TeMA

Journal of
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

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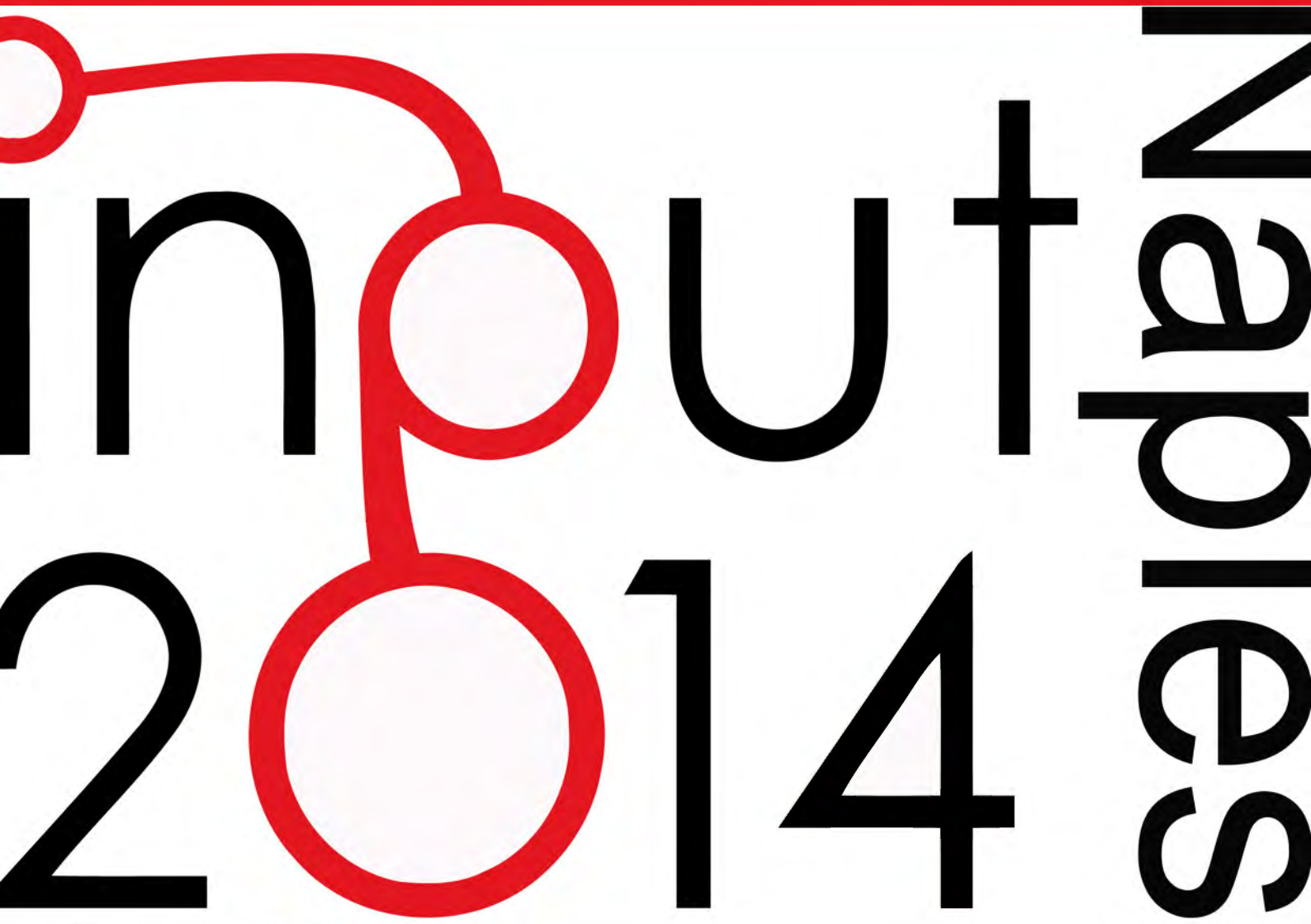

Smart City

planning for energy, transportation and sustainability of the urban system

Special issue, June 2014

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SMART CITY

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TeMA Journal of Land Use, Mobility and Environment

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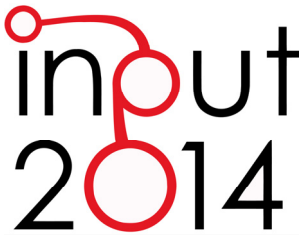
This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



TeMA Journal of Land Use, Mobility and Environment

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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

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Contents

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LEARNING AND SHARING TECHNOLOGY IN INFORMAL CONTEXTS

A MULTIAGENT-BASED ONTOLOGICAL APPROACH

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ABSTRACT

An increasing debate is growing today, in both academic and research-in-action contexts, about the roles of new and traditional technologies in raising knowledge of agents involved, as well as in boosting an effective development of communities.

The last century has been largely dominated by capital-intensive technologies, impacting large and populated areas. From the late 1990s up to the present days, due to social, financial, environmental concerns, new low-impact, local-born, little to medium-scale experiences have been challenging large technologies, with interesting results.

The importance of such experiences seems to lay on the abilities and knowledge of local populations, which are quite difficult to emerge as formal methodologies and attain recognizable levels of generalization and sharing. Yet the effectiveness of local-based technologies is being increasingly documented, often succeeding in cases where more formal technologies had previously failed.

The EU-funded ANTINOMOS project has largely dealt with local-community knowledge enhancing and managing in the water sector management, aiming at creating a real learning environment for the sharing and the active generation of knowledge through mutual synergies.

In this paper, the above subject is discussed and carried out with a cross-disciplinary, cross-scale, multi-agent approach, considering the different forms of local knowledge and language involved.

KEYWORDS

Water resource, Technological memory, Learning architecture, Semantic navigation, Ontological indexing

1 INTRODUCTION

Nowadays the self-reinforcing circular relationship among engineering technologies, education, and engineering educational technologies is gaining considerable momentum both in production and research environments. In particular, debate is growing, in both academic and research-in-action contexts, about the roles of new and traditional technologies in raising knowledge of the agents involved, as well as in boosting an effective development of neighbourhoods and communities.

In the second half of the past century, structures and infrastructures – particularly the publicly managed ones - have been largely dominated by capital-intensive technologies, impacting large and populated areas. From the late 1990s up to the present days, due to social and financial difficulties, as well as environmental concerns, new low-impact, local-born, little to medium-scale experiences have been challenging large technologies, with interesting results worldwide.

Far from being connected with technological innovation per se, the importance of such experiences seems to lay on the abilities and knowledge of local populations, which are quite difficult to emerge as formal methodologies and attain recognizable levels of generalization and sharing. Yet the effectiveness of local-based technologies is being increasingly documented, often succeeding in cases where more formal technologies had previously failed.

Given this situation, governments have approached the emergence of such informal experiences with mixed attitudes, ranging from reluctant or even contrasting actions, to more proactive and encouraging support. European Union acts with a proactive and financial support achieving interesting results, and the Technical university of Bari has been deeply involved in the ANTINOMOS project.

This project was funded by FP6 for Research and Technological Development set up by the European Union under the “Sustainable Development, Global Change and Ecosystems" thematic priority. It was a prototypical example of a process stemming from diverse loops that show a certain degree of “reflexivity” among the project components, being: a) managed by a consortium of partners from different countries; b) interdisciplinary; c) aimed at contributing to global and local knowledge networks for the solution of real life problems in water supply and sanitation in developing countries; d) meant to bridge conflicting views (of conceptual approaches or perceptions of global and local knowledge networks) and knowledge gaps (among the knowledge areas which have only recently been recognized by decision makers as being key issues in achieving the Millennium Development Goals).

In particular, a large part of the ANTINOMOS project has dealt with knowledge management, with the threefold aim of providing stakeholders with (i) access to relevant, timely and easy-to-understand information, (ii) the ability to use such information to take decisions leading to an efficient and effective project implementation, and (iii) a real learning environment, able to allow not only the passive sharing of established knowledge, but also the active generation of novel knowledge through synergies.

Within this project, the role carried out by the Technical university of Bari is interestingly consistent with the management, exchange and increase of knowledge among partners and beyond. According to the project mission, the building up of multiple-agent system architectures is a primary objective, aiming at eliciting, collecting, sharing and promoting local-based technologies among multiple users worldwide.

However, the collection of relevant knowledge from global and local technologies and practices entails a complex cross-disciplinary, cross-scale, multi-user learning environment, able to facilitate the generation of knowledge and to process multiple-source information into significant knowledge for the agents involved. This means that different forms of local knowledge and languages, coming from expert and commonsense domains, need to be decrypted and then rearranged and tailored to the different needs of distributed

agents. Research experiences in this context are scanty, because of the inherent complexity of large knowledge management with different formal and informal languages – hard to be dealt with in system architectures. The approach of the Technical university of Bari research is rooted in computer-science reflections on agent and multi-agent cognition, as well as the identification, discussion and setting up of platforms to support learning exchanges.

The paper is structured as follows. After the present introduction, chapter 2 carries out a brief account on the knowledge aspects of water technologies, with particular reference to the ANTINOMOS project. Therefore, some notes on multi-agent cognition and the role of ontologies in learning system architectures are drawn out in chapter 3. In the fourth chapter a framework discussion on the concept of technological memory and its formal aspects for efficient indexing search is carried out. Finally, chapter 5 deals with the current aspects, potentials and follow-ups of the learning system architecture, followed by final remarks in chapter 6.

2 LOCAL AND GLOBAL WATER TECHNOLOGIES AND KNOWLEDGE

The system architecture described in this paper has been set up within the framework of the EU funded project ANTINOMOS, "A knowledge network for solving real life water problems in developing countries". The overall project strategy starts from the conviction that inadequate knowledge management is at the roots of the present obstacles to solve real life water problems in most developing countries. Although the intrinsic complexity of socio-technical relationships in water field started to be recognised only very recently, current practices in the field still suffer from enduring divisions and sectoral thinking (Latour 1987; Bijker 1997). In this situation, boundaries across different forms of knowledge and disciplinary approaches hamper more holistic understanding of water problems and the capacity to link knowledge to action in most real life contexts.

This is very clear in the conflict between modern technologies and traditional ones, which is part of a larger opposition between the knowledge systems in which those technologies are embedded. While mainstream international interventions are still mainly devoted to transfer modern western technologies to developing countries, local contexts are mainly seen as limiting factors for an easy transfer of external solution instead than a source of useful knowledge for water problems. In this vein, traditional technologies and practices are still often perceived in the mainstream water science as based on irrational belief and myths, thus being subjective, context-specific, and lacking a sound cause-effect basis (Millar and Curtis 1999). They are considered to be the product of a non scientific system of thought, which should be "modernized" through the transfer of other systems of thought. Kloppenburg, for instance, used paired concepts to distinguish the so called Western from non-Western ways of knowing like scientific versus practical, explicit versus tacit, abstract versus concrete, rational versus intuitive, masculine versus feminine, science versus craft, absolute versus relative, scientific versus indigenous (Kloppenburg 1991).

In reaction to this critique, several researches started from the Seventies and then mushroomed in the Nineties, which assert the importance of indigenous knowledge as a system of thought embedded in traditional technologies and practices and their scientific basis. At the same time, several attempts were made by activists and researchers for the rehabilitation of traditional water technologies and practices as a viable alternative to modern technologies, whose ecological and social costs started being increasingly recognized (Escobar 1995; McCully 1996; Postel 1998; Guha 2000). This had important theoretical and practical implications. Theoretically, it helped to relativize moderninst rationality by suggesting that there were equally valid 'native' points of view. On the political side, it contributed to challenge the assumption

that rural poor were somebody else's development strategy, and the subjects instead of the active originators of their own patterns of development, so giving strong emphasis to a large literature on political ecology (Escobar 1996; Peet and Watts 1996; Braun and Castree 1998). Nevertheless, these experiments also led to the construction of an alternative orthodoxy based on an idealistic picture of indigenous people (Baviskar 1997) and to an exaggerated critique of technological modernization. This reinforces instead of reducing the paradigmatic conflict between modern and traditional approaches to water technologies.

Starting from this situation, our project tries to see if the possibility exists to bridge these antinomies and to define a learning space among them. In this way it tries to see if a reframing of water problems is possible in such a way that new knowledge can be generated and new solution spaces opened. In so doing, knowledge would not be simply summed-up across disciplines and boundaries, but it will become input of a much larger process of knowledge development. Knowledge itself would be created as a result of synergies among different "knowledge workers" interacting through new learning spaces (Drucker 1999). This is line with results from the application of open source philosophy, which successfully managed to share knowledge and partial solutions as a starting point for the generation and enrichment of knowledge itself through the interaction of individual actors.

The possibility to create these synergies indeed depends on the capacity to structure appropriate learning spaces where multiple actors can interact in a meaningful way. This is not easy to do, as their knowledge may be embedded in very different knowledge systems, depending of their disciplinary backgrounds – which entails the use of different taxonomies and knowledge frames – the geographical belongings – which entails different knowledge labels and different languages – and different scales – which also means different levels of generalization of concepts. Different actors may indeed belong to different "knowledge communities" (Nonaka 1999), all defining shared codes and jargon for internal communication and rules for sharing information and knowledge. The definition of real learning spaces thus requires strong attention for the development of appropriate cognitive architectures which are able to bridge the gaps between formal and informal knowledge and between global and local contexts, which are still often separate in practice. This necessarily means to single out appropriate knowledge workers and knowledge areas to involve, to create an appropriate structure for learning bridging structural divides between knowledge areas, to link knowledge to action in an action-research perspective. This is what we tried to do with the system architecture described below.

In this system, knowledge about different types of modern and traditional technologies for water supply and sanitation has been structured based on the analysis of their overall performance and on in-depth investigations aimed to assess critical factors for their success or possible reasons for their malfunctioning or bad use, including institutional and organizational issues, socio-economic and socio-cultural issues, hygienic/health risks and environmental consequences. Technologies analysed are from three countries, namely India, Mexico and South Africa.

3 ONTOLOGICAL APPROACHES FOR KNOWLEDGE INDEXING IN MULTI-AGENT ENVIRONMENTS

The setting up and management of social facilities for the development of local communities is increasingly relying on a multiple-scale level of infrastructuring technologies. From large-scale projects serving large parts of anthropic environments to small plants for villages or even households, infrastructure provision appears to be increasingly tailored to different and often non-connected levels of use. However, while large projects leave enough –at least formal- knowledge repositories for technology outreach, small projects often

remain obscure, relegated to a localized and limited use, although being at times successfully implemented in everyday life. Furthermore, due to multifarious – economical, orographic, political/organizational – difficulties in providing all communities with large-scale infrastructuring, small communities remain substantially dependent on local technologies.

Yet when dealing with small and isolated and/or mutually unconnected (e.g., in information and knowledge exchanges) communities, particularly in developing Countries, technologies have difficulty in spreading in time and space, so resulting in ephemeral, discontinued, unreplicated, or inefficient, and many times unsuccessful experiences. Some case-studies literature, particularly in the fields of water provision and sanitation, seem to recognize complex technological knowledge/expertise gaps behind that situation, in building up as well as in managing and maintaining technological infrastructures (Unver 1997; Torregrosa Armentia *et al.* 2006). Acknowledging such complex problem leaves nonetheless space for specific research on narrowing gaps and bridging them by relying on knowledge enhancement and learning environment, able to allow the sharing of established knowledge, as well as the generation of novel knowledge through mutual synergies.

The potentials of IT-based knowledge sharing approaches in local development initiatives have been long debated in literature over the last few decades, focusing on an increasingly large number of positive results mixed up with some criticalities (Borri *et al.* 2005; Borri *et al.* 2010b). Particularly in Developing Countries, the use of large-scale information technologies faces political and demagogical –more than technical and literacy- constraints whose resulting informational asymmetries are beneficial to few corporative agents to the detriment of the general population (Greenwald and Stiglitz 1986, 1990). However, the large real-time, multi-agent, multisource interactive approach is able to set up capillary knowledge networks and learning environments potentially rather effective.

The experience gained in the last years has shown some critical aspects that such initiatives should take into account, when trying to set up operational environments (Khakee *et al.* 2002; Borri *et al.* 2006a). Some important aspects can be outlined in this context as well as in general terms.

(i) A first general issue faced by IT-based interaction systems is well known in organizational studies, and concerns the real possibility for end users of accessing the system, particularly in poor communities. Low possibilities mean delegating access and feedback to selected agents who represent the community, so raising problems of legitimation and representativeness with reference to the community itself. Also, representative agents may even unconsciously filter interaction outcomes, so raising problems of misunderstanding, mystifications and generally poor levels of knowledge transmission to the community (Forester 1988, 1999). Methodological and architectural approaches aimed at facilitating and expanding the access and interaction potentials of all agents could substantially lower the above problems and enhance the effectiveness of knowledge transmission efforts.

In building up our IT-based learning environment oriented to water-resource technologies and issues, an initial knowledge base coming from ad-hoc studies represents the starting point to share (and to build on) cognitive contents among participating agents. Structured as a plain hypertextual document, the initial repository is supposed to be navigated, modified, integrated and acquired cognitively by agents through a dynamic web portal, toward the definition of a complex self-evolving learning environment.

(ii) When focusing on system building up, another important issue deals with the question of idioms and access languages, particularly in knowledge indexing to perform research and navigation features throughout documents (Khaled and Mohamed 2004). In fact, some types of agents such as scholars, professional agents, experts in scientific disciplines rely on formal domain languages and vocabularies in web searching tasks. In this case, document structuring to enhance search options is a relatively easy activity

because search tags are formalized, and the whole knowledge navigation/sharing is a rather straightforward task –at least in simple queries (King and Munson 2004). Yet less expert agents need a commonsense and less formalized approach, largely based on concepts, sentences, periphrases and syntagms (e.g., searching techniques to obtain less 'stinky' water, or techniques to maintain devices 'more easily', etc.). Actually, the same concept-based approach may well be claimed by expert agents when performing more multifarious and composite research tasks. These agent categories entail easier and/or fuzzier approaches to navigation, and need consequently more complex document indexing in the system architecture, in order to allow an effective contribution to the learning environment.

(iii) A further important issue faced by the IT-based interaction system deals with agents' cognitive frames involved in the navigation task. In fact, according to consolidated branch literature, each agent involved in interactive reasoning activities shows different cognitive patterns and organization in carrying out their knowledge-based tasks (Shanahan 1997). Case studies show that the frame problem influences the cognitive agents' ability to navigate without losing themselves in huge 'problem spaces'. Framing is used for context-based and case-based pruning of dangerous and unfruitful regions of those spaces, particularly when the number of knowledge agents is large – such as in web-based multi-agent environments (Borri *et al.* 2004). Also research tasks are affected by the frame problem, inducing differentiated indexing approaches on knowledge memories and repositories for effective navigation. In this concern, allowing a more flexible, fine-tuned, semantic-oriented research indexing seems more suitable to address different agents' cognitive frames than synthetic and taxonomic tag indexing.

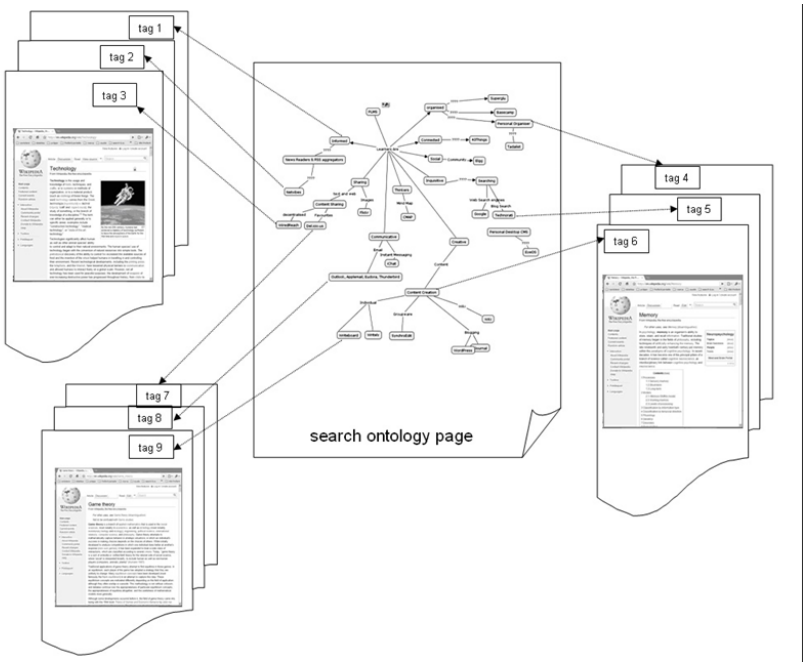


Fig. 1 An example of the ontology-based indexed search

(iv) When getting on with navigation search, agents may infer hints for new indexing criteria from the interaction with other navigating agents and from the substantial results of the ongoing navigation itself. The search activity itself may suggest new concepts that can be used for further navigation fine-tuning and for achieving access to new aspects of technology knowledge. If the finding out of new navigation criteria highlights a structure of relations among concepts, then the search task may lead to ontological structures of interconnected criteria to be used as dynamic indexing frameworks for subsequent navigations. The

ontological indexing can be defined as 'dynamic' if it evolves during the navigation/interaction activity: if the system is able to keep trace, memory and ongoing updating of the indexing modification, then a self-learning ontological indexing system results, similar to self-feeding engineering intelligent systems, with an ontological approach (Abraham and Grosan 2008).

From the above considerations, it could be concluded that ontologies are useful in setting up indexing systems to support navigation tasks in learning-oriented environments. Yet many of the features proposed require large reference to ICT-based devices and computer-science approaches that are pretty far form the scope of the present study. In the following chapters an account will be made of the activities carried out by the study group to set up a web-based interactive learning environment, with particular reference to semantic-based search indexing and their ontological perspectives.

4 THE WEB-BASED INTERACTIVE LEARNING ENVIRONMENT

In the creation of the knowledge management system (KMS), the above general issues are added with needs more directly linked to the research project itself. After a first stage of the actual project, with mainly research and academic aims, a second "distributing" and "organizing" stage has follow, aimed at using information by local communities in different developing Countries (fig. 2).

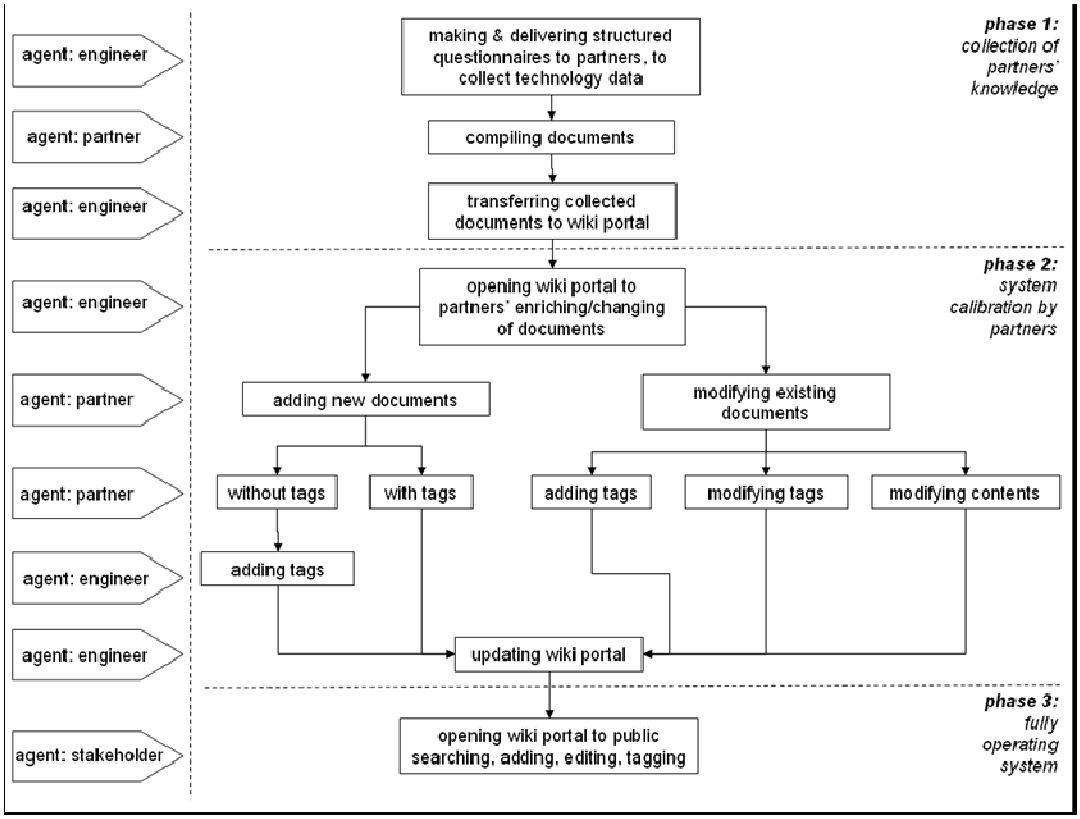


Fig. 2 Stages and agents involved in the building up of KMS

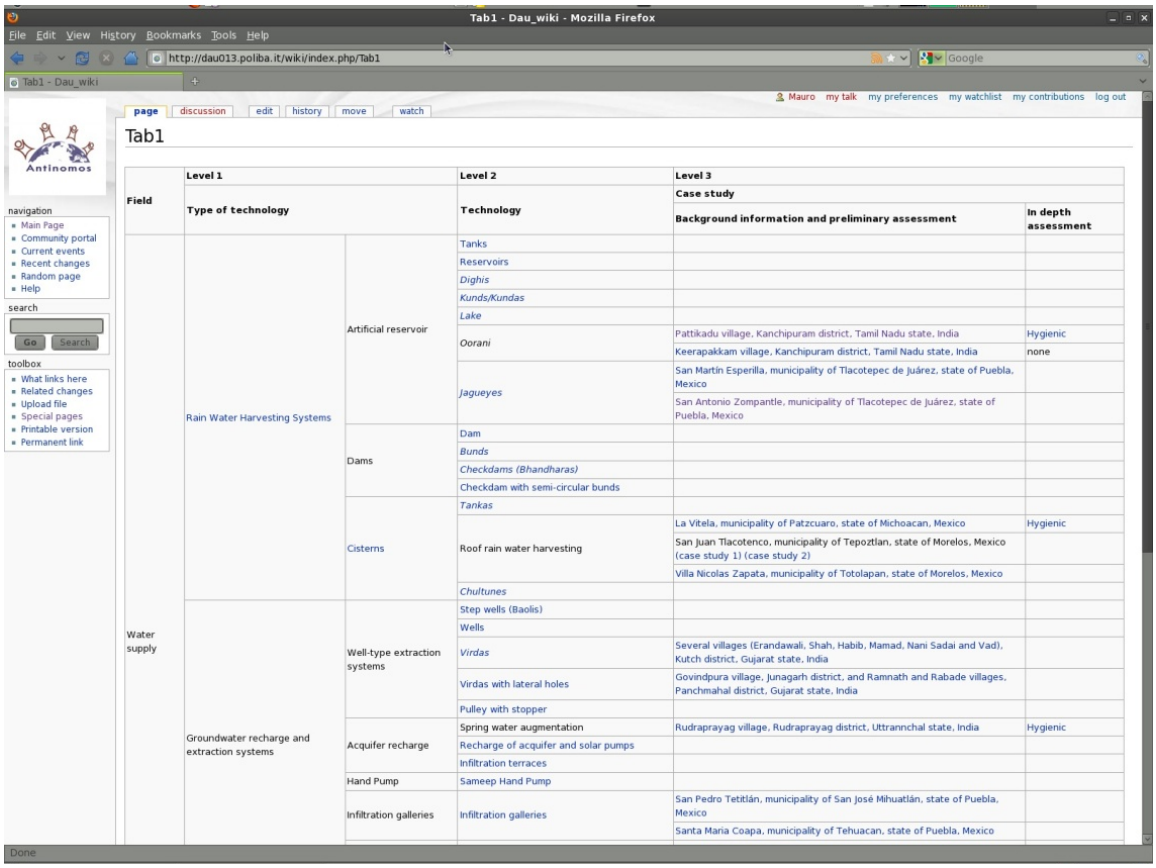
In the first stage, the group of users is mainly made up of author-type agents and is relatively not large. The needs to be satisfied by the system are especially connected with partners' belonging to different disciplines and Countries.

In the second stage, the group of users is much larger and is mainly made up of reader-type agents. The group needs to be registered and submitted to a board which controls newly published and/or modified information. The requirements to be supported by the system are especially related to the connection of global and local networks, to the possibility of filling knowledge gaps and to the ability of facilitating the solution of possible vision differences on subjects at hand.

Transversely to the first and second stage of the project, other characteristics are needed by the KMS. They are the access to remarkable, real time and easy understandable information, the possibility of using such information to take decisions, the creation of a real learning environment able to allow not only passive learning, but also new knowledge generation.

Therefore, from a basic architectural standpoint, the classic LAMP (Linux, Apache, MySQL, PHP) was the solution stack used. The selection of this environment was due to some well known advantages, such as open source code, large user-community support, easy-to-code, easy-to-deploy and develop-locally features, cheap and ubiquitous hosting (Gerner *et al.* 2006).

Also, it was decided to use a collaborative web-based knowledge-sharing software under the so-called 'wiki' category. In particular, the "MediaWiki" software was selected, added with the 'semantic MediaWiki' extension. Its selection was due to some useful characteristics, namely the easiness of creating and editing a very large number of web pages through a browser, using both very simplified markup language and WYSIWIG text editor. Most of the cost of processing (usually very low in the case of wikis) is almost entirely server-side supported: from the client side, a standard, not even last-generation web browser is required (Ebersbach *et al.* 2008).



Field	Level 1		Level 2	Level 3	
	Type of technology		Technology	Case study Background information and preliminary assessment	In depth assessment
Water supply	Rain Water Harvesting Systems	Artificial reservoir	Tanks		
			Reservoirs		
			Dighis		
			Kunds/Kundas		
			Lake		
			Oorani	Pattikadu village, Kanchipuram district, Tamil Nadu state, India	Hygienic
				Keerapakkam village, Kanchipuram district, Tamil Nadu state, India	none
			Jagueyes	San Martín Esperilla, municipality of Tlacotepec de Juárez, state of Puebla, Mexico	
				San Antonio Zompantle, municipality of Tlacotepec de Juárez, state of Puebla, Mexico	
		Dams	Dam		
			Bunds		
			Checkdams (Bhandharas)		
			Checkdam with semi-circular bunds		
		Cisterns	*Tankas*		
			Roof rain water harvesting	La Vitela, municipality of Patzcuaro, state of Michoacan, Mexico	Hygienic
				San Juan Tlacotenco, municipality of Tepoztlan, state of Morelos, Mexico (case study 1) (case study 2)	
				Villa Nicolas Zapata, municipality of Totolapan, state of Morelos, Mexico	
			Chultunes		
	Groundwater recharge and extraction systems	Well-type extraction systems	Step wells (Baolis)		
			Wells		
			Virdas	Several villages (Erandawali, Shah, Habib, Mamad, Nani Sadai and Vad), Kutch district, Gujarat state, India	
			Virdas with lateral holes	Govindpura village, Junagarh district, and Ramnath and Rabade villages, Panchmahal district, Gujarat state, India	
			Pulley with stopper		
		Acquifer recharge	Spring water augmentation	Rudraprayag village, Rudraprayag district, Uttrannchal state, India	Hygienic
			Recharge of acquifer and solar pumps		
			Infiltration terraces		
		Hand Pump	Sameep Hand Pump		
		Infiltration galleries	Infiltration galleries	San Pedro Tetitlán, municipality of San José Mihuatlán, state of Puebla, Mexico	
				Santa Maria Coapa, municipality of Tehuacan, state of Puebla, Mexico	

Fig. 3 The ANTINOMOS wiki portal

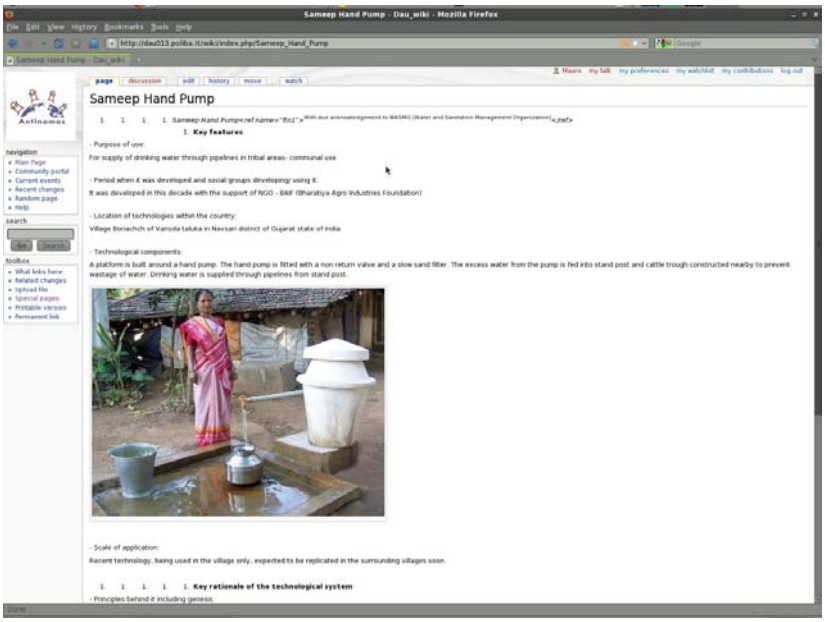


Fig. 4 An example of water supply informal technology

The main idea is to create a KMS with the possibility of being strongly collaborative and community supporting. On the other hand, having the system to deal with a particular subject, then publishing rights should be guaranteed, either to have control on any off-topics, or to safeguard the intellectual rights of different authors.

The need of organizing databases according to different meaningful topics is satisfied partly through the possibility of creating associations among different web pages via hyperlinks and partly through the markup system of the semantical extensions installed.

The fundamental idea is to set up an ongoing process of creation and collaboration, able to change the website 'cognitive landscape' from the standpoint of both the stored raw datum and the classification meaning of information in its entirety and complexity. The attempt is to create a cooperative system of information management, strongly oriented to easing creation, navigation, search and, last but not least, attribution of meaning.

Some features of the website are native characters of the non-linear navigation support of wikis. In that context, users may create links, indexes, tables reflecting any form of organization of information they prefer. However, a more structured form of content organization is being implemented in the website, framed on semantic extensions and ontologies. The completion of such structuration is a particular task of the EU-funded research project and represents an interesting research perspective in developing multi-agent technology learning environments in informal contexts.

5 BRIEF FINAL REMARKS

The present paper dealt with the importance and the perspectives of the multi-agent learning and sharing of water technologies in informal contexts, within the EU-funded ANTINOMOS project. In particular, the setting up of system architectures to support learning and knowledge interactions among diffused agent has been investigated, using web-based models and technologies. In this context, knowledge exchanges and technology learning are supposed to be highly dependent on the quality of the interaction environment. Therefore, the study has devoted a particular attention to the structuring of the searching and navigation features of the system, heavily highlighting the quest for efficient indexing approaches.

To this aim, the importance of semantic navigation has been emphasized, and the quest for searching features has been oriented to the potentials of ontological indexing, as a base to allow semantic tasks.
At present, the study work is still at an early stage of complex yet traditional web searching tasks. This paper has showed some aspects of current features, also presenting the funding rationale, some potential and criticities of the next semantic-based learning environment. The development of the system architecture of that environment represents an important legacy of research activities started off with the ANTINOMOS for the future.

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