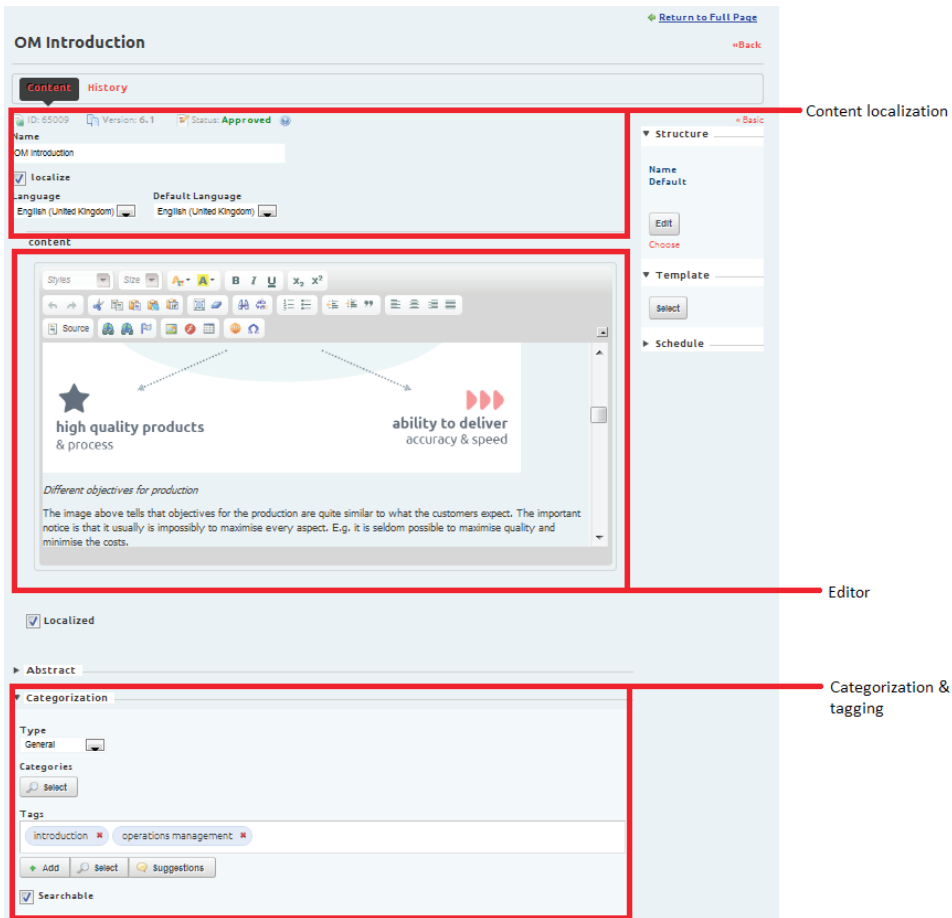
5.3.4 Presenting course study materials

Several Liferay tools can be utilised for presenting the study material. The presentation of the content is dependent on the format. The contents created with Liferay's own editor are applicable with portlets when showing only one document on one single page is needed. The asset publisher portlet must be used to list the contents, if

the meaning is to show numerous contents on one page. Clicking the titles in the list enables the content to open in its own window. The asset publisher portlet includes an Add- function which helps the instructor to structure the course contents without using the control panel.

Both the web content presentation portlet and the asset publisher portlet include ready- to-use extensions that increase the functionality of learning and communication. Both portlets can use a feedback/ commenting tool that enables the participants to discuss the topic of the course with the instructor's guidance.

Study materials included two activating "Think spot" –tasks in Flash animation format. The online study materials included case-studies, making for instance the product lifecycle management issues more concrete (Figure 10).
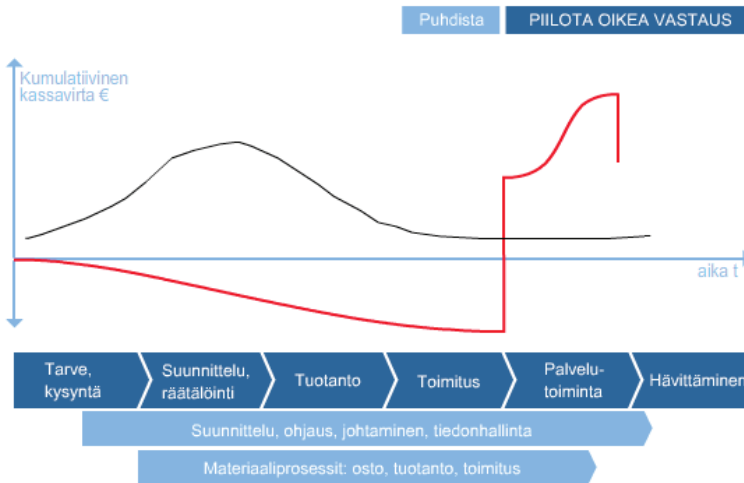
FIGURE 10. A think-spot animation

5.3.5 Portlets used for supporting learning

In addition to content portlets that can be used for presenting static content, Liferay has several other portlets for communication and joint content production which can be utilised to support learning.

Small flash animations can be used in a static web content lesson to enliven the topics and contents. These animations can be for example little tasks where students have to test oneself against what he/she just read. It is also possible to make live meetings to keep lessons by using video-meeting software. One benefit to integrate video conference software with a portal is that users can access a meeting with one user authentication and that no configuration or installation is needed for personal computers.

It is also possible to integrate external web applications with the IFrame-portlet. The IFrame-portlet can be configured to connect as a web client to an external system. With this technique different information systems can be shared to students through a learning environment. This means that systems needed in exercises can be reached from anywhere if one has internet access and a web browser. For a pilot course an open source enterprise resource system, OpenERP, was integrated with the Liferay portal (Figure 11).
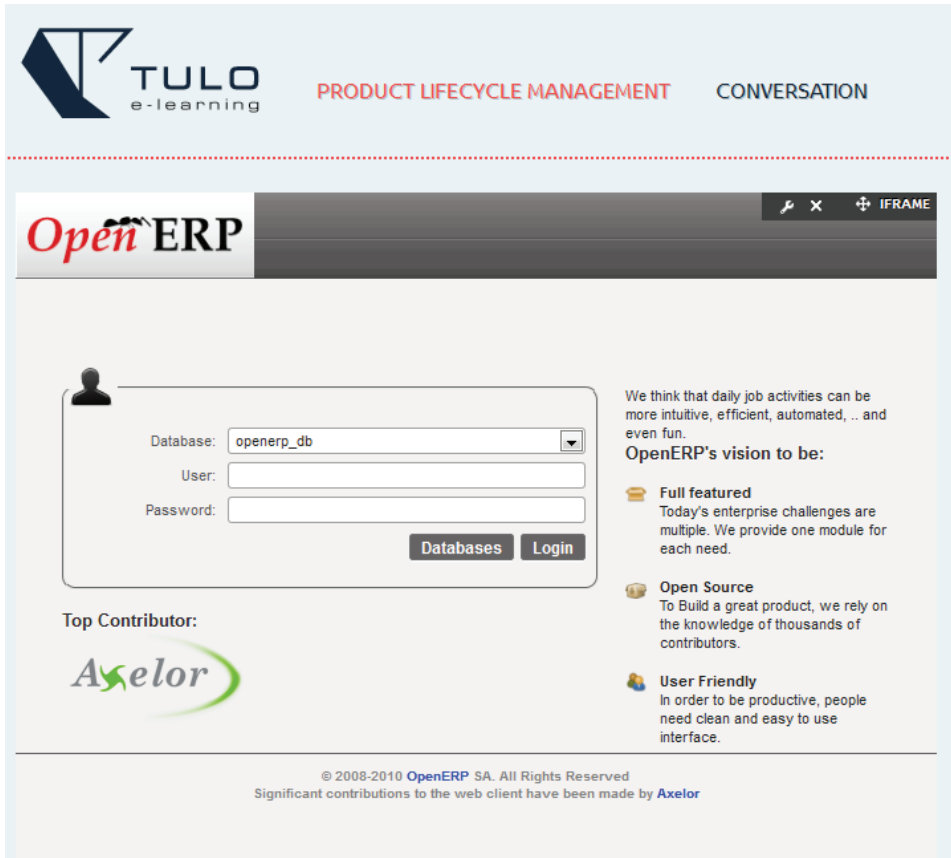

FIGURE 11. OpenERP-system integrated to the learning environment with Iframe

6 ROADMAP FOR FURTHER DEVELOPMENT

This section discusses the next activities in the service development and market entry.

6.1. Education & training services

The development project produced an online service concept that was proven feasible. In the future, the content production and marketing need to be further developed in order to actively utilise the solution. There are also several enterprise portal features still waiting for their application to e-learning. The following steps are planned to be followed in order to fully utilise the developed solution. This roadmap operates as a suggestion and can be utilised in the implementation of the developed online service as is or only to the appropriate extent.

1. Engagement in the development of the service, responsibilities and resourcing
Before the actual implementation and continuation of the development work, the following decisions must be made: who the developers are and with what the service is supported. A decision on the option of posting the monthly solutions to the service's front page has to be made. Tulo-laboratory does not necessarily need to be the only one responsible for online services and educational service, but in order to maintain and develop the operations, the responsibility could be divided to other operators such as those associated with the field. The objective is to bring the operators of the field together anyway, so the maintenance and development of the online services could be carried out in cooperation.

2. Content production to the public part of the online services
As the objective is to develop online communications, it is suggested that the contents are updated to meet the requirements of the online service. Updating the contents in the public part is also important because these materials are used for marketing the renewed services of Tulo-laboratory.

3. From e-learning pilot to a service product
The e-learning pilot needs to be further developed into a complete service. This includes structuring the e-learning and contact training into one meaningful component or continuum and compiling course description as a part of other training products of the laboratory. It is advisable to test the developed entity with target groups and re-construct possible changes in it.

4. Promotion
The following step is active promotion. The information should reach clients, partners and specialists in the field. This can be regarded as the most critical part of the online service concept. Marketing can be used as a tool to give the same information to all clients and interest groups and guide them in using the new services and requesting more information. The right kind of marketing ensures that the clients are not just aware of the service but also start to use it. The objective is to get customers and to build a convincing professional community.

5. Continuous development

In this phase, the contents and the environment should be improved step by step. New content is gathered, assessed, prioritised and implemented. The professional network should be an organic part of the development both in generating ideas and in their realisation.

6.2. E-learning solutions

From Arcusys Ltd's point of view, the pilot project described in this paper aims at service development and European market entry with a new set of e-learning solutions based on open source enterprise portal technologies. The plan is to finalise the services based on the market study and piloting experiences.

6.2.1 Background and goals

Arcusys Ltd develops and outlines new Liferay-based services that support e-learning. The development of the services was started in April 2010, and the first customer projects were launched in autumn 2010. The piloting of the concept has proven the services feasible. There is also clear potential in both the Finnish and European markets. At the moment, no European provider can claim e-learning services based on open source and/or portal solutions. The markets are still quite open and emerging, a situation where this kind of competitive edge can certainly pay off.

Software development improving the supporting technologies is also on-going. The most significant is implementing a SCORM portlet, i.e. enabling the use of SCORM –study material packages in Liferay platform. Sharable Content Object Reference Model (SCORM) is an essential and widely used collection of standards and specifications for web-based e-learning. SCORM enables the usage of the learning materials and versatile exchange of educational and learning information in different platforms. Arcusys launched its SCORM development work between October and November 2010, and the first version of the SCORM portlet was published in the spring of 2011.

In addition to the technical and service developments, an active search for European partners and alliances is underway. The objective is commercialising Liferay-based e-learning platforms in an international context and entering the European e-learning markets with partner companies.

6.2.2 Project guidelines

This section includes a roadmap for finalising the service and entering new markets.

1. International partnering and benchmarks: getting a closer view of the markets, collaboration possibilities and customer needs.

2. Launches in Finland and their utilisation as references and development drivers: the aim is to prove the educational Liferay concepts and ideas not just feasible but profitable as well. The reference may also form a starting point for more extensive joint productisation with international partners.

3. Joint productisation projects: creating a basis for the joint implementation of product concept with the Liferay operators and more extensively demonstrating the solutions created. This is critical as the current markets are dominated by traditional e-learning platforms and evidence for the profitability of other e-learning methods and applications are required. Furthermore, the references and demonstrations have marketing value. In addition, the functionality of the SCORM portlet is tested and finalised during the joint projects.

4. Business models and contracts with the partners: forms of cooperation will be agreed upon with the partners. The objective is to find business models where complete turnkey e-learning solutions are provided by a group of SMEs.

7 CONCLUSIONS

Enterprise portal technology seems to be feasible for e-learning purposes. It provides a highly scalable platform where different content and applications can be adopted with comparatively easy plug-and-play features. Many new and evolving technologies are more efficiently applicable when compared to standalone learning management systems. From the learning point of view this means seamless utilization of external educational resources, social media and professional communities as well as the individual networks of the students. Another major progression is the possibility of combining external web applications, which for instance provides an opportunity to run the technology or applications to be learnt within the learning environment. In our test case ERP and PDM systems were available the students.

Open-source software seems to have its own advantages. An active developer community can provide a wide range of different solutions, development results and support which are free to use and refined for one's needs. Open-source software is interesting from the viewpoint of public organisations. In most cases no commercial client applications or other software is needed. Therefore, service customers are not bound to buy any commercial software for their client devices.

Social applications and collaborative tools can enhance online learning. Communication is not restricted to any one form, but it users can choose between instant messaging, video negotiation, message boards and wikis for example. Modern collaborative tools can make working in teams and the distribution of information more effective. Adapting e-learning users for new features and functions should be straightforward because most of those are already familiar from social media on the Internet.

Although the technology seems to be mature enough to provide versatile and practical online learning courses, the enterprise portal technology could be used to enhance traditional classroom based teaching as well.

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This report describes a new e-learning concept based on open-source enterprise portal techno-
logy with web 2.0 features. As web technology has evolved rapidly in the last decade bringing
different kinds of social applications and collaborative tools, those features have been only
loosely adopted for online learning purposes. New technologies allow users flexible ways of
communication and data distribution through the internet. These web 2.0 tools are already
absorbed by large audiences, providing a great opportunity for utilisation in online learning.
There is also a need for online learning material for operations management. Studies seem to
point out that there are only few if any products online reserved for this theme.

As a result an operations management themed e-learning environment was built in co-operati-
on between North Karelia University of Applied Sciences and Arcusys Ltd.