

COLLABORATIVE WORKPLACE LEARNING FOR DEMOGRAPHERS

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Abstract: *The paper promotes the use of novel learning Web services in the daily work and research of social scientists and other professionals. The case presented in the paper pertains to demographers and their research, but the technology used is generic and can be easily instantiated for use by other social science researchers. Specifically, the case covers facilitating collaboration between a university research group in the field of demography and professionals in the field of demographic statistics. The technology used is a set of new Web services developed as parts of an EU research project. The paper explains the case itself and the motivation for using the services, describes the services themselves, and discusses the experience acquired and the benefits and lessons learned by using the services so far.*

Keywords: *Workplace learning, Web services, Demography.*

1. INTRODUCTION

The majority of researchers who have adopted Web services as tools for their daily use come from computer science, math, and engineering; very few come from social sciences. This has been shown in a recent study conducted by the Research Information Network from UK [1]. However, a notable exception in the study is related to collaborative research: the use of Web services is positively influenced by researchers' involvement in collaborative research activities, and social science researchers are not an exception. Here collaborative research can be work as part of a local team, work with collaborators in different institutions, participation in an informal, local research network, and participation in wider, discipline-based research networks.

This last fact has been one of the starting points for the work presented in this paper. Another one was the recent development of useful Web services that support collaborative learning, work, and research; the services have been developed within an EU-funded, 3-year FP7 research project called IntelLEO (<http://www.intelleo.eu>). A suitable case of collaboration between researchers and other professionals working in the field of demography has triggered the work.

2. PROBLEM STATEMENT

The paper focuses on the following questions:

- What specific kinds of Web services can be of interest to demographers, given the intrinsically collaborative nature of their daily work and research?
- What exactly are the benefits demographers get from using such Web services?

- How to start using specific Web services in collaborative work and research in demography?

An underlying assumption here is collaborative work. However, the approach to collaboration covered in this research is not restricted to collaboration between individuals; the most suitable cases are actually those of collaboration between different teams and/or organizations.

3. MOTIVATION

Much of the work done by demographers is intrinsically collaborative, and is often based on using governmental information sources related to census data and vital statistics. To this end, university research groups often collaborate with professionals from other institutions, such as national and local bureaus of statistics, as well as by various governmental and provincial offices. Also, in many interdisciplinary projects, usually initiated by certain governmental institutions, demographers from universities and demographic research centers are asked to participate to spatial planning, social care, educational policy development, and similar population-related programmes.

In all such cases, both the researchers and the other professionals participating to the collaborative activities face a common problem: certain topics and phenomena of interest to demographers are not well covered in information sources related to census data and vital statistics, and are not readily available. Table 1 shows examples that illustrate this problem.

It is often advocated by both parties that a major step towards alleviating this problem would be to develop and maintain a repository of various documents, research

material, online tools and resources, and other information that all interested individuals and organizations could use in their daily work and activities. Uploading and annotating new relevant resources in this repository, as well as removing or repurposing existing ones, can help learn about new trends and interests of

researchers and institutions, indicate specific services of interest to organizations and individuals that should be developed to support and facilitate their activities, and point out emerging topics and profiles of professionals required to cover them in future projects.

Table 1: Some topics and phenomena of interest to demographers; however, the data to support demographers' work on these topics are often missing in information sources commonly used in demographers' daily work (The topics/phenomena indicated in the table illustrate the case of Serbia, but are observed in many other countries as well)

Topic / Phenomenon	Explanation	Missing data / Further work needed	Target information of interest
Cohabitations	Unmarried couples living together	Number of cohabitations, their durations, resulting fertility, number of cohabitations ending in marriages	More complete picture about the size of married population, celibate, and attitudes towards traditional life; more accurate classification of population according to their marital status
Population ageing	The number of elderly citizens vs. the number of young ones	Social status of elderly citizens, their habitation types, health conditions, sources of income, level of poverty	Estimates of population ageing trends, related actions of local governments, regional and international contexts of ageing
Brain drain	Emigration of highly educated labor force	Demographic data before and after emigration, such as marital status and fertility, professional activities, type of college degree, level of further education	Migration trends to help the government create appropriate population policies
Social mobility	Horizontal and vertical mobility and "generation shift"	Mobility related to ethnical recognition (especially for minorities) and types of habitats	Quantitative insights into how social, political, financial, and other crises affect social mobility
Population activity	Citizens' primary and secondary (additional) activities	Additional activities of a part of the population struck by poverty and turbulent political events	More complete insight in the share of additional activities in the total population activities

Such a repository should be supported by appropriate, intuitive, and easy-to-use Web services to allow for easy access to the resources stored therein and using them as learning materials. In addition, using these Web services should enable interested individuals and organizations not only to collaborate over specific resources in their projects, but also to contribute to the repository with newly created and/or discovered resources. And that is where the IntelLEO Web services come into the play.

4. IntelLEO

IntelLEO project explores supportive technologies for *learning and knowledge building* activities (LKB) of learners in Intelligent Learning Extended Organisations (IntelLEO). The term *Intelligent Learning Extended Organization (IntelLEO)* denotes a learning community emerging as a temporal integration of two or more organizations (e.g., companies from industry, universities, training institutions) that may want to collaborate and share business and educational efforts through performing various LKB activities.

IntelLEO project develops Web services to support collaborative LKB activities between organizations. These services include: searching for human expertise in the organizations involved, to support LKB for individuals/groups, according to predefined objectives; checking for experts' availability; proposing a suitable working group based on available expertise, individual competences and experience, and organizational objectives; content/knowledge provision (CKP), i.e.

discovery, delivery, and sharing of LKB resources within the organizations involved; LKB planning, i.e. selection of appropriate sequences of LKB activities and criteria to provide resources in a specific context; and many more (see the project Web site for details).

5. APPLICATION CASE

Through private connections, IntelLEO dissemination activities, and another research project, a group of demographers from the Institute of Demography (ID) at the Faculty of Geography of the University of Belgrade has got introduced to the IntelLEO Web services. Although the IntelLEO project is not completed yet, and its services are still getting improved, ID wanted to experiment with the current versions of the services and find out if they can help them address some of the issues described in section 3. This paper focuses on how they experimented with the CKP service. The working context was related to the demographic phenomenon of population ageing (see Table 1).

The issue of population ageing

Population ageing is the increase in the number and proportion of older people in society [2]. It has three possible causes: migration, longer life expectancy (decreased death rate), and decreased birth rate. Being a global phenomenon, population ageing has a significant impact on society.

Data on elderly population of interest to demographers are only partially available straightforwardly from census sources. In many countries, such data are not even tracked systematically (e.g., what are their health conditions, their typical diseases, who helps them, how they spend their time, what are their incomes, and the like). Some institutions may even keep track on some of these data (e.g., healthcare institutions and NGOs), but when it comes to using the data in demographic research it takes considerable time and effort to get the right information and to get through various administrative and data access procedures. Worse still, when professionals from national and local bureaus of statistics, public health, and other institutions call for meetings with demographers in order to get suggestions and advice on how to extend and modify relevant forms for the next census, it usually turns out to be too costly to do it or that the time remaining is too short.

The CKP service

This IntelLEO service provides context-dependent and proactive discovery/delivery of LKB resources within the organizations involved, including discovery/delivery of information and knowledge on individuals and working groups.

When working with digital resources, CKP enables bookmarking/uploading them to a shared repository. The resources uploaded to a repository using CKP can be appropriately annotated to facilitate subsequent search and use. Part of the annotation happens automatically and the end users do not have to take care about it; it is based on semantic markup of resources by terms from domain ontologies (that have to be developed and made available to CKP prior to using it, for optimal performance). The other part is done by end users in the form of tagging. Annotations help users to get to the relevant material easily and to recognize other users interested in the same resources and topics.

From an end-user's perspective, CKP has to be (integrated with and) accessed from another tool/environment the user is working with. For example, when integrated with a Web browser, CKP appears as a set of buttons in one of the browser's toolbars.

Some scenarios for using the CKP service

As scenario 1, assume that Joan, a professional from the National Bureau of Statistics (NBS), is working on a publication that would cross-reference selected data from the latest census to focus on (and cover in more detail) elderly population only. She is interested to learn what specific data should be cross-referenced, what composite indicators should be calculated, and how to present them in the publication to be of most use to the readers. Using IntelLEO services and especially CKP, Joan can be in a regular (online) touch with demographers from ID and have access (through CKP) to the repository of relevant resources exemplifying the issues of interest to population ageing studies. Moreover, she can upload (to the repository) resources available at NBS, at another institution, at an NGO, or elsewhere, and ask researchers

to check them out and comment them in order to help the new publication include more relevant data and exclude irrelevant ones.

Scenario 2 is another hypothetical scenario that ID has come up with. It might involve Helen, a young PhD student and researcher from ID who currently works on her thesis related to population ageing in a selected region of the country. She collaborates with the regional government institutions and NBS alike, and has already contributed a number of useful documents to the common repository. She is always eager to learn what data relevant for her research can be obtained from these institutions, and at what cost. She is also interested in finding out how easy it is for these institutions to start tracking specific data they did not track in the past, and is ready to illustrate how it is done in other regions, or in other countries. She can do it by using CKP to upload specific resources to the repository and by asking people from the other institutions to use CKP to take a look at them.

Remember that all IntelLEO services, including CKP, facilitate online *collaboration* between different individuals, groups, and organizations. As the next subsection illustrates, it is likely that in the above two scenarios Joan and Helen will "run onto each other" through the repository resources and CKP. Joan can always see in CKP that a document in the repository relevant for her publication is annotated by Helen (and possibly some other users interested in the same document and/or topics). The opposite is also true. Thus Joan may want to use other IntelLEO services to initiate more intensive collaboration with Helen.

Working with the CKP service

Together with researchers involved in both IntelLEO and the other research project mentioned above, ID has set up a repository and a testbed for working with CKP.

Now assume that Joan (or Helen) from the scenario(s) described above wants to bookmark a resource in (and possibly upload it physically to) the common repository. The resource can be an online one (a Web site, a Web tool, an online document, and the like), or it can be a local document stored on her computer. She opens/accesses the resource in her browser and clicks the appropriate CKP button in her browser. A popup window like the one shown in Figure 1 opens.

In the upper part of the popup window, a few standard terms from Dublin Core Terms vocabulary (<http://dublincore.org/documents/dcmi-terms/>) instantiate the usual metadata for the resource. If any of them is not retrieved automatically from the resource, it can be filled manually if the user wants to do it. The *Tags* field is not mandatory, but it is highly recommended that the user tags each resource appropriately, for it may benefit all other users of the repository. *Visibility* is related to the access restrictions that can be set for the resource being bookmarked in the repository. The possible values that can be set include *public*, *organization*, *group*, and *private*. *Also tagged by* indicates who else has tagged (and

hence presumably is interested in) the same resource. This is important, since in collaborative work users share common resources.



Figure 1: CKP service

When the user clicks the *Semantic Annotation* button, related domain concepts are inserted automatically by CKP in the *Annotations* panel (hidden in Figure 1), provided that CKP is pre-fed by an appropriate domain ontology. Domain ontology contains the domain vocabulary and describes domain concepts and their relationships. Experts from ID and from the IntelLEO project have developed the ontology of population ageing. It is used by CKP under the surface and enable the service to automatically recognize what the resource is about. This can be a useful addition to the end-user's tags, because it allows for an automatic resource annotation with domain concepts.

The *Related Goals* tab of the CKP service, Figure 1, allows the user to interact with the IntelLEO LKB planning and, indirectly, with other IntelLEO services as well. Users of the IntelLEO LKB planning service can specify what they use a shared resource for. In the IntelLEO terminology, it is called a *learning goal*. For example, Helen (or Joan) may have used the resource described in Figure 3 to find out more (i.e., "learn about") *mortality transition* as an important issue in population ageing. Alternatively, she may have just thought that the resource is good for people from ID to be aware of it. In either case, she may have also indicated this intended use of the resource through the IntelLEO LKB planning service. In such a case, the *IntelLEO* tab will show it in the *Learning Goals* column.

Relevance indicates on the 0-1 scale how relevant the resource is for that purpose (i.e. for that learning goal). Clicking *Details* takes the user to the IntelLEO LKB planning service and a more in-depth description of the corresponding learning goal; however, describing all the

idiosyncrasies of the IntelLEO LKB planning service is beyond the scope of this paper. Clicking *Add* is another useful CKP feature – it automatically adds the corresponding learning goal to the *Tags* field.

Clicking *Save* saves the bookmark related to the resource in the shared repository. It means that a description of the resource (essentially, most of the things shown in Figure 1) will be uploaded to the repository, and the resource itself will be physically kept elsewhere on the Web. Invoking CKP by clicking another appropriate button in the browser would bring up a dialog similar to the one shown in Figure 1, but then clicking *Save* would physically upload to the repository both the resource description and the resource itself. This is useful in cases when the user wants to store a copy of an original resource in the shared repository, or when resources originally stored on the user's local computer should be uploaded to the repository physically.

Other CKP functionalities, also available from the browser by clicking specific buttons, include browsing the repository (in order to examine other resources in it), updating details (e.g., tags) about a resource in the repository, deleting resources, and querying the repository for specific resources. CKP can be instructed to query the repository looking for the resources that have the same annotations like, e.g., Joan's or Helen's tags and learning goals. The process of ranking the search results is based on calculating semantic similarity between the resources and Joan's/Helen's tags and learning goals (as well as her competences, activities, and other details coming from her user profile and from the IntelLEO LKB planning service), depending on the search filtering selected.

6. EVALUATION AND DISCUSSION

In order to get a feeling of how demography researchers and professionals perceive CKP and other IntelLEO services, a formative evaluation has been conducted with 22 people (4 teachers and 10 PhD and MSc candidates associated with ID, and 8 professionals from NBS and partner institutions). The objective was to find how relevant, how useful, and how interesting would it be for such users to make CKP and other IntelLEO services part of their regular working environment. This section focuses on the evaluation of CKP only.

The participants were explained the functionality of CKP. The moderators have then demonstrated the use of CKP to the participants and asked them to reflect briefly on how (if) they would use it in their work. After they did, the moderators asked them to run CKP themselves, completing tasks that roughly corresponded to the scenarios described in section 5. In the end, the participants were asked to fill in specifically designed questionnaires.

In designing the questionnaires, three important sets of guidelines have been used. The first one was borrowed from evaluations of IntelLEO services conducted as part of the IntelLEO project, where one of the objectives has been to collect information about motivational issues related to learning in the workplace [3]. The second one is published at the *Usability and user experience surveys* Web site (http://edutechwiki.unige.ch/en/Usability_and_user_experience_surveys) and covers a number of guidelines and practical examples of organizing evaluations related to perceived usefulness and perceived ease of use of software systems and applications and their user interfaces. The third one was published in [4].

The questionnaires and the questions were related to the following criteria:

- relevance (5 questions) – issues like benefits for individuals and teams/organizations, support when looking for potential resources and partners, support for collaborative work/research, and organizational support
- organization of information (4 questions) – issues like simple and natural dialogue, sequence of screens (interactions), and logic and terminology related to task
- perceived usefulness (6 questions) – issues like accomplishing tasks more efficiently, improve job performance, increasing productivity, increasing inter-organizational collaboration, enhancing effectiveness on the job
- perceived ease of use (6 questions) – issues like learning how to use the service, straightforwardness, using it without written instructions, clear and understandable interaction with the service

The questions were designed as 5-point Likert scale ones (the possible answers being from 1 to 5, corresponding to highly unlikely to highly likely, or strongly disagree to strongly agree, or the like), but free-form qualitative judgments and comments were also encouraged.

Table 2 summarizes the evaluation results. Due to space limitations, the figures shown are rounded averages of the ones obtained from the figures obtained for specific questions related to the same criterion.

Table 2: Results of formative evaluation of CKP by a group of demographers

Criterion	Percent of Likert-scale answers (1 – lowest, 5 – highest)					Notes
	1	2	3	4	5	
Relevance	7	8	24	34	17	See discussion on free-form comments
Organization of information	11	11	28	17	3	Indicates possible need for changes in the user interface
Perceived usefulness	11	8	11	40	17	
Perceived ease of use	6	8	11	31	18	

Two observations follow from Table 2 immediately. First, most of the participants thought that CKP offers functionalities relevant for their work (the Relevance criterion), that it would be useful in their everyday work (Perceived usefulness), and that it is easy to use (Perceived ease of use) – over 50% of all participants answered the corresponding questions with '4' or '5' on the Likert scale. Second, a lot of reluctance is observed in answers to questions related to Organization of information. Many participants did not like some of the labels in the user interface (e.g., *Related Goals* in Figure 1), and some thought that certain labels were even redundant (the *Annotations* section in Figure 1). This may indicate a need for possible changes in the user interface of CKP.

In addition, the analysis of free-form comments and suggestions revealed that a considerable number of participants thought that organizational support (or restrictions) can be of high importance for adoption of Web services such as CKP. Free distribution and share of certain resources may be difficult to achieve in practice, which may hamper a wider adoption of CKP among professionals.

Some participants also did not seem to understand the use of the term 'learning' in the CKP screens. While the IntelLEO services are originally developed to support learning activities at workplaces, many participants thought that it sounded more like 'studying at school' and that using some other term(s) would make the user interface clearer. In fact, they agreed that the CKP functionality is actually more related to knowledge and resource management, although it can be understood as learning as well. Others commented that it was difficult to grasp immediately (i.e., after initial explanations and use of CKP) the actual difference between CKP and widely used social bookmarking services like Delicious (<http://www.delicious.com/>).

Still, the overall impression from the participants' free-form comments was that their perception of the IntelLEO services, especially CKP, was very positive. Some of them even put in their comments that they would like to be advised on other similar Web services. Over 80% of their comments indicated that using CKP regularly would

help them, in their view, do their job more efficiently and more effectively, and would also help their institutions a better insight into the needs of their collaborating organizations. An important suggestion emerging from their comments was that promoting the use of Web services in their institutions would be very beneficial.

7. RELATED AND FUTURE WORK

A recent study has indicated that researchers in the field of demography are not completely aware of the benefits they can have from using Web services and other new Web technologies and tools [5]. Moreover, creating online communities of demographers is not that widespread yet, compared to the communities in other disciplines. More effort is needed in order to raise the awareness of demographers for new Web technologies and online communities, and especially for using them in everyday work in their organizations.

A possible path to follow in this direction is to learn how professionals from industry and business areas have started to use Web services and Web 2.0 technologies at workplaces, a movement known as Enterprise 2.0. Likewise, getting familiar with some of the existing Web services for demographers may be helpful. For example, DOTS Demographics (<http://www.serviceobjects.com/products/address/demographics>) provides ZIP code-level, small-segment demographics for in-depth local-area profiles for USA. It's built with sources such as U.S. Census data, housing and urban development (HUD) data, current-year demographics and data culled from millions of consumer purchase records.

Of course, as in many other situations, motivational aspects are the key to starting and maintaining successful and collaboration and resource sharing. To this end, Holocher et al. argue that a continuous dialogue between interested parties at workplaces and organizations may contribute to creating a sense of shared ownership over resources and tools, and become a motivational driver for use of related knowledge sharing technologies [3].

As IntelLEO includes several other services in addition to CKP, experience is growing in terms of evaluating and using them. In a recent survey, Siadaty et al. (2011) have found users to be willing to contribute to organizational learning and resource sharing provided that they receive some recognition of and feedback about their contribution. The recognition should come from their peers and organizations, and should state organizational expectations explicitly.

Further work is also needed to enrich CKP with more demography-related ontologies/vocabularies (or, again, to make it easily configurable for using other ontologies). As discussed in [5], good-quality domain ontologies are not easy to develop. Thus reusing existing relevant ontologies (e.g., the GeoNames ontology <http://www.geonames.org/ontology/documentation.html>) with CKP can increase the service's usefulness and also save a lot of work.

8. CONCLUSION

There are many situations in everyday's work of demographers where Web services can help them learn more about issues of interest. Familiarization with such Web services and raising awareness among demographers of the benefits they can get from using the services can help make the work of demographers more efficient. The case presented in the paper illustrates how, with only minor assistance from professionals with more technical background, demographers and other social scientists can make the use of Web services a part of their daily work and continuous collaborative learning practices.

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