

A Knowledge Base supporting the Technological Research Project TR36035 on Climate Changes and Urban Development

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Abstract

The paper presents experiences and outcomes of the two years of development of the Knowledge Base supporting the ongoing Technological research project titled: SPATIAL, ENVIRONMENTAL, ENERGY AND SOCIAL ASPECTS OF DEVELOPING SETTLEMENTS AND CLIMATE CHANGE – MUTUAL IMPACTS, involving 50 researchers from several Serbian research institutions. Combining the knowledge from two different fields, the one of climate changes that is rapidly growing and enlarging in recent decades, and the one of urban development affected by a range of factors, the Knowledge Base is shaping a very specific knowledge domain, requiring a complex, iterative ontological engineering. After explaining the main technology behind the system and basic functionalities, the structure of contents is presented, as well as the system of further contents (re)structuring. In the final part of the paper, some of the issues and challenges are discussed, related to development and maintaining the knowledge resources supporting research in Serbia.

Keywords: knowledge, management, climate, urban development, research, architecture, design

1 Introduction

The notion of knowledge bases has been applied quite widely, covering predominantly Web based resources, ranging from simple repositories of referent files, to sophisticated systems¹ allowing users to browse complex, geographically spread knowledge [1], [2].

¹ An example of such sophisticated Knowledge Base related to Climate Changes, please find at: <http://www.ecoresearch.net/climate/#1>, **Climate Change Media Watch**, Climate Change Collaboratory funded by the Austrian Climate and Energy Fund within the ACRP program line [1]

Another example worth checking is the **Climate Change Knowledge Portal**, at: <http://sdwebx.worldbank.org/climateportal/index.cfm> [2]

The Knowledge Base presented in this paper has been established with an aim to support the Technological Project TR 36035 titled: **SPATIAL, ENVIRONMENTAL, ENERGY AND SOCIAL ASPECTS OF DEVELOPING SETTLEMENTS AND CLIMATE CHANGE – MUTUAL IMPACTS**, funded by the Ministry of Education and Research of the Republic of Serbia. The institution responsible for the Project is the Institute of Architecture and Urbanism of Serbia (IAUS)², and the main participating institutions are Faculties of Architecture, Civil Engineering and Electronics of the University of Belgrade, with participation of researchers from the Faculty of Mathematics, University of Niš and from the Glasgow Caledonian University. The Project, headed by Mila Pucar from IAUS, is focused on various issues of actual climate changes and their impacts on urban development, combining a multidisciplinary knowledge of many disciplines involved directly and indirectly.

The main idea behind the presented Knowledge Base [3] was to establish an efficient communication channel aimed at:

- Sharing knowledge between the researchers - members of the Project TR 36035
- Highlighting external knowledge relevant to the Project TR36035
- Disseminating the knowledge created within the Project
- Connecting the knowledge created within the Project TR 36035 with other relevant knowledge bases
- Being sustainable, in terms of maintaining contents during the Project and preserving it creation time after the Project conclusion.
- Being a base for continuous ontological (re)engineering³ of the observed domain [4].

² IAUS – Institute of Architecture and Urban & Spatial Planning of Serbia, <http://www.iaus.ac.rs>, one of the leading research institutions in the field of architecture and urban planning in Serbia

³ “Ontologies are specific, high-level models of knowledge underlying all things, concepts, and phenomena. As with

Creating the proposed Knowledge Base, particular consideration included the following:

- Knowledge is information in action [5], so dealing with knowledge does not mean just systematizing information, but considering various sorts of related actions.
- Knowledge is dynamic, so it cannot be captured in a certain moment as absolute.
- Knowledge is social and in any kind of organization it goes through four characteristic states identified by Nonaka and Takeuchi [6] as: socialization, externalization, combination and internalization.

Finally, deciding to capture the observed knowledge it was our aim to increase the body of explicit knowledge [7] on urban development.

2 Technology behind

The Knowledge Base is technically supported and hosted by University of Belgrade Computer Centre - RCUB, initiated and created by Mirjana Devetaković, supervised by Mila Pucar, head of the Project and Slavko Gajin, responsible for allocated computing resources within the RCUB, and maintained by programmer Bojan Mitrovic, responsible also for the RCUB/AMRES⁴ e-Learning platform⁵. For the purpose of creation of this particular resource, a new Web domain <http://e-science.amres.ac.rs> has been established, presuming that in the near future there might be more requirements for Web hosting by other research projects. Similarly with establishment of the

other models, ontologies do not represent the entire world of interest. Rather, ontology designers select aspects of reality relevant to their task. In the domain of books, for example, the ontology designer selects one set of book attributes when developing the ontology of a library, and quite a different set when developing the ontology of bookbinding. All models follow principles and constraints, which are called concept relations and axioms.” Devedžić, V.: **Understanding Ontological Engineering**, Communications of the ACM, Vol. 45, 2002, pp.136-144, <http://fon.fon.bg.ac.rs/~devedzic/CACM2002.pdf> (accessed January 2012.)

⁴ AMRES – Academic Network of Serbia, <http://www.amres.ac.rs/> (accessed January 2013)

⁵ AMRES e-Learning Platform, <http://elearning.amres.ac.rs/moodle/> (accessed January 2013)

AMRES e-Learning platform, this is regarded as a seed for a possible AMRES e-Science platform⁶.

Having in mind the required functionalities of the future Knowledge Base and limited funds allocated for purely technical and programming support, the initial examination included several content management systems (CMSs) against their capabilities to support the creation of the Knowledge Base. This examination included the MOODLE⁷ platform, already in use for the AMRES e-Learning Platform, and various CMSs available as open source or freeware solutions, including the Blogspot⁸ and WordPress⁹.

Finally the WordPress has been chosen as a solution that could respond to the needs of this particular project. Main feature of the system that helped to make this decision was a double system of structuring the contents, by categories predefined by editors and by tags set by content contributors.

3 Appearance of the Knowledge Base and main functionalities

The presented Knowledge Base is available from the spring 2011 at the following web address: <http://e-science.amres.ac.rs/tp36035>. During the year 2011 it was an experimental resource used by few people directly involved in creation and beta testing.

⁶ In accordance with the Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015, where the development of powerful IT infrastructure has been listed as one of the few main priorities for success of Serbian science, with particular focus on making widely accessible the research results, pp.48

⁷ MOODLE – Modular Object Oriented Dynamic Learning Environment, <https://moodle.org> (accessed January 2013)

⁸ Now <http://www.blogger.com/> (accessed January 2013)

⁹ “WordPress is a free and open source blogging tool and a content management system (CMS) based on PHP and MySQL. It has many features including a plug-in architecture and a template system. WordPress is used by over 16.7% of Alexa Internet's "top 1 million" websites and as of August 2011 manages 22% of all new websites. WordPress is currently the most popular blogging system in use on the Web.” WordPress, <http://wordpress.org/> (accessed January 2013)

3.1 Appearance

Created using the WordPress content management system, the Knowledge base inherits its chronologic, blog-like appearance (Figure 1). The main knowledge representing unit is a single post, created by unique author, described with a title, date and time of posting, as well as with particular categories to which the content belongs and a set of tags - the content related keywords.

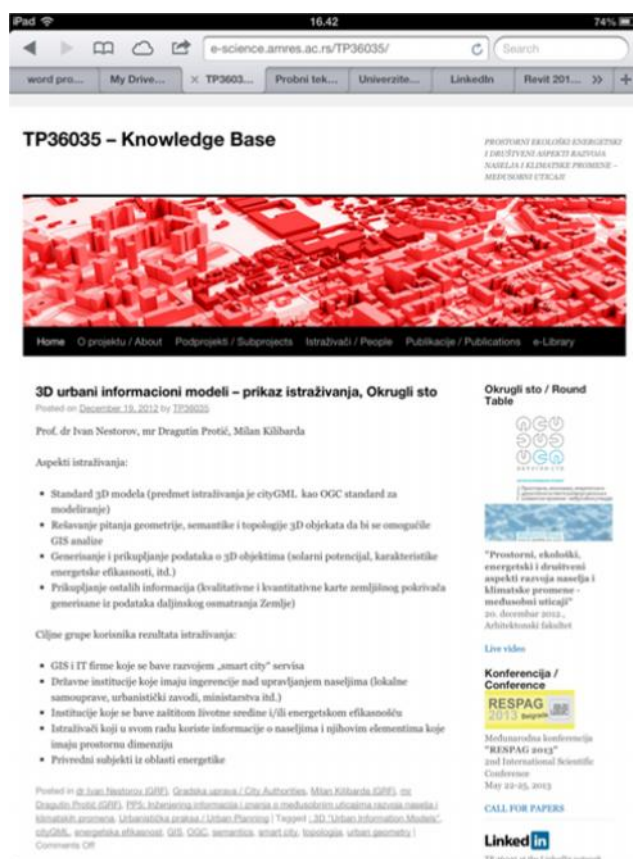


Figure 1 The entry page of the Knowledge Base

3.2 Main functionalities

The main idea behind the presented Knowledge Base is to establish a socio-constructivist electronic context, friendly to both users and contributors.

Posts – A typical post contains a title, basic data on the author and date/time of posting, the post content, and finally categories and tags. The post content could be a simple text, a hypertext containing links, an image, and recently an embedded functionality like the Scribd publication view, etc.

Basic and specific content browsing – The basic browsing could be performed by authors name and by date. The name of an author that contributed the post, however, does not necessarily indicate the authorship of contributed knowledge. For example, during the first year

of use, the majority of posts were contributed by the KB editor, including a range of documents created by other participants. For the purpose of browsing the Knowledge Base by an author, the category Researchers has been added, including all people directly involved in the Project.

Search engine – The standard WordPress search engine has been replaced with the Relevanssi¹⁰ Version 2.9.14, by Mikko Saari. The Relevanssi comes as a free plug-in, available from the WordPress Plugin Repository. It is the search engine that searches the contents by its relevance, highlighting the exact searched phrases within the content.

Content publishing – For the content publishing, one needs to be logged-in, i.e. identified as a Knowledge Base contributor. The publishing is supported by the Dashboard, with an interface slightly different from the standard Base appearance.

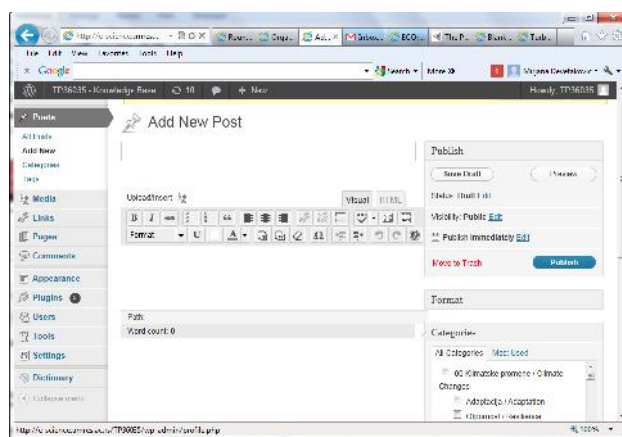


Figure 2 Adding a new post, the Dashboard

Linking with the AMRES Media Portal – The memory consuming documents, like video recordings of related events are kept on external servers and linked in the Knowledge Base. The example of such linking is the series of lectures by Branka Dimitrijevic, from the Glasgow Caledonian University [8], that has been recorded and published within the Media Portal of the Academic Network of Serbia (Figure 3).

Linking with social networks – The Knowledge Base has recently been interlinked with the LinkedIn social network. There are two reasons for such interlinking. Firstly, there's a fact that more than 50% of the researchers in this Project, actively use LinkedIn, maintaining regularly their profiles. So the profiles of researchers have been linked in the Knowledge Base. This way, the Administrator/Editor has been released of the duty to keep the profiles updated. The

¹⁰ <http://www.relevanssi.com/> (accessed January 2013)

second reason is a possibility for researchers to publish less formal posts within the LinkedIn group that has been also created.

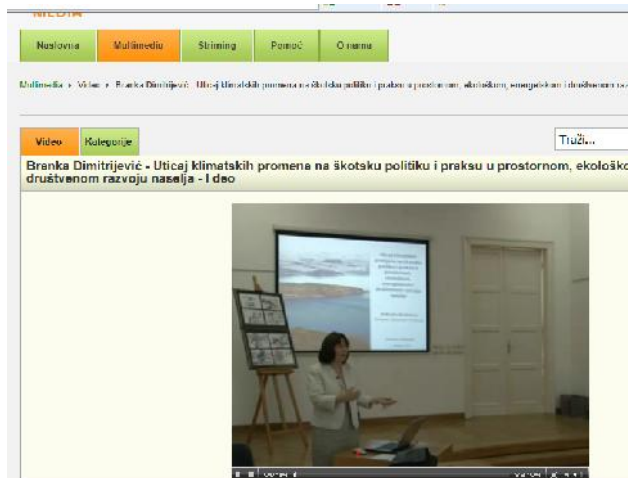


Figure 3 Recorded series of lectures by Branka Dimitrijević, Project participant from the Glasgow Caledonian University

Glossary - The latest functionality added is the glossary of characteristic terms that has also been added as a plug-in to the main WordPress system. It supports defining a set of selected terms. These definitions appear when cursor rolls over the defined term that appears underlined in the text.

Availability on mobile devices - In the recent months the presented KB has been used on mobile devices as well as on tablets based on iOS (mobile operating system developed and distributed by Apple), and its functionality is very satisfying, which means that the resource can be used and updated out of the standard workplace.

4 The structure of presented Knowledge Base

An advantage of the WordPress platform is that the contents could be structured and restructured, on many different ways, allowing users numerous browse scenarios.

4.1 Chronology

The main structural characteristic of presented system is chronological structuring, coming from the blog-like platform lying behind it. This structural organization seems to be quite convenient for many reasons. First of all it captures the time of entering particular contents into the Base, allowing all interested parts to follow the newest posts. It also allows placing the contents in the past, so that it appears in the Base exactly when it has been published or presented. This way, the relevant knowledge, for example the Kyoto Protocol document, has been dated the year 1992, the exact year when it has been launched, but

long time before the presented Technological project started. The chronological structure of the content permits following dynamics of the Project, i.e. checking the contents submitted in particular year, or month.

4.2 Categories

After two years of development of the presented Knowledge Base, six main categories reflecting the contents have been differentiated (Figure 4). In the ontology engine like Protégé [9] these categories would be named classes, and in OWL they would be concepts [10].

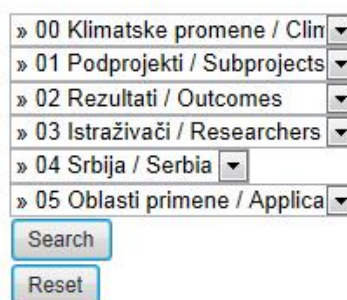


Figure 4 The Categories of the presented Knowledge Base

The category marked as 00 is the one related to main body of knowledge on climate changes, that includes four principal phenomena (instances of the concept): mitigation, adaptation, resilience and vulnerability. By these instances it is possible to differentiate majority pieces of knowledge related to climate changes and urban development. The main relation between the category (concept, class) would be defined as “affect” (alternatively “consider”, “influence”, “provoke”, etc.).

Next category is related to main structure of the Technological Research Project TR36035, and its subcategories include the main topics of the five sub-projects proposed by the researchers in the conceptual stage of the Project. This category reflects the main structure of the Project.

The category that follows is titled Researchers and contains names of all researchers participating in the project. Searching the contents by this category allows users to find the research results and all of contents related to particular researchers, regardless if that researcher added the contents himself or someone else did it (for example KB editor, other researchers, co authors of research results, etc.).

The next category is related to the systematization of research results according to the research policies of the Ministry of education and science of the Republic of Serbia. The instances within this category are

Stimulating the researchers to contribute and enlarge the body knowledge - The research culture in our country still seems to presume a passive approach to knowledge resources. This means that our researchers are quite keen to use a wide range of knowledge resources, but are not extremely motivated to actively share neither the knowledge they produce, nor the information on the knowledge production. On the other hand, they are happy to see the range of research results created within the Project, and to be part of this knowledge creation. Since the contribution to the Knowledge Base is a time consuming activity, it is necessary to find more powerful means stimulating researchers to share the knowledge.

6 Conclusions

After two years of existence, the Knowledge Base supporting the Technological project TP36035, went through two characteristic stages, the stage of conception and the stage of initial use. While in the stage of conception its main functionality has been set, it is the stage of initial use in which it starts to get its real shape, since the knowledge started to be structured in main categories reflecting the knowledge domain of interdependencies among the climate changes and urban development.

Until now, about 20% of researchers which are involved in the Project use the Knowledge Base actively, regularly contributing various aspects of related knowledge. In the next stage it is expected to improve its socio-constructivist character and to achieve more than 50% of researchers to use it actively. Based on the knowledge captured that way, the resource will go through further fine (re)engineering.

This approach can be a positive example for other researches of how to achieve an open access to scientific results, which is one of the top priorities of European research area.

7 References

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