

A CASE STUDY OF COMMUNITIES OF PRACTICE AND ICT TOOLS IN KNOWLEDGE MANAGEMENT ON INTERNATIONAL COOPERATION IN SCIENCE AND TECHNOLOGY RESEARCH

Juan Miguel González-Aranda, Rafael Rodríguez-Clemente
*Doñana Biological Station, Spanish Council for Scientific Research-CSIC
Avenida de M^a Luisa S/N Pabellón del Perú, 41013 Seville, Spain*

Sebastián Lozano
*Department of Industrial Management, University of Seville
ESI, Camino de los Descubrimientos, s/n, 41092 Seville, Spain*

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Abstract: This paper discusses how Formal Workgroups within the framework of Coordination Actions projects funded by the EU Commission within the context of the MEDA and the different Framework Programmes on Scientific and Technological Research (STR) initiatives, have assisted and nurtured the existing and emerging Communities of Practice (CoP) in International Cooperation on STR, Development and Innovation in the Euro-Mediterranean Area. It also illustrates how in some specific cases these CoP are evolving towards Formal Electronic Networks of Practice (NoP) thanks to the application of specialized thematic-oriented Knowledge Management (KM) methodologies, by means of the intensive use of new Information and Communication Technologies (ICT) instruments, mainly based on the adaptation of open source Content Management Systems (CMS) architectures. Hybrid platforms, specifically based on “mixed” schemes between LAMP (Linux+Apache+MySQL+PHP) and Plone/Zope (Python programming language scripting) architectures and technologies are proposed to achieve these ambitious objectives. A case study of the Euro-Mediterranean Integrated Water Resources Management (EU-MED-IWRM) CoP is presented as an example of an on-going development.

1 INTRODUCTION

The future creation of the Euro-Mediterranean Free Trade Area (EU-MEFTA) (scheduled for 2010), the development of the European Neighbourhood Policy (ENP) and the activities of the MEDA Programme that implements the Euro-Mediterranean Partnership (launched as a consequence of the Barcelona Declaration, November 28, 1995) have favoured initiatives financed by the EU Commission which have characterized the International Cooperation on Science & Technology Research, Development and Innovation in the Euro-Mediterranean Area (EU-MED-STRDI).

This Cooperation has revolved around two main axes:

- the bilateral cooperation initiatives between the 27 EU Member States (EU-MS) and the so-called Mediterranean Partner Countries (MPC): Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Turkey
- and the actions funded by the EU by means of the use of several instruments, mainly the MEDA Programme (e.g. the EUMEDIS Project on IST) and the different EU Research Framework Programmes (FP). The authors have been actively engaged in applying KM and ICT tools in several 6th and 7th FP funded projects aimed at fostering the EU-MPC cooperation, notably: MELIA, MED7, ASBIMED and EUROMEDANET 1&2 (Rodríguez-Clemente and González-Aranda, 2007).

An in-depth analysis of the results of these initiatives shows that the international cooperation on EU-MED-STRDI is not a new phenomenon. It has existed from around the middle of the 20th century or, even, earlier, i.e., when most of the MPC get their independence from European powers. These collaborations started from the establishment of spontaneous STR relationships between both sides of the Mediterranean Area in the form of small-sized Communities of Interest (CoI). These relationships involved groups of individuals (scientists, technicians, economists, industrialists, Ph.D students,...) where knowledge sharing occurs among them as they engage in debate and discussion of each other's ideas and results, and through collaboration on joint research projects, thus leading to the establishment of the first Formal Workgroups, a process already studied in general by Crane (1972). Thus, knowledge and innovations are shared quickly across organizational, cultural and national boundaries through these informal relationships, which are usually reflected into the form of many publications on specific common interest topics. This reasoning is based on the concepts of "reciprocity" in knowledge sharing, respect for intellectual property rights and common trust in research (Bouty, 2000; Liebeskind et al, 1996).

The analysis also shows how the role of KM in these initially informal social networks has changed due to the new paradigms associated to the Information Society Technologies (IST) and how the connection with the new Knowledge-Based Economy also affects the EU-MED-STRDI cooperation itself: Past are the times when all the possible interactions were based on the exchange of postal letters. Today, ICT tools and KM methodologies creates a scenario where these social networks are mainly structured around either CoI or CoP. These social networks are themselves reinforced and nurtured by ICT/KM through the provision of coordination and management mechanisms, implemented via existing or new Formal Workgroups (FW), structured as Virtual Teams by means of Tele-work and collaboration, (a.k.a. groupware tools). Eventually, these networks may increase in size and evolve towards the well-known as Formal Electronic NoP (Brown and Duguid, 2000; Teigland, 2003).

Recent advances in ICT have also enabled the creation of computer-supported social networks akin to CoP, where individuals are able to discuss and debate issues electronically. The success of CoP for facilitating knowledge exchange, both electronically

and in face-to-face meetings, has recently pushed initiatives on how to take advantage of this type of networks as well as gather their benefits in workgroups and virtual teams. Note, however, that CoP are broader than FW and their associated virtual teams, as they tend to gather all interested parties in a given domain that have interacted, in a way or another. Yan and Assimakopoulos. (2003) discusses this distinction in detail.

2 BACKGROUND AND THEORETICAL FRAMEWORK

The literature offers several definitions for the concept of CoP. Wenger et al (2002) define CoP as follows: *Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting in an ongoing basis.*

According to the theoretical background proposed by these authors, a CoP is combination of three structural elements:

- the DOMAIN of knowledge, which defines the area of shared inquiry and the set of issues discussed in the community
- the COMMUNITY, its members, the social fabric, their motivation, and interactions
- and the PRACTICE, the set of interacting processes, frameworks, ideas, tools, information, styles, language, stories and documents that the community members share.

The DOMAIN is the space of questions that could interest a number of parties, individuals, organisations, etc. In this sense, it defines the universe where different COMMUNITIES are created, considering a COMMUNITY as the network formed by the interested parties that have entered into contact by any means (physical contact, letters, news in journals, electronic communication, etc.). The PRACTICE of the COMMUNITY is the interaction among its members, in such a way that it could be more or less guaranteed that a member of a CoP can reach another member by a direct or an indirect interaction. In a given DOMAIN there can be several CoP that could expand or merge by interacting with each other.

The COMMUNITY is subject to an evolution process and changes itself as time goes by. It is initiated and develops over time to the current shape and it is also embedded in a political, environmental, social and economical context that is always evolving. There is a mutual interaction between the

COMMUNITY and its surrounding CONTEXT. Every CoP has some kind of output, outcome and impact. Outcomes are the results of a programme or project relative to its objectives that are generated by its respective partners' outputs. Outputs are the tangible products (goods, services) of a programme or project. And impacts are the effects, positive and negative, primary and secondary long-term changes produced in a community by a programme or project, directly or indirectly, intended or unintended. In this sense, it is clear that depending on this positive and/or negative impact the sustainability will or will not be guaranteed.

Additionally, there are two key factors:

- the Motivation of its members, visible in their personal interest and in the priority they attribute to CoP in their daily activities
- the Mandate of the concerned organisation(s) defines, on the one side, the thematic focus with the declared interest of the organisation in a concrete outcome and, on the other side, the mandate gives open space for self-commitment to its members (working time and financial resources).

Another concept to consider is Legitimate Peripheral Participation (LPP), which refers to how newcomers become members and eventually experienced old timers of a CoP or collaborative project. According to LPP, newcomers become members of a community initially by manifesting their interest and/or participating in minute and superficial yet productive and necessary tasks that contribute to the overall goal of the community. These activities are typically simple and carry low risk to the community as a whole, but are also important. It crucially involves participation as a way of learning —of both absorbing and being absorbed in—the “culture of practice.” by means of interacting and developing an “absorptive capacity” of the new knowledge created and feedbacked again by the CoP.

An extended period of LPP provides learners with opportunities to make the culture of practice theirs (Lave and Wenger, 1991).

CoP can be initially classified in 2 groups:

- Internal CoP: defined entirely within a single organization
- and CoP in Network Organizations: A network organization is a relationship among independent organizations (Powell, 1990).

We will focus our analysis on the latter. Member organizations in a network work in close and continuous cooperation on projects or processes involving partnerships, common products and/or services, and possibly sharing a common strategy. In

solving problems in today's environment, it is becoming increasingly important to cross boundaries, either within the organization or to external organizations for fresh insights. Learning and knowledge exchange through networks focuses on the inter-organizational network as a resource generator to enhance learning. Simultaneously, the concept of NoP (Brown and Duguid, 2000; Teigland, 2003) has emerged as a means to describe informal, emergent social networks that facilitate learning and knowledge sharing among individuals conducting practice-related tasks. Brown & Duguid (2000) argue that CoP are a localized and specialized subset of NoP, typically consisting of strong ties linking individuals engaged in a shared practice, typically face-to-face and who usually coordinate through third-party new ICT instruments (e.g. internet-based groupware tools). In Electronic NoP, the essential communication channel of asynchronous computer-mediated communication has a profound influence on how knowledge is actually shared. In this respect, inter-organizational CoP are close to NoP. A NoP is an open activity system focused on work practice, and it may exist primarily through electronic communication. It is a type of CoP in which there is a social space where individuals working on similar problems help each other and share perspectives about their practice. However, in a NoP, people working within occupations or having similar interests engage in knowledge exchange about the problems and issues that are common to their occupational community and shared practice.

In turn, NoP can be classified into:

- Self-organizing NoP: a loosely organized and informal network that has no central management authority or sponsor, whose membership is voluntary, and where there is little explicit commitment
- and “Formal” NoP: those which have a membership that is controlled by fees and/or acceptance through some central coordination authority, usually based on a FW structure (Programme, Project, etc) that also assists in organizing, facilitating and supporting member communications, events, and discussion topics.

However, a NoP has a focus on specific work issues and strategies of immediate importance to the membership, and it may in fact become an adjunct to an affinity network. An example of an affinity network is purchasing managers, members of an association who may form NoP where they communicate on a regular basis on strategies, practices, opportunities, and innovations. Therefore, the frame of a CoP or, even, a NoP can give rise to a

FW when an structure, means, and deliverables are foreseen. On the other hand, a FW can assist to support the evolution of existing CoP, which, in some specific cases, evolve towards Formal Electronic NoP. A real-world example of how that can be done is presented in the next section.

3 THE EU-MED-IWRM COP

There exists a general perception that water management models in the Mediterranean Countries are still constructed from points of view that ignore contributions from all the key stake-holders (specially users and citizens), who are determinant for the impact on the territory of water schemes and the satisfaction of the water demand, specially from the sustainability point of view and taking into account the social, economic, environmental and institutional dimensions. In this section, the process and methodology that allow moving from FW initiatives to Electronic NoP is illustrated with a specific case study, namely the EU-MED-IWRM CoP.

3.1 The MELIA Coordination Action Project

Research in this topic (i.e. DOMAIN) is of common interest of the EU and its MPC in view of the economic integration of both sides of the Mediterranean area, the risks associated to the climatic change and the increase in frequency of water risks events (such as droughts or floods). Another general perception in the Mediterranean area is the lack of visibility of the important role that Science and Technology play in the sustainable development of the region. Part of these problems are due to communication gaps between political and administrative institutions, scientists, cultural workers, lawyers, economists, end-users and citizens, who, following the theoretical framework provided in the last section, make up the EU-MED-IWRM COMMUNITY. Within this COMMUNITY, there exist many individuals who have been actively involved in past and ongoing initiatives, mainly in form of Projects supported by the European Commission through different Framework Programmes or other Cooperation instruments: WASAMED, FOGGARA, WADAMED, MED-REUNET, SED-Net DESURVEY, WADI, MELIA, SEMIDE-EMWIS, EU-MEDA-WATER, MED-EUWI, EU-MEDSTAT-ENV, REMOC-INBO, etc, and whose targeted objectives should be

disseminated by using appropriate instruments, language and contents based on the DOMAIN dealing with IWRM in the Mediterranean Area.

The MELIA (Mediterranean Dialogue on Integrated Water Management) Coordination Action (CA), was officially launched in September 2006 as a strategic EU Commission funded FP6-INCO-MPC project. Its aim is to establish an open dialogue between experts from both sides of the Mediterranean and among the key stakeholders concerned and affected by water use and management, that is, to strength the interactions, PRACTICE, between the EU-MED-IWRM COMMUNITY.

Some of the main goals of the MELIA Coordination Action are:

- Building a knowledge base for IWRM planning, based on integrating contributions from different perspectives, involving the wide spectrum of stakeholders and based on the EU Water Framework Directive.
- Develop a Mediterranean-wide awareness of the social (cultural and participatory), economic and technological issues related to water management.
- Propose participatory mechanisms and prevention tools to avoid competition in resources allocation between regions states and different waters users.
- Provide legislative and administrative bodies with criteria and arguments agreed in a consensual way by a wide representation of social, economic, scientific and political actors from different countries, to support sustainable water policies and economy.
- Provide the intellectual basis and the indicators to perform a benchmarking exercise of Integrated Water resources management in the Mediterranean area.
- Contribute to the construction of a common frame and knowledge, and to the development of a common terminology and semantic and help water negotiations.

On the other hand, the opening of MELIA to interested people by the dissemination of the results obtained, will be the most relevant and appreciable output, namely: extending the CoP within the EU-MED-IWRM COMMUNITY. This purpose needs a wide communication strategy, addressed to all those stakeholders involved in water use who set up the EU-MED-IWRM CoP, in rising awareness at the educational level, in research, administration and, specially, policy making.

information management and knowledge creation will be organized in a way that the following cycle of functions is ensured: (1) Establishment of the information base; (2) Adaptation of information and sharing within the network; (3) Transfer of the information to target groups (water users, managers, IWRM implementers); (4) Generation – or better – consolidation of common knowledge (local and global levels).

The essential outcomes of information management, knowledge generation and transfer, will be to provide innovative strategies for relevant stakeholders, such as the Directors of Water and the Ministries of EU and

MED Countries, and, on the other hand, to raise public participation and awareness. Their level of impact is in direct relation with their level of activity and operation.

4 MELIA CA ICT PLATFORM

Figure 3 shows the visible face of the MELIA CA Platform, which consists of a Groupware web-based portal (<http://www.meliaproject.eu>). This type of user interface can be considered as a common, well-understood and friendly paradigm. Its Extranet platform is based on “hybrid-mixed” schemes between LAMP (Linux+Apache+MySQL+PHP) and Plone/Zope architectures, where specific PHP and

Python programming language scripts were designed and implemented, providing a series of tools:

- synchronous tools (web conferencing, chats,...)
- asynchronous tools (fora, external editors, both very useful in the scientific context for the exchange of common ideas and publications collaborations, etc.)

Given the large amount of actors involved (45 partners in the MELIA CA case), using just the traditional mechanisms of interaction, mainly based on the exchange of emails, would be inefficient and practically unmanageable. One of the main distinctive features is the Virtual Teams design, which aims at a symbiosis of physical and virtual work environments. There exists a simple premise: one Work Group per WP and one Virtual Team per Work Group. In order to get a feeling of the working of the Platform, Figure 4 shows the internal folders structure of one of the WP, namely WP0: Coordination and Management.

4.1 Platform Members’ Role scheme

Each WP follows the following Role-oriented scheme.

- *General Public:* They are not registered into the system and they have only Read permission to the contents that have been published (“Public content state”).

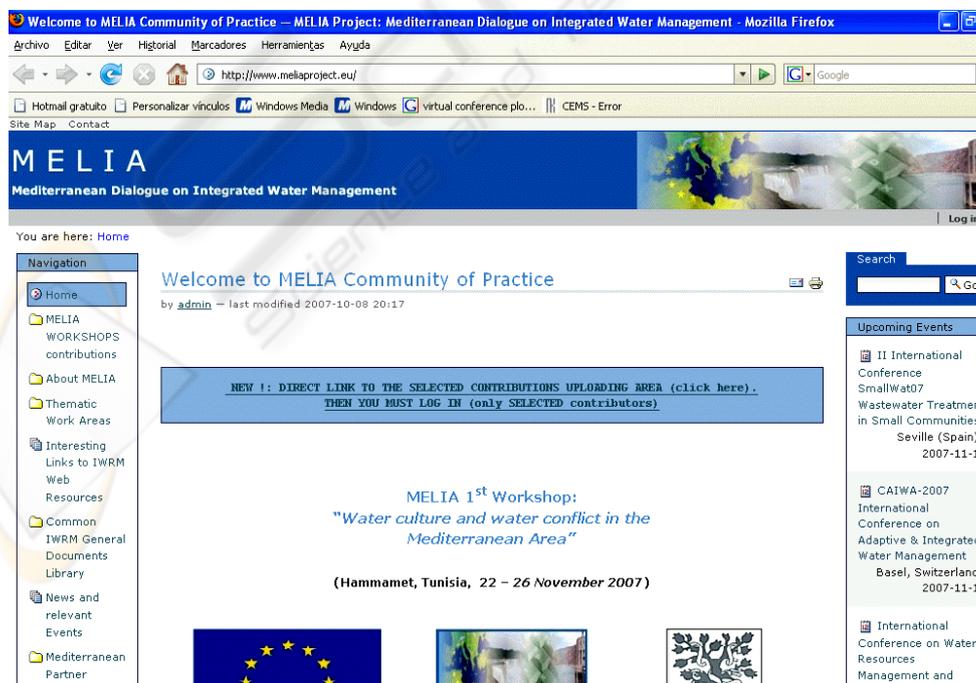


Figure 3: MELIA CA web Platform.

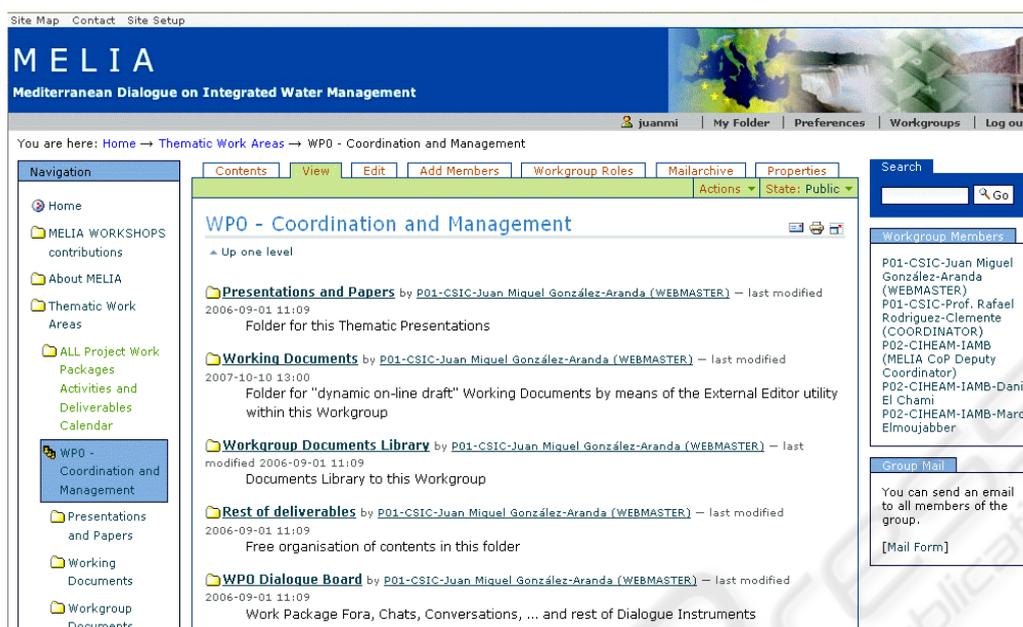


Figure 4: Folder structure of WP0: Coordination and Management.

- **Intranet Members:** Members who are registered into the system. They have a login and password to access into the Intranet. There are two types:
 - **WP members:** At least, an Intranet member belongs to one WP. WP members have at their disposal interactive tools to add new contents: files, folders, links, HTML web-pages; etc. they can work collaboratively on these contents (using external editors,...) and interact among them (Fora and P2P tools).
- **WP Leaders and Deputy Leaders:** They are WP members who assume the role of activity coordinators within the WP. They are “Reviewers” of the KM products generated into their WP, and they decide if they can be published or not. They have the responsibility of giving visibility of the contents to the General Public, allowing them to be indexed by the search engines in Internet, etc...
- **Manager:** This is a role only reserved to the MELIA Coordinator and the Webmaster.

4.2 Contents Workflow and Members’ Role Scheme

The Role-oriented scheme used is complemented with a Contents Workflow, with its corresponding states and transitions. This Workflow assists the users to upload, submit for reviewing and, if approved by the WP Leaders/Deputy Leaders (acting as KM WP Managers), publish new contents.

In a first phase, an initial Knowledge Base Taxonomy was implemented, structured through:

- One Thematic Area Library corresponding to each Thematic WP
- One Library for each MPC.
- One Library for each EU-MS

In order to compile a single final EU-MED Knowledge Base on IWRM, semantic-oriented mechanisms are necessary for using the Platform. In this sense, some OWL Web Ontology Language instances have been designed. They are mainly based on the key terms of reference suggested by the IWRM experts within each WP. Presently they are running as Beta prototypes.

All these features are complemented by the users’ personal areas, where users can configure their profiles, shared activities, consult their tasks and deliverables “smart” calendar, etc.

5 CONCLUSIONS

This paper presents MELIA CA as a FW initiative created within and aiming to assist the Euro-Mediterranean IWRM CoP, to uncouple its work environment from physical locations. MELIA Work groups offer team members intuitive and ubiquitous access to each other, and to information and resources of their Virtual Work Teams and their own tools. It is observed in some cases an evolution towards a Virtual Electronic NoP model.

Despite these technological developments, 'human factors' should not be neglected in an increasing virtual environment. Useful as they are, ICTs cannot fully replace face-to-face contacts and more conventional means of communication (telephone). Many people are yet unfamiliar with these new developments. In fact, it has taken around one year to expand the use of the MELIA CA Platform to acceptable levels. Additionally, the costs associated to the displacements (travels and accommodations) justify the creation of this type of supporting Coordination Action structures which, assisted by Tele-work and Collaboration tools based on these Virtual Teams schemes, provide essential instruments to the sustainability of these Euro-Mediterranean RDI social networks.

The ongoing success and the experience acquired during the course of the MELIA CA Project has led to the application of the same adapted ICT tools in the MIRA "Mediterranean Innovation and Research" CA Project (<http://www.miraproject.eu>). Necessary research and continuous innovation on the new technological trends (i.e., research on the Web 2.0 requirements, essentially focused on the semantic web mechanisms, (OWL)) as well as their development is guaranteed during the next years in order to nurture these types of social networks.

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<http://www.w3.org/tr/owl-features/>
- Php programming language (<http://www.php.net/>)
- Plone CMS (<http://plone.org/>)
- Python programming language (<http://python.org>)
- Zope CMS (<http://www.zope.org>)