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An online information system to support blended training of rural SMEs on e-government

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Abstract

Purpose – Away from central public authorities, regional (also called rural) enterprises do not have direct, physical access to all the services that governmental or public agencies offer. Very often, these services are essential for enterprises, mostly small and medium-sized enterprises (SMEs), in such areas, in order to perform their business operations. This paper aims to present an example of how such types of information management and use took place in the case of familiarizing rural SMEs with the use of e-government.

Design/methodology/approach – This paper is a case study of how a practical application is designed and developed for the blended training of rural SMEs. First of all, an identification of the main information resources that will be stored, annotated, shared and accessed through the system took place. Then, an outline of the general architecture and user roles involved was developed. System analysis and specification using Unified Modeling Language (UML) then took place. This was accompanied by design and specification of the database, based on appropriate metadata schemas for describing the information resources. The whole process was completed by the design and prototype development of the interface, which was put into public operation and testing with a sample set of real users.

Findings – Although there are several information management systems focusing on the education and training of rural stakeholders, their learning resources are not directly relevant to SMEs’ needs. The main finding of this paper is that it shows a complete case study of designing, developing and evaluating an information technology application for rural businesses.

Originality/value – The value of the approach presented here is the combination of training resources in an information system with a blended training approach, so that it better matches the learning needs of SMEs. Through this web-based environment, rural SMEs are able to find information on the e-government services offered in their region, as well as gaining access to e-learning content on how they can use such services.

Keywords Learning repository, E-government, E-learning, Software engineering, Small to medium-sized enterprises

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1. Introduction
Away from central public authorities, regional (also called rural) enterprises do not have direct, physical access to all the services that governmental or public agencies offer. Very often, these services are essential for enterprises, mostly small and medium-sized enterprises (SMEs) in such areas in order to perform their business operations. They include services offered by several types of governmental agencies/authorities, from taxation offices, legislative authorities and local authorities, to chambers of commerce (Huang, 2009; Salkute and Kohle, 2011). Information and communication technologies (ICT) aim at addressing such problems, first by providing the means for public authorities to deploy and offer electronic government (e-government) services, and second by facilitating rural SMEs in accessing these services from a distance. On the other hand, often professionals and citizens are not aware of electronically available public services, or do not know how to use them effectively to reap their benefits in their everyday business activities.

This paper presents an initiative that aims at familiarizing rural SMEs with the use of e-government services. Its scope is to provide rural SMEs from five European countries (UK-Wales, Germany, Greece, Slovenia and Poland) with the following:

- a specially designed training curriculum that can demonstrate how SMEs may use existing e-government services to support their business;
- a series of training scenarios that combine traditional forms of learning with e-learning forms (based on blended learning models) in order to train rural SMEs in the use of e-government services; and
- the Rural-eGov Observatory, an online point of reference that SMEs can access continuously for relevant information and digital training resources.

Specifically, this paper has the following objectives:

- to review relevant approaches and identify the need for deploying e-government training initiatives that will particularly focus on rural SMEs;
- to introduce the deployment of the Rural-eGov Observatory; and
- to present the way that the rural trainees evaluated the Observatory during the training activities of this initiative.

The remainder of the paper is structured as follows: section 2 provides the background to this paper by giving some definitions on what e-government and SMEs are, and explaining why training rural SMEs in e-government is important. It also reviews related training initiatives, and introduces the training approach of the Rural-eGov initiative. In section 3, the design, specification and implementation of the Rural-eGov Observatory is presented. The pilot evaluation of the Observatory and its main results are presented in section 4, and the main conclusions of this work are discussed in section 5.

2. Background
2.1 Definitions
According to the European Union’s (EU) definition, e-government is the “use of ICT in public administration, combined with organizational change and new skills, in order to improve public services and democratic processes and strengthen support to public
policies” (European Commission, 2003a). By adopting the i2010 strategy (European Commission, 2005), the EU is committed, among other things, to provide better, more accessible and cost-effective public services through the use of ICT, acknowledging in this way the significance of e-government for social inclusion, economic growth and quality of life. An important aspect is that e-government may raise the productivity of public agencies and better meet the needs of the private sector, therefore boosting the competitiveness of the economy. E-government can particularly benefit SMEs, which often face difficulties in dealing with public administration.

The European Commission (EC) defines as an SME any enterprise that employs fewer than 250 persons and that has an annual turnover not exceeding €50m, and/or an annual balance-sheet total not exceeding €43m (European Commission, 2003b). With 23 million SMEs operating in the EU representing 99.8 percent of all European enterprises, which provide jobs for more than 75 million Europeans, it is well justified that SMEs have been characterized as the heart of Europe’s economy (Ntaliani et al., 2009). They are a major source of entrepreneurial skills, innovation and employment. However, they often face with market imperfections. SMEs frequently have difficulties in obtaining capital or credit, particularly in the early start-up phase. Their restricted resources may also reduce access to new technologies or innovation. Therefore, support for SMEs is one of the EC’s priorities for economic growth, job creation and economic and social cohesion.

Having realized the importance of SMEs, improving the integration and innovative use of ICTs by them has been a primary challenge for policymakers the over the last few years. However, the difficulties of SMEs are more obvious when considering SMEs in rural areas, which are away from decision-making centers and public authorities. Thus, they often do not have physical access to the required public services for doing business with government or public agencies. Furthermore, due to lack of transportation, time and money, or even because of bad weather, it is not possible to contact public authorities by visiting local service points. An effective way to overcome such obstacles is to develop and deliver high-quality e-government services (Pratchett et al., 2006; Chen et al., 2007; O’Toole, 2007; Sengupta and Bandyopadhyay, 2009).

2.2 Training requirements
A requirements study for SMEs in the five targeted rural areas of our initiative, which took place around March 2007, revealed that SMEs in rural areas lack of awareness of relevant e-government services that they could take advantage of (Parfett et al., 2007). In addition, it highlighted that rural SMEs are in great need of specialized training programs that will introduce them to the world of e-government. This observation is in line with the results of other related studies. For instance, Bose (2004) identified the need of citizens and professionals to be continuously trained on e-government topics in order to take advantage of the electronic services that governments deploy for them. He particularly highlighted the role of e-learning as a vehicle to support such continuous education and training activities.

On the other hand, the relevant literature identifies that training initiatives on e-government topics mainly focus on the provision of necessary skills for the personnel of public and governmental agencies (Bose, 2004; Falivene and Silva, 2008). E-learning and blended-learning training approaches for SMEs (especially in rural areas) have been extensively reported in both academic studies (e.g. Cannarella and Piccioni, 2005;
Drigas and Koukianaki, 2006; Kotey and Folker, 2007; Powell and Houghton, 2008) and in R&D projects (e.g. NISSOS, 2007; SMECTRA, 2006; INTELS, 2007; INNOVA, 2006). Nevertheless, the training of rural SMEs in e-government topics is still an area that remains unexplored – especially as far as technology-enhanced approaches are concerned (Manouselis et al., 2008b).

### 2.3 Learning repositories

The internet has increasingly become the dominant medium for making resources available online in a digital format, in order to be accessed, used and reused by interested audiences. In technology-enhanced learning, the central paradigm of this reuse-oriented technology is the notion of learning resources (sometimes referred to as “learning objects”) as reusable pieces of digital content. Very often learning resources are organized in learning repositories (LRs), which are systems for the storage, location and retrieval of content. In LRs, resources are described using appropriate metadata (Miller, 1996; Steinacker et al., 2001; Taylor, 2003; National Information Standards Organization, 2004; Sen, 2004; Lytras and Sicilia, 2007; Manouselis et al., 2010) that help users to discover them online and decide whether/how they can put these resources to new educational uses.

A number of LRs of rural and agricultural interest have already been developed worldwide. Characteristic examples include (source: http://aglr.aua.gr):

- Centre National de Recherche Agronomique (CNRA) – www.cnra.ci (Côte D’Ivoire);
- CGIAR On-line Learning Resources – http://learning.cgiar.org (USA);
- COTR’s e-training site – http://kirk.estig.ipbeja.pt/cotr/ (Portugal);
- EcoLearnIT – http://ecolearnit.ifas.ufl.edu (USA);
- FAO Capacity Building Portal – www.fao.org/capacitybuilding/ (Italy);
- Lao Agriculture Database – http://lad.nafri.org.la (Lao People’s Democratic Republic);
- Network of Aquaculture Centres in Asia-Pacific – www.enaca.org (Thailand);
- BIOAGRO repository – www.bioagro.gr (Greece);
- SANREM CRSP Knowledge Base: – www.oired.vt.edu/sanremcrsp/professionals/knowledgebase/ (USA);
- TrAgLor – Turkish Agricultural Learning Object Repository – http://traglor.cu.edu.tr (Turkey);
- Organic.Edunet – www.organic-edunet.eu (EU);
- OER Commons Green – www.oercommons.org/green (USA);
- AgroWeb – www.agrowebcee.net (global);
- ECOLOGICA – www.ecologica.net (EU); and

Although many of these (and possibly other) repositories have collected and store learning resources of interest for rural professionals and stakeholders (Palavitsinis et al., 2011), until today there has not been any effort that has particularly focused on
rural SMEs with a special interest in e-government and electronic public services (Costopoulou et al., 2010).

2.4 Rural-eGov Learning Repository
To this end, an LR with digital training resources on e-government, with a particular focus on rural SMEs, has been developed. The training resources in this repository aim at supporting the blended training approach that is adopted, so that it better matches the learning needs of SMEs. In our approach, first a set of proposed training scenarios (based on blended learning strategies for vocational training) are developed. These scenarios promote the combination of ICT-based learning (such as LRs that support virtual communities) with traditional forms of learning (such as face-to-face seminars and learning groups). They target at training SMEs from rural areas on how they can understand and reap the benefits from the use of e-government services. Furthermore, innovative and relevant e-learning content supports the proposed training scenarios.

To make resources available to the trainees through a web-based environment, the so-called Rural-eGov Observatory has been deployed. The digital training resources are described with metadata and stored in the Observatory’s LR. During a number of pilot training sessions, representatives from rural SMEs are able to access this online LR with digital training resources, and use them as a self-paced medium of acquiring skills and competences that will help them make effective use of existing e-government services.

3. Rural-eGov Observatory
The major enabler for achieving the aims our training approach is the Rural e-Gov Observatory. Through this web-based environment, rural SMEs are able to find information on e-government services offered in their region, as well as gaining access to e-learning content on how they can use such services. The focus of this paper goes beyond the development of the LR with the Rural-eGov training resources, to the design and deployment of the overall Observatory environment.

3.1 Methodology
The steps to be followed in order to develop and evaluate the Rural-eGov Observatory are:

(1) identification of the main information resources that will be stored, annotated, shared and accessed through the system;
(2) outline of the general architecture and user roles involved;
(3) system analysis and specification using the Unified Modeling Language (UML; see www.uml.org);
(4) repository design and specification, based on appropriate metadata schemas for describing the information resources;
(5) interface design and prototype development; and
(6) public operation and testing with a sample set of real users.

3.2 Information resources
In the context of Rural-eGov, two types of information resources (or objects) are mainly stored, shared and accessed online:
The DTOs support a variety of training scenarios for rural SMEs, and include different types of educational material (such as lectures, best practice guides, self-assessment forms, etc.). These are stored as electronic files in the form of PowerPoint presentations, Word documents, PDF documents, short demo videos, and others. Since they are developed to cover the needs of the five targeted rural areas, they are made available in English, Greek, German, Polish and Slovenian. All the DTOs that are produced to support the SME training scenarios are uploaded in the repository of the Rural-eGov Observatory. To facilitate searching, locating and downloading appropriate resources, the characteristics of the DTOs have to be briefly reflected in their descriptions. In this way, users can simply go through the various descriptions, and select the most appropriate resources for their needs, instead of downloading each file and checking its appropriateness. Apart from reflecting the most important characteristics, descriptions have also to be available in the language of the users (that is, multilingual descriptions will be necessary). An example of a Rural-eGov DTO is the best practice guide presented in Figure 1. It is a guide that explains with an illustrative step-by-step example how a particular Greek e-government service is used.

Apart from the training resources, the Rural-eGov Observatory lists a number of e-government services (i.e. eGROs) that may be useful for the SMEs in the five regions. This is a practice that is also followed by other e-government initiatives (Batini et al., 2006). The eGROs listed are mainly the ones to be examined in the context of the training scenarios (i.e. their case studies). Descriptions of the e-government services are included in the Observatory, in order to allow users searching through the listings of services and identify ones that may be useful for their needs. For this reason, these eGRO service descriptions are structured in such a way to allow searching and browsing according to various properties such as their geographical coverage, their business sectors, and others. An example of a Rural-eGov eGRO is the Zanzibar e-procurement marketplace presented in Figure 2. It is an e-market providing catalogues of buyers and procurement opportunities for UK-based suppliers.

**Figure 1.**
Screenshot of a best practice guide for using a Greek e-government resource
3.3 Overall architecture

Figure 3 illustrates the main architecture of the Rural-eGov Observatory portal. The users accessing the portal, the corresponding services, as well as the repositories involved are depicted.

There are three types of user, each accessing the Observatory in a different way (Karetsos et al., 2011):

1) **Visitors**, who can use the services of the portal such as browsing or searching for DTOs and eGROs. Visitors can be either registered or unregistered, with the registered ones having access to a wider set of the portal’s functionalities, such as adding annotations or rating DTOs and evaluating eGROs.

2) **Content providers** (CPs), who can insert DTOs or reference to eGROs and their corresponding metadata. CPs comprise of DTO developers, who have the ability to upload DTOs and the corresponding metadata, and eGRO collectors, who insert into the portal reference to eGROs as well as the corresponding metadata.

3) **Administrators**, who perform all the administrative functions related to visitors, content providers, DTOs and eGROs. These include viewing/deleting/deactivating DTOs/eGROs and the corresponding metadata, accepting or declining requests for registration from CPs, viewing/activating/deactivating registered visitors or CPs, etc.

In Figure 4, the users of the Rural-eGov Observatory Portal and their categorization are illustrated.

3.4 UML analysis

To further analyze the system and its expected operations, we have used UML, which is the *de facto* software industry standard modeling language for visualizing, specifying, constructing and documenting the elements of systems in general, and
software systems in particular. UML provides a rich set of graphical artifacts to help in the elicitation and top-down refinement of software systems from capture of the requirements to the deployment of software components (Boggs and Boggs, 2002).

In UML, a system is described using different levels of abstraction and considering various views (i.e. business view, use case view, design and process view, implementation view). Each view is realized using different UML modeling tools (diagrams), such as use case diagrams, activity diagrams, sequence diagrams,
collaboration diagrams, statechart diagrams, class diagrams, component diagrams, and deployment diagrams. UML is largely process-independent, meaning that it can be used with a number of software development processes.

Due to space restrictions, we only present the use case diagrams, in which the identified users are shown (Figures 5–7). Figure 5 provides a high-level analysis of the use cases, while Figures 6 and 7 focus on use cases related to DTOs and eGROs, respectively. A detailed analysis is included in the technical documentation of this initiative (Manouselis et al., 2007).

3.5 Repository design and specification
The UML-based analysis led to the identification of the user roles and interactions, and therefore to the identification of required functionalities and components to support them. Furthermore, the design and specification of the Observatory also called for the design of the system’s repositories – that is, of the databases that store information about DTOs and eGROs. This stored metadata about the resources is represented according to two selected metadata standards.

More specifically, for the description and classification of the eGROs for rural SMEs, the Rural-eGov Observatory used a specialization of the e-Government Metadata Standard (e-GMS, 2004). In addition, for the description and classification of the DTOs, a specialization of the IEEE Learning Object Metadata (LOM) standard (IEEE LOM, 2002) has been used (Tzikopoulos et al., 2007). Figures 8 and 9 provide an overview of the structure and elements of the two metadata schemas that have been used as a basis for the specification of the databases of the Rural-eGov Observatory.

3.6 Interface design and prototype development
The final stage of the design and specification of the Rural-eGov Observatory was the design of its interfaces, and the implementation of its prototype version. Interface design took place bearing in mind the structure of information to be presented through the Observatory. This structure should be consistent in any web application (from a single web site to an advanced web portal); therefore, the process consisted of the generation of typical page descriptions, where major information blocks were identified. The final layout of the implemented interface could differ at the end, but the components identified should be presented on all pages. An example is presented in Figure 10.

As soon as the interface design process was completed, the development of the first version of the Observatory portal took place. This first version was tested and debugged by users, leading to a number of revisions that were implemented in the final version of the portal.

3.7 Current operation
The public version of the Rural-eGov Observatory was initially made available online through http://egov.aua.gr:8080/observatory/. A screenshot of its first public home page is presented in Figure 11. It is available in five different languages, i.e. English, German, Greek, Polish and Slovenian. It contains around 80 DTOs in its training resource repository, and over 70 eGROs in its e-government service directory. About 15 content provider experts have contributed DTOs for rural SMEs, whereas seven experts were collecting and contributing eGROs. Currently, the Rural-eGov
Figure 5.
High-level use case diagram
Observatory is being migrated to a new environment (available at see www.rural-observatory.eu) in order to extend its coverage and support more rural communities in the context of the Rural Inclusion CIP PSP project (see www.rural-inclusion.eu). This has also led to a recent elaboration of its functionalities and features (Karamolegkos et al., 2010).

4. Evaluation

In the context of the Rural-eGov training activities, rural SMEs from the participating regions have been invited to use the Observatory in order to locate relevant training resources that would help them understand and use specific e-government services. In this light, a pilot evaluation trial has taken place with targeted users, in order to collect useful feedback regarding the satisfaction of the users from the Observatory environment. The evaluation trial was organized during September 2008, with a selection of users who participated as trainees in the project’s activities. In total, 118 people used the Rural-eGov Observatory over this one-month period, carrying out a number of tasks that were designed by the project experts. After the end of this period, the participants were asked to complete an online questionnaire assessing their satisfaction from various system dimensions. The WebQual questionnaire was adopted (Barnes and Vidgen, 2002). WebQual 4.0 (see www.webqual.co.uk/instrument.htm) is a generalized instrument for measuring user satisfaction with web-based environments. It measures user satisfaction on three general dimensions:

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To do so, it analyzes user preferences on 23 dimensions. It uses a 1-7 scale to assess the user rating of each dimension, with 1 indicating the least satisfying option and 7 the most satisfying one. An online version of WebQual for the Rural-eGov Observatory was developed and has been made public in five languages at: http://infolab-dev.aua.gr/ruralegov/questionnaire/

Figure 12 presents the distribution of the 118 respondents by country, depending on the language in which they completed the questionnaire. More specifically, Slovenian and German users are those with the highest response rates (more than 30 people from each country). About 20 people answered the questionnaire from Greece, and ten from Poland. Only five seem to have responded from Wales (UK), which could be partially explained by the fact that the Welsh SMEs were mainly agricultural.

The overall distribution of the responses by dimension is given in Figure 13. Considering responses that are (on the 1-7 scale) at least 5 and beyond to be positive, we can see that general acceptance of the Observatory by its users is satisfactory (in...
Figure 8. An overview of the metadata schema used for eGRO description.
Figure 9. An overview of the metadata schema used for DTO description.
most dimensions, around 80 percent). There are some dimensions where satisfaction is lower. In questions like “Has a good reputation”, “It feels safe to complete transactions”, “My personal information feels secure”, and “Conveys a sense of community” the neutral and negative responses were somewhat higher, but again less than 35 percent. These are the aspects of the Observatory that have to be further elaborated in future in order to achieve higher appreciation by rural SMEs.

Figure 14 illustrates per country (according to their language) the final results of the evaluation experiment: the overall satisfaction of users from the Rural-eGov Observatory, illustrated. As shown, the overall satisfaction of the rural trainees is rather high, as far as the Observatory is concerned. The most satisfied users are Slovenian and the Greek users. Polish users seem to be rather satisfied, although a smaller number of people responded to the questionnaire. German users seem to be generally satisfied, but also hold some reservations. Welsh users are rather divided: three were generally satisfied by the Observatory, whereas two were totally disappointed. The differences among the various countries could possibly be explained by the difference in the synthesis of the user groups: in Slovenia and Greece, users were
Figure 11. Implemented version of Observatory’s home page

Figure 12. Distribution of users per country/language
young professionals who are computer- and web-literate; in Poland and (especially) Wales, participants are generally reluctant to use electronic services, something that may be reflected in their responses.

5. Conclusions and discussion
In this paper we present the development of an online information system that supports the deployment of blended technology enhanced training in a rural educational context. This environment, called the Rural-eGov Observatory, is one of the main outcomes of the LdV Rural-eGov initiative. The system collects, categorizes and provides access to the digital training resources and e-government services that may help rural SMEs to use and exploit services that are relevant to their needs. In the paper, the design and implementation of the Observatory have been presented, as well as characteristic results from its pilot testing with real users.

Although there are several repositories focusing on rural stakeholders, their learning resources are not directly relevant to the needs of SMEs. On the other hand, in the cases of repositories that are being developed to generally support vocational education and training of SMEs (such as the Australian Learning Object Repository Network; see http://lorn.flexiblelearning.net.au), there are no resources that particularly focus on rural SMEs. Therefore the originality of this paper is the deployment of a LR that particularly focuses on the rural SMEs.

The web-based environment developed here is mainly providing the repository infrastructure and portal services, and thus is not focusing yet on aspects like personalization and adaptation to individual user needs. Its focus is on maintaining interoperability with other related repositories, and this is why metadata standards like eGMS and IEEE LOM have been adopted and specialized. This facilitates the federation of this repository with other repositories with content of an agricultural and rural interest, such as that of the Food & Agriculture Organization (FAO;
see www.fao.org) of the United Nations (Manouselis et al., 2008a; 2010). Nevertheless, further functionalities and services could be provided to users in order to extend the resource-based network of this web-based environment (Hill, 2007) For example, Web 2.0 features and social annotation of resources could be introduced (Vargas-Vera and Lytras, 2009). With this in mind, the Observatory already collects ratings of resources from its users in order to further deploy and offer services such as recommendations (Adomavicius and Tuzhilin, 2005).

References


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