SWAMP

SMART WATER MANAGEMENT PLATFORM

Project nº: 777112

WP7

D7.3 Plan for managing knowledge and IPR

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List of Abbreviations

CooA	Coordination Agreement
DoA	Description of Action
DSS	Decision Support System
EDC	Enterprise Data Capture
EPC	European Patent Convention
EPO	European Patent Organization
GA	Grant Agreement
GPL	General Public license
IKMS	Integrated Knowledge Management System
IP	Intellectual Property
IPR	Intellectual Property Rights
KM	Knowledge Management
MIT	Massachusetts Institute of Technology
MPL	Mozilla Public License
PCT	Patent Cooperation Treaty

1. Executive Summary

This deliverable *D7.03 Plan for managing knowledge and IPR* results from *Task 7.4 Knowledge and innovation management* where one of the objectives is to balance the efficient management of the project, the work to be performed and the reports to be produced. Further, it deals with the administrative and financial management of the project, which aims to provide information on existing mechanisms, standards and currently adopted strategies for *SWAMP* knowledge management.

SWAMP strives for the realization of a high-precision smart irrigation system concept for agriculture to enable the optimisations of irrigation, water distribution and consumption based on a holistic analysis that collects information from all aspects of the system including even the natural water cycle and the cumulated knowledge related to growing particular plants. The project has a considerable number of partners, and for this reason planning activities, meetings and synchronizing every group is a hard task. In this sense, the document describes the most common Knowledge Management tools and the best alternatives for intellectual property protection. Additionally, the IP tools are detailed and focused on the project's main goal.

2. Introduction

2.1. Purpose and context of this deliverable

The *D7.03 Plan for managing knowledge and IPR* document describes an overview of knowledge management tools used today. Additionally, the importance of bringing IP tools for *SWAMP* is presented.

2.2. Scope

In Brief, the main ideas introduced in this document are summarized in the list below:

- Identification of the most common Knowledge Management tools
- Description of the tools used for *SWAMP*
- Give an overview of artificial intelligence based tools
- Description of the most used Intellectual Property tools
- Recommended IP practices for *SWAMP*

2.3. Relationship to Description of Action

Although this document includes references to the Description of Action (DoA), the two documents are complementary in purpose. While the DoA focuses on the technical objectives, content and resources of the project contractually agreed with the European Commission, the focus of this document is to guide consortium partners in the practical processes and quality standards for the work undertaken within the project.

3. Introduction to Knowledge Management

Knowledge management (KM) was initially defined as the process of applying a systematic approach to the capture, structure, management, and dissemination of knowledge throughout an organization in order to work faster, reuse best practices, and reduce costly rework from project to project. KM is perhaps best categorized as a science of complexity (Dalkir, 2012). It is a multi-disciplinary field that draws on aspects of information science, information technology, interpersonal communications, organizational learning, cognitive science, motivation, training, publishing and business process analysis (Dataware Technologies, Inc., 2012). It is not about managing knowledge for knowledge's sake; the overall objective is to create value and to leverage, improve, and refine company´s competences and knowledge assets to meet organizational goals and targets (Frost, 2012).

With regard to KM´s history, it spans through three generations. In the first one, the emphasis was placed on containers of knowledge or information technologies. The second generation swung to the opposite end of the spectrum to focus on people. The third stage of KM brought about an awareness of the importance of shared context: how to describe and organize content so that intended end users are aware it exists and can easily access and apply this content.

The knowledge that you need to manage is that which is critical to your company—that which adds value to your products or to your services. KM must understand the value and applications of the new knowledge created; it must store this knowledge and make it readily available for the right people at the right time (Frost, 2012). For that, this management can be made in four activities: acquire knowledge (learn, create, or identify), analyze knowledge (assess, validate, or value), preserve knowledge (organize, represent, or maintain) and use knowledge (apply, transfer, or share).

Creating an enterprise-wide knowledge management system is not a simple task. However, the benefits of a well-designed system are immense (Dataware Technologies, Inc., 2012):

- Awareness. Everyone knows where to go to find the organization’s knowledge, saving people time and effort.
- Accessibility. All individuals can use the organization’s combined knowledge and experience in the context of their own roles.
- Availability. Knowledge is usable wherever it is needed whether from the home office, on the road or at the customer’s side. This enables increased responsiveness to customers, partners and coworkers.
- Timeliness. Knowledge is available whenever it is needed, eliminating time-wasting distribution of information for “just in case” people are interested.

Knowledge management is a continuing cyclical process with no end, not a linear one with a single goal. That is, it will therefore be continually evolving, or learning, and any technology used to implement it must support evolution and learning (Watson, 2003). KM relates to the fact that it deals with knowledge as well as information. Knowledge is a more subjective way of knowing and is typically based on experiential or individual values, perceptions, and experience (Dalkir, 2012).

Some typical knowledge management objectives are to facilitate a smooth transition from those retiring to their successors who are recruited to fill their positions, minimize loss of corporate memory due to attrition and retirement, identify critical resources and critical areas of knowledge, build up a toolkit of methods that can be used with individuals, with groups, and with the organization to stem the potential loss of intellectual capital.

Individuals are the source of organizational knowledge: tacit and explicit as shown in *Table 1*. Tacit knowledge is the sum of personal experiences or collective working routines and traditions. Besides drawing and biking, also the passive vocabulary, which is understood but not used to communicate with others, is tacit knowledge. It is personal, context-specific and is difficult to transmit. This is called the People-to-People strategy. Explicit knowledge is the knowledge that you can codify and transmit in a package, such as a spreadsheet. This is called the People-to-Document strategy. For the knowledge to gain value, the organization must provide mechanisms that capture it and transfer it across the organization (Dataware Technologies, Inc., 2012).

Table 1: Differences between tacit and explicit knowledge (Dalkir, 2012)

Properties of Tacit Knowledge	Properties of Explicit Knowledge
Ability to adapt, to deal with new and exceptional situations	Ability to disseminate, to reproduce, to access, and to reapply throughout the organization
Expertise, know-how, know-why, and care-why	Ability to teach, to train
Ability to collaborate, to share a vision, to transmit a culture	Ability to organize, to systematize; to translate a vision into a mission statement, into operational guidelines
Coaching and mentoring to transfer experiential knowledge on a one-to-one, face-to-face basis	Transfer of knowledge via products, services, and documented processes

Although the four modes of knowledge conversion have been widely referred to, their names have varied in different representations (Dataware Technologies, Inc., 2012):

- Socialization deals with sharing experiences and is often done through observation, imitation and practice.
- Capture is concerned with articulating tacit knowledge and turning it into an explicit form.
- Dissemination is the conversion of the knowledge from one explicit form to another.
- Internalization is the process of experiencing knowledge through an explicit source.

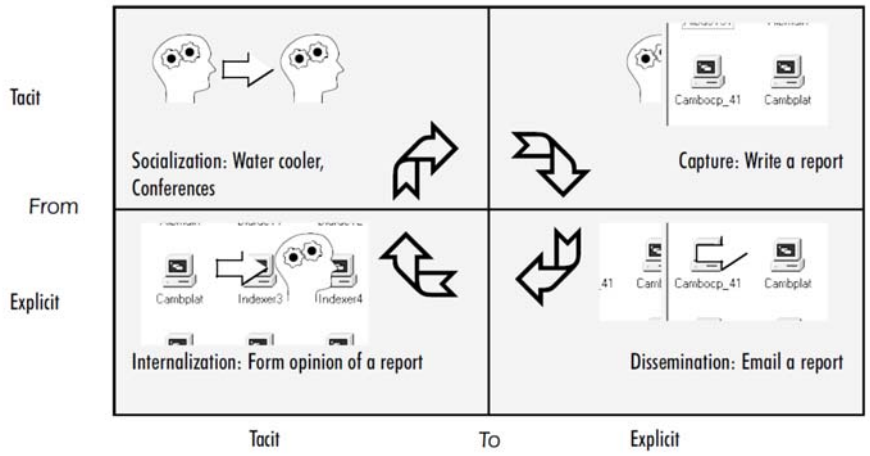

Figure 1: Knowledge transfer process (Dataware Technologies, Inc., 2012)

A thorough understanding of these knowledge transfer processes is essential for discerning an organization´s strengths and weaknesses. Organizations that have successfully implemented knowledge management principles have used this as a guide to help them design new processes for increasing knowledge capture and sharing.

KM systems should be open, distributed, customizable, measurable and secure. These systems can be categorized as showed in the next sections.

4. Classification of Technical Tools to Support Knowledge Management

This section classifies and gives some examples of Technical Tools that Support Knowledge Management. There are several criteria for the classification of KM Tools (FORSYS, 2011):

- Criteria according to the type of the decision problem:
  - Decision situation (unilateral, collegial, participatory)
  - Level of planning (operational, tactical, strategic planning)
- Criteria according to stakeholders / users /organizations
  - Allow participation (active / passive)
  - Technical skills of users required
  - Level of acceptance of users in terms of usability, reliability, easiness, …
  - Kind of introduction of the tool to users
  - Role of stakeholder within the process (expert, decision maker, public)
  - Type of organization (public bodies, forest enterprises, …)
  - To whom to give access to information / knowledge (skill, commercial, privacy)
- Criteria for development issues - technical aspects
  - Allows to generate interfaces between tools/techniques
  - Allows a definition of interfaces between methods and models
  - Rules for selecting information (in hierarchical decision making processes, robustness, reliability, …)

Based on literature search and related web site examples, about twenty KM tools and methods were identified and classified into eight groups (FORSYS, 2011). The KM tool groups were evaluated according to their contribution to knowledge management processes within developing a DSS (Decision Support System) on the one hand (*Figure 2*) and within applying a DSS on the other hand (*Figure 3*). The figures below show 'performance profiles' of the tool groups in the processes of identifying, generating, assessing, storing and transferring knowledge that can be integrated in the DSS.

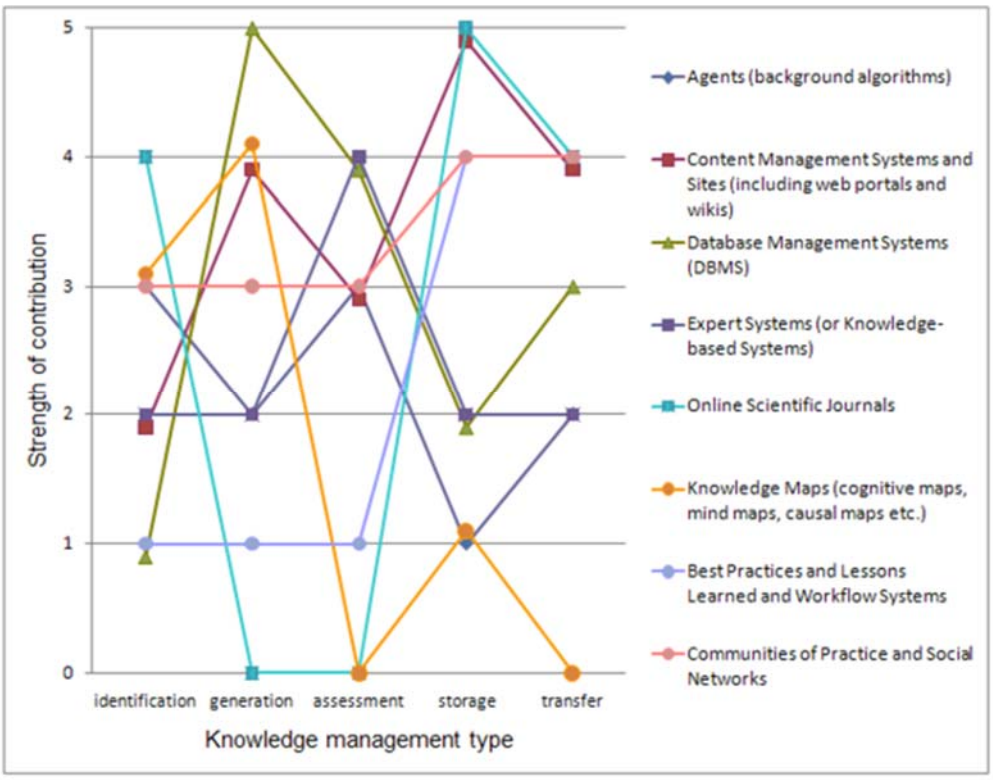

Figure 2 - Contribution of different KM tools to knowledge management processes in the context of developing DSS (FORSYS, 2011)

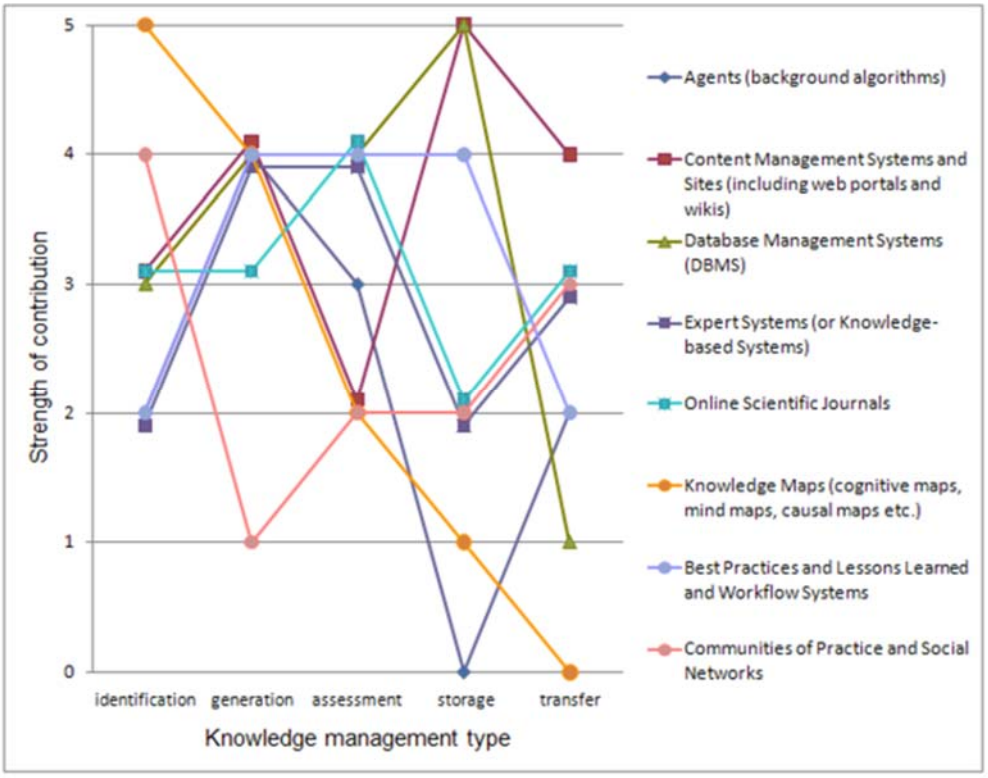

Figure 3 - Contribution of different KM tools to knowledge management processes in the context of applying DSS (FORSYS, 2011)

In a developing DSS, the KM tool groups have the greatest variation in the potential support for knowledge generation. Some tools are specifically beneficial in generating knowledge (e.g. DBMS) while others are strong in storing knowledge (e.g. Online scientific journals and Content management systems). No single KM tool group seems to support perfectly well all knowledge management types, but Communities of practice and Social networks appear to have rather stable performance.

The potential of KM tools to support knowledge management in applying DSS varies highly when it comes to knowledge storing. For knowledge identification, in turn, most tools are well applicable. Knowledge maps (cognitive maps, mind maps, causal maps etc.) are highly useful in the identification of knowledge and less useful in storing and transferring knowledge. Content management systems and sites (including web portals and wikis) and database management systems (DBMS) are highly potential for the storage of knowledge (FORSYS, 2011).

The following subsections will explore some tools that help the Knowledge management: groupware systems, content-oriented systems, systems of artificial intelligence, visualization systems and integrated knowledge management.

4.1. Groupware Systems

Groupware is a term that refers to technology designed to help people collaborate and includes a wide range of applications. They can greatly facilitate explicit knowledge sharing through publishing and communication tools and support the knowledge creation process with collaborative management

tools - although this process is still very much about people interacting and experimenting (Frost, 2012). They are computer-based systems that support two or more users engaged in a common task, and that provide an interface to a shared environment. These systems frequently require fine-granularity sharing of data and fast response times (Ellis & Gibbs, 2012). A multi-player game, a computer-supported cooperative work, a real-time conferencing are examples of groupware systems. There are some challenging aspects to consider such as interfaces, access controls, social protocols and concurrency.

Nowadays, more companies are interested in groupware systems because they realized that their edge lies in more efficiently transferring knowledge across the organization. Groupware allows formal and ad hoc conversations in cases when the participants cannot communicate in real time. This makes groupware an important technology for enhancing the exchange of tacit information (Dataware Technologies, Inc., 2012).

Groupware systems usually provide very low knowledge context information but provide relatively high knowledge usage capabilities, since they enable users to retrieve, share, organize their work in workspaces, and to distribute artifacts (Dustdar, 2005). There are basically two groupware models showed below:

- Communications-oriented groupware – using communications as the underlying interaction pattern (i.e. e-mail). These do not support organizational components and structures such as people and their associated roles, groups, tasks, skills, etc.
- Workspace-oriented groupware – allows team members to upload/download artifacts using files and folders to organize their work.

The selection of the groupware systems should be influenced by the users. We should consider also how the chosen tools relate to one another, and if one should invest in an integrated solution. For instance, an integrated groupware system composed of many complementary modules may be easier on the user since it implies getting accustomed to one brand.

4.2. Content Oriented Systems

Content-oriented systems approaches focus on information and its use. Some authors classify these systems just as Content Management Systems, which are responsible for the creation, management and distribution of content on intranet, extranet or a website (Frost, 2012). Others classify according to a particular phase of Knowledge Management Cycle in which they are used, named Knowledge Capture and Creation. This phase is subdivided into Content Creation and Content Management. Some examples of each Knowledge Capture and Creation are described below (Dalkir, 2012):

- Content Creation tools
    a) Authoring tools, like word processing or web page design software, are the most common used content creation tools.
    b) Annotation technologies enable short comments to be attached to specific sections of a text document
    c) Data mining extracts predictive information from large databases based on statistical analysis. It is also possible to apply this technique and use these tools to mine content other than data — namely, text mining and thematic analysis and web mining. They are currently in use in market segmentation, customer profiling, fraud detection, evaluation of retail promotions, credit risk analysis, and market basket analysis
    d) Blog is a popular and fairly personal content form on the Internet. A blog is a frequently updated, publicly accessible journal. Large organizations can use a well-formed blog to

exchange ideas and information about web development projects, training initiatives, or research issues.

- Content Management tools – There is a wide range of applications where Content Management systems are used. In the enterprise view, they are subdivided in some categories (Wikimedia Foundation, Inc., 2012):
  a) Document management (DM) – controls document from creation and archiving. According to Microsoft (Microsoft Corporation, 2012), the SharePoint Server 2010 can identify document management roles, analyze document usage, plan the organization of documents, how content moves between locations, content types, workflows, content control and policies.
  b) Collaboration (or collaborative software) – provides use of data from information databases and processing methods to use simultaneously by multiple users. According to Oracle, the Oracle Beehive (Oracle Corporation, 2012) provides a comprehensive set of collaborative, communications and social networking services on a single platform that was built from scratch to be secure, fully integrated and scalable.
  c) Web content management - is used to present information already existing and managed in the Enterprise Content Manager repository using workflow, access control, versioning, delivery and authorization modules. According to Alfresco (Alfresco Enterprise, 2012), Alfresco Web Content Manager is an open source solution that offers greater control and visibility over current and future costs within a single integrated platform (documents, images, video, audio) built on industry standard technology.
  d) Records management - Ensures that controlled information is efficient and is only accessible to those with the right of access and that it is duly retained according to corporate and legislative rules. It helps to ensure that an organization knows what information it has, is confident of its accuracy, and that it is discoverable and quickly accessible. The Autonomy Meridio (Autonomy Meridio, 2012), an HP company, allows records to be managed whilst remaining in their source repository or automatically migrated to a central Autonomy Records Management repository using Enterprise Data Capture (EDC). Its processes deal with capture, indexing, classification, security and access control, e-mails and instant messenger, retention, usability, storage and search.
  e) Workflow and business process management (BPM) – Workflow deals with design and visualization of process and organization structures with reminders, deadlines, delegation and others administration functionalities (Wikimedia Foundation, Inc., 2012). Business Process Management discover, document, automate, and continuously improve business processes to increase efficiency and reduce costs. Organizations must understand the business goals and strategy and analyze their current processes to identify the processes that will deliver the greatest return on investment (IBM Corporation, 2012) speed the creation and deployment of workflow-oriented applications. Even complex processes can be automated with little or no programming by providing graphical point-and-click tools, built-in workflow logic and reusable object libraries for routing rules, role assignment, deadline handling and task automation. An IBM Business Process Management (BPM) software (IBM Corporation, 2012) has wide variety of categories such as automation and integrity, business monitoring, decision management, discovery and design and industrial process accelerators.

As we can see, selection and implementation of a content management system is something that requires careful consideration. As with all Knowledge Management related information technologies systems, the functionality must be weighed against organizational needs and processes as well as expected costs.

4.3. Systems of Artificial Intelligence

Most sophisticated commercial Knowledge Management tools embed AI technology: Bayesian reasoning, ontologies, data mining, intelligent agents to name a few (Staab & Maedche, 2000).

Knowledge ontologies are typically created for building expert and other intelligent systems. Ontology formally represents knowledge as a set of concepts within a domain, and the relationships between those concepts. The main purpose of ontologies is to provide a common language to support knowledge sharing. In practice, a common language guarantees effective knowledge sharing, and thus should be a requirement for all systems intended to implement knowledge tasks (Valente, 2004).

According to Staab (Tsui, Garner, & Staab, 2000), *"ontologies constitute the glue to tie together all knowledge subprocesses (i.e. knowledge creation, knowledge import, knowledge capture, knowledge retrieval and access, and knowledge use)".*

Other AI techniques like intelligent agents (Bradshaw, et al., 1998) can be used to help in the search and knowledge retrieval methods for use by context of knowledge management systems. Agents can be used to help in combining knowledge which would ultimately lead to the creation of new knowledge.

Additionally, knowledge discovery and data/text mining approaches (AI-related methods) could be used to inductively determine relationships and trends in these knowledge repositories for creating new knowledge (Liebowitz, 2001).

4.4. Visualization Systems

With the evolution of Knowledge Management tools, the visualization of this data by presenting diverse forms with an easily understandable graphic representation has become necessary. The visualization helps users to make critical business decisions around the enterprise processes. There are several software products that are used in multiple sectors of the business and technical industries (Advanced Visual Systems, 2012). Some types of these applications are described below:

- Analytics – Load data from datasets with high data processing and display all reports in a structured form to user;
- Dashboards – help to adjust the strategy or tactics showing main data, grouping them on screen. Some data can be showed in real time;
- Real Time Monitoring – Shows specific data on screen in real time, aiming for a best analysis of critical information, with high performance features and capabilities;

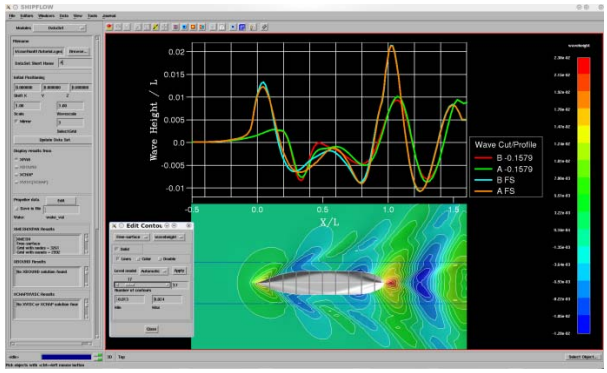

Figure 4 - Using visualization software to visualize complex CFD (computational fluid dynamics) (Advanced Visual Systems, 2012)

4.5. Integrated Knowledge Management Systems

KM systems refer to any kind of IT system that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories for hidden knowledge, captures and uses knowledge, or in some other way enhances the KM process (Frost, 2012). The idea is to enable employees to have ready access to the organization's documented base of facts, sources of information, and solutions. As an example of commercial systems with knowledge management components we cite: Tableau, IBM Watson and Microsoft Teams.

Integrated Knowledge Management System (IKMS) can be considered an extension of standard information and KM systems with the addition of software-enhanced models, modules, and feedback to allow the IKMS to operate across much broader information domains (Zaki, et al., 2008).

The IKMS provides access to data or information required to complete an analysis or answer a question. A fundamental requirement of any KMS is to provide access to relevant information in response to user queries. Implied in this requirement is an ability to ingest and deliver information to the user, with or without pre-processing or automated assistance and qualifiers. Designing the IKMS for functionality and performance for use in conjunction with expanded applications requires an adaptive and flexible architecture to consider additional data sources that may not have been considered in the original IKMS design (Zaki, et al., 2008).

While the core architecture and functionality of the IKMS may remain static, a flexible approach to obtaining and processing new data sources must be considered in the design. A proposed solution is using agents and preprocessing modules to achieve flexibility and cost savings while improving access to data content not originally anticipated. This approach allows the re-use of the core IKMS functionality while adapting to changing requirements by building and implementing agents, bots, or preprocessing at reduced cost and operational impact. IKMS functionality can be extended by adaptive data delivery using "mashup" technologies. In order to meet end-user requirements for data content to meet analysis requirements, it may be necessary to "mix-and-match" internal and external data sources. This information mashup can be presented in a variety of formats, incorporated in graphical interfaces or GIS content, and be made available for display or automated analysis within applications or analysis tools (Zaki, et al., 2008). The key is enabling the analyst to choose the data content applicable to his needs, without re-engineering the core functionality of the IKMS.

No software system or application can be engineered to provide universal applicability or capabilities to solve all problems for all users. This is true for an IKMS, as well. Modularity, flexibility, and adaptability are key features to consider in scaling software to satisfy a broader and more complex range of problems. Improved approaches must address several fundamental and systemic issues through

improved architectures, software selection, and engineered solutions (Zaki, et al., 2008). These solutions appear to be available within existing technologies, if thoughtfully applied. These observations are little more than suggestions to apply existing technologies. The most important element in extending IKMS capabilities is to couple data modeling and coding skills to analyst requirements during initial design, architecture development, and solution evolution.

A "build-test-build" approach allows the analyst's needs and subject matter expertise to be considered in an iterative process (Zaki, et al., 2008). Where the application (IKMS) must service a variety of end-users, early and expanded participation by end-users will inevitably produce an improved final product.

5. Knowledge Management in SWAMP

- Twitter? Used much as internal sharing tool.
- ResearchGate? At elast RG is used as a repositoiry.
- VTT Open Acess repository? I do not recall te name now. Something to do with Elsevier.
- Open Data ideas that we have somewhere. Do they belong into this?
- Should we have the same classification as in introduction of tools: identification, generation, assessment, storage, transfer. And show ahat tools are our choices in SWAMP. And maybe even why?
- Should we put something on the knowledge management of experiments that we have as pilots? How do we manage the knowledge related to water distribution, plant /crop conditions, irrigation control, etc. Should it be presented somehow?

There are many popular Knowledge Management Systems used nowadays. Some of these tools are used as part of the *SWAMP* development and are listed below:

- Microsoft OneDrive: Cloud storage for document sharing and backup.
- Microsoft SharePoint: Cloud tool for collaborative document editing.
- Microsoft Teams: Online collaborative system that connects the entire business, where everyone can create, share, discuss and discover a lot of resources.
- Website (http://swamp-project.org/): containing a description of project goals, partner descriptions, discussion forum, calendar of events, etc.
- Regularly telephone calls or Skype chats for informal exchange.
- Mailing Lists: several mailing lists are in place, organized by topic and Work Package.
- GoToMeeting: Allows hosting an online meeting with up to 15 people and sharing any application on your computer in real time. Made for Web and Telephone conferences enabling regular synchronization and collaborative work of project partners.
- RNP GitLab: A Web-based Git repository hosting service. It offers all of the distributed revision control and source code management (SCM) functionality of Git as well as adding its own features. Unlike Git, which is strictly a command-line tool, GitLab provides a Web-based graphical interface and desktop as well as mobile integration. It also provides access control and several collaboration features such as bug tracking, feature requests, task management, and wikis for every project.
- Common Information Model (CIM) for SWAMP pilots: The project will develop a CIM for representing the data collected in the pilots to manage the knowledge related to water distribution, plant /crop conditions, irrigation control, etc.

Apart from support by those technical systems, knowledge is shared among project partners in the regular project and work package meetings with talks, brain storming and workshops.

6. IPR and IP Protection Tools

6.1. IPR General Overview

The concern with protecting the rights of authors of intellectual works is fairly recent (1883 – Convention of Paris). Though, this type of concern came much before 1883, books for examples had the number of copies naturally limited by the manual labour of the copyists, there were no difficulties in the process of distinction and reproduction of goods before modern industry arises. With the invention of printing, the rulers felt threatened by the impending democratization of information and created an early cunning instrument of censorship, which permitted the owners of the means of production of books achieve security.

In this context, IPR is represented by a set of national and international frameworks, which have evolved over more than a century. The IPR system is determined by wider political and commercial considerations. Increasing emphasis is being given to IP in the context of international trade negotiations in response to the theory of the rise of the Knowledge-based economy.

"IPR are legally enforceable rights over the use of inventions or other creative works. IPR creates rights over the embodiments of intangible ideas, but not over ideas themselves. Like all property rights, they confer a right to exclude others from their use (ETAN Expert Working Group, 1999)". In parallel to the development, it can be observed that traditional property rights on physical goods are complemented or even displaced more and more by intellectual rights, including IPR.

The premise underlying IP throughout its history has been that the recognition and rewards associated with ownership of inventions and creative works stimulate further inventive and creative activity that, in turn, stimulates economic growth. In brief, IP tools are powerful drivers for economic development.

6.2. IP Protection Tools

According Imprint (2012): "*Intellectual Property is an important tool for the economic, social and cultural development of all countries. It is very important to know how to use and protect effectively IP*". Intellectual property may refer to any type of new creation: inventions, literary and artistic works, symbols, names and images, used in commerce. It is crucial to both protect IP and properly choose which group or partners to share innovations and trade knowledge. In order to operate on foreign markets, international regulations must be well defined and studied.

In brief, IP tools may be classified in four groups with different characteristics of criteria, expiring time, registration type and competent authority. Some of these are presented in the next table:

Table 2 - Classification of the IP tools

IP Tools	Patents	Utility Models	Trademarks	Copyright
Criteria	New inventive process, machine or article. Industrial applications	Innovations of a rather incremental character	Products, services, words, names, colours, and/or sound	Literary graphic, or musical works, software
Approximated Expiring Cycles	20 years	10 years in most EU member states	10 years, indefinitely renewable	Author's lifetime +70 years
Registration	National Patents European applications	National utility models (not	National trademarks Community	No registration

	International applications. Patent Cooperation Treaty (PCT)	available in all EU) International application (PCT)	International registration of trademarks	The protection arises through the act of creation
Competent Authority	National patent offices. EPO (European Patent Organization)	National patent offices	National patent offices	Does not have.

6.2.1. Patents

Patents in the modern sense originated in 1474, when the Republic of Venice published a decree in which new and inventive devices, once created, had to be communicated to the Republic in order to obtain the right to prevent others from using them (Schippel, 2001). At a first moment, it was an instrument related to the industrial society. Recently, the concept was expanded, and to accept patents on many other characteristics and possibilities of use, such as living organisms.

Nowadays, the most common definition states that the term patent usually refers to "an exclusive right granted to anyone who invents any new, useful, and non-obvious process, machine, article of manufacture, or composition of matter, or any new and useful improvement, and claims that right in a formal patent application (Wikimedia Foundation, Inc, 2012)".

A patent is not a right to practice or use the invention; rather, it provides the right to exclude others from using, selling or offering for sale the invention for the term of the patent, which is usually 20 years from the filing date subject to the payment of maintenance fees. Like any other property right, it may be sold, licensed, assigned or transferred, given away, or simply abandoned.

However, having a patent does not necessarily give the owner the right to exploit it. For example, many inventions are improvements of prior inventions that may still be covered by someone else's patent. "If an inventor takes an existing, patented mouse trap design, adds a new feature to make an improved mouse trap, and obtains a patent on the improvement, he or she can only legally build his or her improved mouse trap with permission from the patent holder of the original mouse trap, assuming the original patent is still in force (Wikimedia Foundation, Inc, 2012)." On the other hand, the owner of the improved mouse trap patent can exclude the original patent owner from using the improvement.

Although a definition has been stated in this document, different countries and regional offices have different standards for granting patents. This is applied for software or computer-implemented inventions, especially where the software is implementing a business method.

The European Union member states, EPO and other national patent offices have issued many patents for inventions involving software since the European Patent Convention (EPC) came into force in the late 1970s. "Articles 52 EPC excludes "programs for computers" from patentability to the extent that a patent application relates to a computer program "as such" (Wikimedia Foundation, Inc, 2012)". This has been interpreted to mean that any invention that makes a new "technical contribution" or solves a "technical problem" in a non-obvious way is patentable even if that technical problem is solved by running a computer program.

Computer-implemented inventions may have a significant difference related to its purpose. Inventions which only solve a business problem using a computer, rather than a technical problem, are considered "not patentable" as lacking an inventive step. Nevertheless, the fact that an invention is useful in business does not mean it is not patentable if it also solves a technical problem (Wikimedia Foundation, Inc, 2012).

The concept of "Patent" presented in this section may differ from the ones on other countries, due to their laws and standards. For this reason, it does not have a universally accepted definition. Moreover, because it is relatively new, software patent has also no universal concept associated. Additionally, there is an intense debate over the extent to which software patents should be granted, if at all. Important issues concerning software patents include:

- Where the boundary between patentable and non-patentable software should lie
- Whether the inventive step and non-obviousness requirement is applied too loosely to software
- Whether patents covering software discourage, rather than encourage, innovation.

6.2.2. Copyright

Original creations such as paintings, computer software, novels, and compositions (music) may be protected through many mechanisms. Copyright is the area of law that provides protection to original works of authorships. The legal protection afforded such works permits the development of cultural industries, as well as technology-oriented businesses based on computer software and other technologies (European Patent Office, 2007). Some particular characteristics of this type of IP are described:

- A Copyright does not protect ideas or principles.
- Copyrights do not considerate the quality or aesthetic aspects.
- Copyrights are not transferable.

In brief, copyright refers to "Laws that regulate the use of the work of a creator, such as an artist or author. This includes copying, distributing, altering and displaying creative, literary and other types of work. Unless otherwise stated in a contract, the author or creator of a work retains the copyright" (Lerner & Bresler , 2006).

The type of protection provided by a copyright is ideal for small companies or personal creation. Other intellectual protection tools may be very expensive or take many months to prevail, on the other hand, a copyright is commonly flexible, in other words, registration or any type of formality is not needed.

Protection provided by copyrights, however, is imperfect. Copyright may easily be bypassed, for example, a computer program that presents strong similarities with that of a competitor will not be investigated if the author can prove that his creation is independent.

"It is generally accepted by judicial doctrine that the "blind room" method enables programmers to acquire an independent creation. The implementation of such a technique requires two teams of researchers. (Collaboration@Rural, 2007)" The first dissects and analyses the competitors' products, then it transmits the results to a second team who develops a new product based on the first team's results. By comparing the progress and outputs of the program, similarities may be discovered.

6.2.3. Utility model

Defining of the term "utility model" is a hard task due to the fact that there is no global acceptance of the term because there are fundamentally different concepts from one country to another, in Australia the term is "innovation patent", in Malaysia is "utility innovation" and in France is "utility certificate". Some systems define utility models as "intangible subject matter such as technical concepts or inventions or devices, while others anchor their definitions to three dimensional forms" (Suthersanen, 2006). Yet others profess to grant "utility model" protection which, in actuality, is equivalent to patent protection without examination and for a shorter duration. Thus, "utility model" is a generic term which

refers to an exclusive right granted for an invention, which allows the right holder to prevent others from commercially using the protected invention, without his authorization, for a limited period of time (World Intellectual Property Organization, 2012).

Nevertheless, the term is commonly used by many jurists to refer to a second layer of the patent system, offering an advantage of being cheap, no-examination protection regime for technical inventions which would not usually fulfil the strict patentability criteria. Although there is no single definition, there are few common characteristics to all the national "utility model" laws from a global perspective, which are:

- All utility model laws confer exclusive rights on the proprietor of the right (as opposed to an anti-copying right)
- Novelty is a criterion in all utility model systems, though the standard of novelty varies widely.
- Registration is a requirement but that usually there is no substantive examination of applications.
- Most utility model laws protect the technical character of the invention, as opposed to the ornamental function or the appearance of the product (Suthersanen, 2006).

Utility models may be considered especially beneficial for developing countries that are advancing their technological capacities through local innovation by small and medium enterprises (SMEs). SMEs have strong presence in those industries where cumulative innovation is the norm and unfair copying is rife. Indeed, it is often mentioned that a rapid second tier patent regime may improve the legal environment for SMEs, especially those which are engaged in an ongoing process of innovation.

This type of IP relies mostly in relation to special product sectors which are concerned with incremental and improvement innovation and not with revolutionary technological breakthroughs.

In its basic definition, which may vary from one country to another, a utility model is similar to a patent. In fact, utility models are sometimes referred to as "innovation patents."

Few differences between utility models and patents are described below:

- The requirements for acquiring a utility model are less stringent than for patents. In practice, protection for utility models is often sought for innovations of a rather incremental character which may not meet the patentability criteria.
- The term of protection for utility models is commonly shorter than for patents and varies from country to another (usually between 7 and 10 years without the possibility of extension or renewal).

In most countries where utility model protection is available, patent offices do not examine applications as to substance prior to registration. This means that the registration process is often significantly simpler and faster, taking, on average, six months. In most places, utility model protection can only be obtained for certain fields of technology, only for products but not for processes (World Intellectual Property Organization, 2012).

6.2.4. Trademark

Trademarks are used by businesses to distinguish their services and products from those of competitors. A registered trade mark may provide you with exclusive and automatic rights to a brand. This section describes the essential concepts, comparison with other IP mechanisms and main characteristics of the "Trademark" term.

A trademark may be characterized by the following symbols:

- ™ (for an unregistered trade mark, that is, a mark used to promote or brand goods)

- ℠ (for an unregistered service mark, that is, a mark used to promote or brand services)
- ® (for a registered trademark or service mark)

"A trademark is typically a name, word, phrase, logo, symbol, design, image, or a combination of these elements" (American Law Institute, 2009). There is also a range of non-conventional trademarks comprising marks which do not fall into these standard categories. In brief a trademark can be one, or a combination of, the following:

- a business name
- a product name
- a sub-brand
- a distinctive catch phrase
- a logo, picture or symbol
- a distinctive product shape
- an aspect of packaging
- a scent

After registering a trademark, the owner of the product or process has legal responsibility and this prevents unauthorized use of that trademark. However, in some countries unregistered rights in a sign may also be enforced. The essential function of a trademark is to exclusively identify the commercial source or origin of products or services; it indicates source or serves as a badge of origin.

"It should be noted that trademark rights generally arise out of the use or to maintain exclusive rights over that sign in relation to certain products or services, assuming there are no other trademark objections" (Wikimedia Foundation, Inc., 2012).

It is important to clarify differences between patents, copyrights and trademarks, some important points are listed below:

- While trademark law seeks to protect indications of the commercial source of products or services, patent law generally seeks to protect new and useful inventions.
- Copyright law differs from trademark concept because it generally seeks to protect original literary, artistic and other creative works, whereas is in use mostly in commercial or industrial products and services.

Patents and copyrights cannot be 'abandoned' and a patent holder or copyright owner can generally enforce their rights without taking any particular action to maintain the patent or copyright. On the other hand, a trademark must be used to maintain rights in relation to that mark.

6.2.5. Open source

The open source definition is much more than free access into the software source code. It is a philosophical concept that cherish for a few criteria.

Free redistribution is on top of the list. It is the main key to the open source concept. The software that had being distributed must be redistributed to anyone else without any restriction. This includes the source code as well. Furthermore, the license shall not require any royalties or any type of fee for sale or other purpose (Opensource.org, 2012).

But there are some restrictions, the license may restrict source code from being redistributed in modified form only for instance and must not discriminate any person or group of persons. Even more, it cannot

be restricted the use of the program in any field of endeavor (Opensource.org, 2012). This means that the program can be used in any type of business and even genetic and scientific research.

Open source code is typically created as a collaborative effort in which programmers improve upon the code and share the changes within the community (ITBusinessEdge, 2012). This is one of the biggest advantages of open source, because it makes the bugs number much lower and the development of the software way faster than proprietary solutions. Moreover, there are other features that may be taken into account (Wikimedia Foundation, Inc, 2012).

- Security;
- Affordability;
- Transparency;
- Perpetuity;
- Interoperability;
- Localization.

Open Source movement is not something anti-capitalist or anarchist, but an alternative business model for the software industry. The collaborative model of intellectual production offers a new paradigm for copyright law. Some large companies have also invested in open source software, joining efforts to create an Open Source Development Lab (OSDL), an institution designed for the creation of open source technologies.

The success of automation in the industry depends heavily on choosing the correct tool. For this, it should also consider factors such as purpose, efficiency, usability, product type and cost (Renner, 2010). It is very advisable for all mentioned advantages to look for open source tools that can be tailored to the needs of each company.

6.2.6. Licenses

Software Licenses are the legal agreements that allow users to use, distribute or modify software. Depending on the license these parameters may change to a more open or restrictive approach.

This topic encompasses more than just software licenses, it also addresses the concept of copyleft and copyright, known as the major license systems in the market. About the copyleft system is important to mention that copyright law is used to enforce the removal of restrictions on distributing copies and modified versions of any kind of work (Answers 2000 Limited, 2012). Can then be said that copyleft is a legal mechanism to ensure that intellectual property rights holders could license the use of their works beyond the limits of the law, though supported by it. In this case licensees would be guaranteed to avail himself of the works of others under protection of a public license (Lemos & Júnior, 2006).

“GPL” or General Public license is perhaps the best known license that uses the concept of copyleft. It was originally created (1989) by Richard Stallman for the GNU project with the idea of ending the problem that free software faced with multiple licenses in several different programs, which meant that the programs could not share code. One interesting fact about GPL license is that it does not allow modification of the work to be made in private. All of then must be distributed and shared under the GPL. LGPL which is also quite described is a derivative of the GPL designed mostly for software libraries (O'Reilly & Associates, Inc., 2000).

Another license that is widely used because of the massive use of its products is the Apache license that was created by the "Apache Software Foundation" in order to achieve the goal of providing reliable and long-lived software products that were open source collaborative. The newer version of it, is the 2.0

version (2004). The primary goal is to allow the license to be reusable without modification by any project and to allow the license to be included by reference instead of listed in every file (O'Reilly & Associates, Inc., 2000). With this, the Apache Software Foundation created a license that is compatible with other open sources licenses and yet still remaining true to the original goal of the Apache group.

Another relevant license is the MIT license which is a free software license originating at the Massachusetts Institute of Technology (MIT). It is a permissive free software license, meaning that it permits reuse within proprietary software provided all copies of the licensed software include a copy of the MIT License terms and the copyright notice. Such proprietary software retains its proprietary nature even though it incorporates software under the MIT License. The license is also GPL-compatible, meaning that the GPL permits combination and redistribution with software that uses the MIT License. This license is often used in Python and Node.js packages.

Finally, it is good to talk about the Mozilla Public License or "MPL". The MPL has been described as containing a mix of characteristics from other licenses, but is not generally compatible with the GPL (O'Reilly & Associates, Inc., 2000). The license is a weak copyleft and it requires source code that is copied or changed under the MPL must stay under the MPL, which makes a choice not so good (Answers 2000 Limited, 2012).

Choosing a license is not an easy job, but if the software holder wants to be all covered and if the software is open source, the best choice should be GPL license. It is solid and very used for many applications from home to industrial automation.

6.2.7. Software protection

Create a form to protect the software is still necessary, even after it goes under a license, especially if it is open source.

In many countries, courts have held software to be within the subject matter protection of existing copyright law. Generally, copyright laws protect the form of expression of an idea, but not the idea itself. With respect to software, this typically means that the computer program, in both human-readable and machine-executable form, and the related manuals are eligible for copyright protection, but the methods and algorithms within a program are not protected expression (Fenwick & West LLP, 2008).

The main concern is that because free and open source software is built with the source code publically available, access is also open to hackers and all sorts of malicious users. As a result, there could be the assumption that this kind of software is less secure than proprietary applications. In addition, there is the thought that free and open source community is a little bit slow to emit critical software patches as vulnerabilities emerge. Studies show that these concerns are unfounded and open source can match other types of software for security and, in several cases, offer greater and reliable security (TechTarget, 2008).

6.2.8. SWAMP IPR Strategy

To begin with, the whole project and consortium is committed to principles of open research, e.g. providing results on open access fora, sharing code under open source licenses, and sharing the research results in general to be applied in open innovation. The IPR principles described below are only used in very exceptional situations that we are not aware yet. Also, there are other documents that may provide detailed information about this topic, such as the Consortium Agreement *SWAMP*.

6.2.8.1. Access Rights and Ownership

In the first place, Foreground (project results) and Background (project basis) should be used only for the purposes for which Access Rights to it have been granted. In order to have Access Rights, its request may be made up to twelve months after the end of the Project or, in the case of Art. 9.6.2.6 of the *SWAMP* Coordination Agreement (CooA), after the termination of the requesting Party's participation in the project.

The granting of Access Rights may be made conditional on the acceptance of specific conditions aimed at ensuring that these rights will be used only for the intended purpose and that appropriate confidentiality obligations are in place.

Also, the Access Rights to own Foreground should be granted on fair and reasonable conditions. Access Rights for internal research activities including for third-party research shall be granted on a royalty-free basis, however, such Access Rights do not include that Foreground of another Party may be passed on to or accessed by any third party.

It is important to state that no joint ownership has yet been concluded. However, the consortium agreement presents that each of the joint owners should be entitled to use their jointly owned Foreground on a royalty-free basis, and without requiring the prior consent of the other joint owners.

6.2.8.2. Dissemination Activities

This sub-section describes the main concerns about the dissemination of information for academic and commercial purposes such as products and publications.

Dissemination activities such as publications must be guided by the procedure of Article 29.1 of the EC-GA; A notification has to be provided 45 days before the publication. Also, any objection should be made in accordance with the GA in writing to the Coordinator and to any Party concerned within 30 days after receipt of the notice. If no objection is made within the time limit stated above, the publication is permitted. An objection is justified either if the claiming part´s legitimate academic or commercial interests are compromised by the publication or the protection of the objecting Party's Foreground or Background is affected. However, it has to include request for necessary modifications.

It is also recommended that anyone publishes Foreground or Background of another Party, even if such Foreground or Background is related with the Party's Foreground, without the other Party's prior written approval. On the other hand, publication and defense of any dissertation or thesis for a degree which includes other parties Foreground or Background must be accepted by the partners, always respecting confidentiality and publication. More information may be found in section 8 of the *SWAMP* CooA.

Briefly, the IPR Strategy may consider the following:

- The use of single patent protection under enhanced cooperation in Europe to reduce filing costs.
- The software produced by the members of the *SWAMP* consortium is available to all its members for internal use in the project activities. The software must be jointly copyrighted, or the MIT license used.
- The choice of type of copyright is a decision that should be made by the *SWAMP* partners in a joint decision.
- Project patents should be filed first in the US to ensure that they have a real chance for becoming accepted. These could be filed in Europe and Brazil in a second phase.
- IPR costs are met using the *SWAMP* own project resources.

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