USING CONVERSATIONAL KNOWLEDGE MANAGEMENT AS A LENS FOR VIRTUAL COLLABORATION IN THE COURSE OF SMALL GROUP ACTIVITIES

by

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Abstract

During the last two decades, Knowledge Management (KM) has emerged as a truly interdisciplinary and actively research field building on scholarships from social sciences (i.e., sociology, organization and management) as well as engineering (i.e., information science, Human-Computer Interactions and Computer-supported cooperative work). Indeed, it is widely acknowledged that effective Knowledge Management is critical for business success and prosperity. This has sparked substantial investments on Information Technologies (IT) to create solutions favorable to making knowledge an evolving organizational asset sharable among employees and accountable for.

To this effect, various conceptual frames of reference have been proposed to address key research questions such as the type of knowledge needed and the processes through which it is captured, codified and appropriated by end users. Consequently, since the importance of utilizing knowledge resources is ever increasing as well as most modern organizations demand the right knowledge at the right time, two issues have become imperative – the quality of information and the information processing capacity of knowledge management technologies.

This present thesis focuses on a relatively recent approach to knowledge management and collaborative learning, namely Conversational Knowledge Management (CKM). The term coins the shift in perspective from explicitly codified forms of knowledge to knowledge that is tacit, frequently circumstantial and most often embedded in informal dialoguing patterns of collaborating peers in the course of small group settings. Phrased differently, CKM emphasizes the local and situated activities in which knowledge proliferates (in a myriad of forms) rather than the general and global contexts that characterize its appropriation. Consistent with such a commitment to the local and situated, the present work examines technologies that may be conductive to successful CKM practices. The lens through which we approach this target is informed by scholarships mainly in the fields of Information Systems, Computer Science and especially in the area of Computer Supported Collaboration Work.

Specifically, using empirical data from a case study, we identify prominent conversational patterns and assess intrinsic properties of the media types through which they are articulated. This helps anchor these patterns as ‘Dialogue for Action’ in the tradition of the Language-Action perspective and consolidate their scope in relation to certain pre-conditions and

outcomes. Based on these findings, we then consider suitable design tactics that inject conversational capabilities into portlets of the Liferay portal so as to foster collaborative exchanges amongst peers engaged in constructive argumentation to negotiate details and establish common ground in a knowledge-intensive task, namely qualitative data analysis.

In light of the above, the main contributions of the present research are two-fold. On the one hand, it frames computer-mediated conversational discourse as a mix of peer dialogue exchanges (i.e., questions and answers, comments and structured argumentation), social constructs (i.e., invitations and role taking) and certain linguistic patterns for externalizing intentions (i.e., rating, voting and tagging). Then, online discourse becomes an enacted social accomplishment of peer groups capable of appropriating certain technologies. On the other hand, it demonstrates the application of this concept in a concrete case study where small groups exploit dedicated tools (i.e., portlets of the Liferay portal) explicitly designed to foster conversational knowledge management in the course of analyzing qualitative data samples - a task widely acknowledged as demanding and knowledge-intensive.

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List of Acronyms

(CCSAV)	Collaborative Computer-Supported Argument Visualization
(CKM)	Conversational Knowledge Management
(CMC)	Computer Mediated Conversation
(CoP)	Communities of Practice
(CS)	Computer Science
(CSCW)	Computer Supported Collaboration Work
(DfA)	Dialog for Action
(DSS)	Decision Support Systems
(FAQ)	Frequently Asked Questions
(FtF)	face-to-face
(ICT)	Information and communications technology
(IS)	Information Science
(KM)	Knowledge Management
(KMS)	Knowledge Management Systems
(LAP)	Language-Action Perspective
(WoM)	Word-of-Mouth

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Chapter 1 - Introduction

Since the importance of utilizing information and knowledge resources in an organization is ever increasing as well as most modern organizations demand the right knowledge at the right time, two issues have become imperative – the quality of information and the information processing capacity of knowledge management technologies. In response to this imperative, knowledge management (KM) has emerged as one of the most actively and intensively researched fields of science and engineering in the past two decades, with an ever increasing number of companies investing on the development and implementation of knowledge management tools. As a result, a variety of models and techniques have been proposed to serve knowledge management in industry, public institutions and service sectors such as tourism, education and learning.

In spite of recent progress there are still debates on what knowledge management actually is and how it is mediated by the variety of technologies available. According to Sarmento et al., (Sarmento, Ramos, Carvalho, Lopes, & Morais, 2005), the definition of Knowledge Management is not a simple task as it coins an interdisciplinary area that accepts contributions from different fields including social and engineering disciplines such as Organizational Theory, Management Science, Psychology, Sociology of Knowledge, Information Systems and Computer Science. Each of these fields contributes to Knowledge Management with theoretical frames of reference, tools, technologies and engineering paradigms. In a similar vein, Hong, Suh, & Koo (2011) claim that "…knowledge management involves the systematic management of vital knowledge resources and the associated processes of creating, gathering, organizing, diffusion, utilizing and exploiting information".

Although early research focused largely on the explicit and formal representation of knowledge in computer-based KM systems (KMS), more recent approaches acknowledge the compelling need for tackling implicit, informal and tacit knowledge (Davison, Ou, & Martinsons, 2013; Holste & Fields, 2010) in an effort to alleviate barriers (both individual and organizational) that prevent firms from effective knowledge sharing (Hong, Suh, & Koo, 2011). A consequence of this shift in perspective has been the call for Conversational Knowledge Management (CKM) which is the topic of the present research. Scholars attribute this shift to the evolution of technology and the advent of web 2.0 tools which arguably catalyzes a change from conventional and formal approaches to more interactive, informal and conversational models of knowledge management (Hong, Suh, & Koo, 2011). Indeed, the advent of Web 2.0 technologies and the proliferation of social technologies have brought about novel linguistic vocabularies (i.e., social widgets, tagging schemes, etc.) that serve the purposes of CK management just as well as the more traditional means.

The term Conversational knowledge (CK) is frequently used to coin knowledge that is embedded in informal dialoguing patterns of peer collaborators (Lee & Lan, 2007) and emphasizes the tacit, the circumstantial and social aspects of knowledge management (Hong, Suh, & Koo, 2011; Davison, Ou, & Martinsons, 2013; Holste & Fields, 2010; Lee, Kim, & Koh, 2009; Majchrzak, Wagner, & Yates, 2013).

Arguably, this is valid both for small group activities as well as organizational settings where knowledge is actually shared informally (Davison, Ou, & Martinsons, 2013).

CK management differs from more traditional knowledge management methods in the fact that CK is targeted on collective intelligence rather than the mere accumulation of knowledge as codified in repositories (Lee & Lan, 2007). As a result CK entails a more interactive and collaborative approach which relies heavily on an emergent process of creating and sharing knowledge through peer collaboration and communication (Lee & Lan, 2007), (Davison, Ou, & Martinsons, 2013). Due to its nature, CK is typically embedded and retained in "conversational" patterns such as narratives and storytelling where peers can raise issues and engage in argumentation. As such CK is profoundly evident and proliferates in "Communities of Practice" (CoP) - a term describing groups of people who are interested in the same topics and share a common practice (Wenger, 1990).

Although CK is appealing and frequently cited in the knowledge management scholarship, it remains largely under-theorized. One of the reasons appears to be the lack of appropriate credibility mechanisms (Hong, Suh, & Koo, 2011). In computer-mediated settings, credibility of user-generated contents is a crucial issue that may distract people from making purposeful use of available information and knowledge. Many people do not easily trust articles created from contributors whom they do not know by name or whose experience and point of view are unclear or dubious (Hong, Suh, & Koo, 2011). This is further complicated when physical referents are substituted by digital accounts or profiles that stand for people, or when there is suspension that the user of the account may not actually be the owner of this account. Phrased differently, in computer-supported conversational knowledge management contexts, there are aspects of conversations that are hidden in details or preconceptions inscribed in technology. Consequently, it is both critical and timely for the research community to invest on developing new methods and techniques that 'speak-out' the value of credible contents and users.

The present work concentrates on a particular thread of research that explores CK management and its possible applications in small group collaborative settings where the outcome of the collaboration is determined by the reliability of both tacit and explicit knowledge as it is being shared amongst credible peers. One such representative case is when remote experts co-engage to acquire skills and build new competencies by exploring, negotiating points of view and capitalizing on peer expertise and involvement. A typical case of this sort of collaborative engagement may be found in e-learning situations where peers seek to disentangle aspects of an unknown topic. Another case is when experts collaborate to analyze qualitative data from interview transcripts with a given coding scheme (based on an existing theory) or when the coding scheme is to be developed from scratch following qualitative data analysis techniques (i.e., open coding, inductive coding, etc.). Both cases depict small group endeavors where CK management can be assessed not only in terms of underlying theory but also with respect to practical challenges and implications for knowledge-intensive virtual work.

Motivation and research questions

Small group activities, such as those implicated in the two cases outlined above, pose several challenges for CKM and the supporting tools. Firstly, they make compelling the need for detailed analysis of the digital 'episodes' in which knowledge is embedded, exchanged and shared. In face to face situations, the users' co-presence, the shared context and the use of language create favorable conditions for humans to express opinion, reflect on what is being addressed and contribute to debates. However, in virtual settings co-presence is conditional, the shared context is limited and the use of language is replaced by computer-mediated linguistic conventions. Thus, digital 'episodes' may be anchored differently and in relation to various premises. Secondly, whereas in face to face settings conversations can be easily framed in standard communicative patterns such as expressing opinion, turn-taking, argumentation, story-telling or even civic inattention, in virtual settings some of these become meaningless (e.g., there is no expression of civic inattention) while additional acts such as tagging resources may be understood as communicative patters. Due to the above, CKM as a computer-mediated practice deserves special attention.

In the light of the above, the present research sets out to address pre-requisites and outcomes of CKM systems. To this effect, the work is motivated by certain research questions which can be formulated as follows:

- Which are the features of an effective CKM system?
- What are the requirements of an interactive system that supports collaborative CKM tasks?
- Can CKM systems provide a baseline for virtual work in the course of small group activities and how can this be facilitated through designing appropriate dialectical tools?

Many technologies can be used to facilitate CKM. However, despite the variety of CKM tools, there are aspects of conversations that are still hidden in details or preconceptions inscribed in technology. Thus, for instance the right to co-engage (in conversational patterns) frequently assumes registration (under certain terms and conditions) to create a profile for the users' virtual presence. Typically, co-engagement is mediated by representations that stand for users (i.e., their voice, text on screen or highlighter) and invite for certain uses (i.e., pressing a button to convey state of mind or opinion, introducing tags to externalize cognitive behavior, etc.) while constraining others (i.e., dismissing the importance of reputation, turn-taking, use of metaphor, indexing, etc.). Such simple observations have implications for what it is that may be part of online discourse and the underlying organization of conversations. For instance, in the Twitter micro-blogging platform online discourse is anchored by linguistic markers such as the hashtag. As a result, tweeting and retweeting in combination with the asymmetric social network model create opportunities for conversations that are different from other computer-mediated conversations. For instance, Twitter makes it possible for ambient affiliates who may not know each other or who may have never interacted before to engage in conversations. Therefore, it

may be concluded that conversational patterns are hidden in intrinsic details and preconceptions inscribed in technology. This anchors online conversation as relative to certain affordances of the software and/or the medium that determines the range of possible exchanges. Such affordances may relate to:

1. How users are represented in the digital setting
2. What is possible to be expressed
3. What may not be easily expressed using virtual referents or what was unnoticed and is now brought to the forefront as a result of new linguistic constructs

Consequently, any meaningful analysis of computer-mediated conversational acts requires an understanding of the technology and the tools that capture the social and collaborative aspects of knowledge management.

The present work concentrates precisely on the challenges outlined above and attempts to investigate both methodological as well as engineering aspects of effective CKM systems. This is approached by using a formative case study as a research method that allows investigation of a phenomenon within its real-life context. Our case study aims to (a) identify popular conversational patterns in small group activities; (b) assess the suitability of current technologies and tools, and (c) devise a model for conversational co-engagement that takes into account features of web 2.0. In terms of phases, our methodology is structured as follows. In the preparatory phase, we identified conversational patterns by examining qualitative data transcripts. Then, based on Language Action Perspective (LAP) we modeled the patterns identified forming an online discourse. Finally, the last step entailed the design of Liferay portlets that exhibit the LAP model.

Contribution

This thesis sets out to investigate and implement mechanisms that will facilitate the creation and sharing of both tacit and explicit knowledge, fostering reliable contents from credible contributors with experience in a specific domain. The perspective adopted shares common ground with scholarships in the fields of Information Systems, Computer Science and especially in the area of Computer Supported Collaboration Work. The main contributions are two-fold. Firstly, we advance a proposition that anchors computer-mediated conversational discourse as a mix of peer dialogue exchanges (i.e., questions and answers, comments and structured argumentation), social constructs (i.e., invitations and role taking) and certain linguistic patterns for externalizing intentions (i.e., rating, voting and tagging). Secondly, we demonstrate the application of this concept in a concrete case study where small groups exploit dedicated tools (i.e., portlets of the Liferay portal) explicitly designed to foster conversational knowledge management in the course of analyzing qualitative data.

The above establish a baseline for assessing not only the value of CKM but also its practical challenges and implications for knowledge-intensive virtual work. The latter is illustrated by means of developing a *working prototype* influenced by the Language-Action perspective on Information Systems development. This prototype facilitates creation and sharing of both tacit and explicit knowledge. Additionally, it fosters mechanism for acquiring reliable contents from credible contributors with experience in a specific domain.

Finally, although the reference domain of the present work is specific and targeted, the analysis aims to advance more general insights on how collaborative technologies can create new knowledge.

Outline

This thesis consists of seven chapters. The first chapter provides an introduction of the research, focusing on the targets set, the underlying rationale and the aim and the objectives of the research. The second chapter is a literature review, which provides a consolidated account of the subject matter, namely Knowledge Management, with emphasis on Conversational Knowledge Management. In the third chapter we investigate popular conversational patterns, their media types and the technologies through which they are supported. In the next chapter, we present the methodology guiding our empirical inquiry in a specific setting, the approach to identifying core conversational patterns as well as their modeling as Dialog for Action. Based on these models, the fifth chapter discusses the implementation of a system for CK management. Chapter six elaborates on the system by describing a use case that depicts a realistic scenario. The final chapter concludes the thesis and discusses implications and future work.

Chapter 2 - Literature Review

Knowledge Management

Knowledge management (KM) features as one of the emerging subjects of academic and professional discourse across different disciplines, such as information science (IS), sociology, cognitive sciences, management science, economics, artificial intelligence or knowledge engineering (Kebede, 2010). During the last decades, knowledge management gained increased attention as a source of competitive advantage (Wagner, 2004), with more and more firms investing on effective knowledge management in an attempt to enhance the strategic value of organizations and their competitiveness (Lee, Kim, & Koh, 2009). According to Lee, Kim, & Koh (2009), the reasons why Knowledge management is very essential are as follows: (a) knowledge facilitates sustainable, heterogeneous resource distribution (b) knowledge changes the nature of resource investment decisions (c) knowledge changes the nature of work and property and (d) knowledge emphasizes the social context.

Definition of Knowledge Management

To define Knowledge Management is not an easy task since KM is emerging as an interdisciplinary area and it is affected from different disciplines such as Management Science, Organizational Theory, Sociology of Knowledge, Information Systems, Psychology and Computer Science. Each area explores Knowledge management from different lenses bringing up a diversity of theories, methodologies, paradigms, technologies and tools (Sarmento, Ramos, Carvalho, Lopes, & Morais, 2005). In this section, we will attempt to approach this term from the field of Computer Science and Information Systems, although we acknowdge different perceptions that may exist in other scientific literatures.

According to Hong, Suh, & Koo (2011) Knowledge Management involves the systematic management of vital knowledge resources and the associated processes of creation, accumulation, organization, dissemination, use as well as the exploitation of information. Furthermore, Fadzil, Jaafar, Abdullah, & Murad (2013) refer to KM as a process to identify, develop, and effectively apply the existing organizational knowledge in order to accomplish the organizational aims, while further knowledge can be created. Knowledge management is also defined as a method to apply the selective knowledge from past experience to the current and future decision making activities in order to improve the organizational effectiveness (Fadzil, Jaafar, Abdullah, & Murad, 2013). Nasser et al. in (Nasser H. Zaied, Gawaher Soliman, & Hassan, 2012) define the term ‘management of knowledge’ by referring to a definition of Wiig (1995) where Knowledge Management is “a process that helps organizations to find, select, organize, disseminate, and transfer important information and expertise necessary for activities. Finally, Smith (2001) and Liss (1999) consider knowledge management as “a formal, directed process of determining what information a company has that could benefit others in the company and then devising ways to making it easily”.

According to Dorairaj, Noble, & Malik (2012) knowledge management comprises four key processes:

- *Knowledge **generation*** (creation and acquisition),
- *Knowledge **codification*** (storing),
- *Knowledge **transfer*** (sharing) and
- *Knowledge **application*** (use)

Knowledge generation is the creation of innovation and opportunities for problem solving, and obtaining knowledge from external sources. Knowledge codification is the translation of tacit knowledge into explicit knowledge in written or verbal forms for storage in repositories. Knowledge transfer is sharing of knowledge between individuals within an organization. Finally, Knowledge application is the use of knowledge to acquire the competitive advantage.

According to (Hong, Suh, & Koo, 2011), knowledge sharing is the most critical process of knowledge management, since effective knowledge sharing practices allow individuals to reuse and regenerate knowledge at the individual and organizational level.

Traditional models of KM refer to a framework of centralized repository that accumulates large amounts of information. Knowledge in repositories has not been aggregated in order to create new intelligence. Actually, it refers to an aggregation of knowledge creating from the combination of knowledge and experience of individuals and workers within the organizations or the society (Lee & Lan, 2007). It is a model of expertise where knowledge is gathered from the expert members of an organization or a community, thus it is also known as expert model (Majchrzak, Wagner, & Yates, 2013). However, this traditional view faces some challenges and weaknesses which have lately resulted in calls for alternative models of KM.

Definition of Key terms

Before attempting a more elaborate review, we consider important to define some key terms, such as data, information and knowledge.

Data: Each scientific discipline defines differently the term of data. According to (Davenport & Prusak, 2005), data is a "set of discrete, objective facts about events". In an organizational context, data is most usefully described as structured records of transactions.

Information: It is described as "a message, usually in the form of a document or an audible or visible communication" (Davenport & Prusak, 2005).

Knowledge: It can be defined as the information in conjunction with experience, context, interpretation, and reflection. Since knowledge is ready to be used to decisions or actions it is a high-value form of information (ElMaraghy, 2009), (Davenport & Prusak, 2005). It is common to qualify two types of knowledge, namely formal or codified knowledge and tacit knowledge or informal (Nonaka, 1994; Nonaka & Takeuchi, 1995; Raman, 2006; Hasan & Pfaff, 2006). Neither of this kind of knowledge is superior, better or more efficient, but

each complements the other. Indeed, both tacit and explicit knowledge must be freely shared among peers in order to facilitate the creation of new knowledge and better efficiency in companies.

Explicit – Formal knowledge is defined as the knowledge that can be transmitted in a formal and codified language (ElMaraghy, 2009), thus facilitating the centralized accumulation of knowledge in repositories. That is to say, formal or explicit knowledge is knowledge in computer based information technology (Davison, Ou, & Martinsons, 2013). By and large, previous scholarship has largely concentrated on this kind of knowledge. It is the type of knowledge easily articulated and documented (Lee, Kim, & Koh, 2009) or reduced to writing. It is often impersonal and formal in nature, thus it is typically found in reports, documents, catalogues, 'white papers', patents, presentations, or formulas (Holste & Fields, 2010). Lastly, according to Dorairaj, Noble, & Malik (2012), explicit knowledge is the academic knowledge or "know what" knowledge that can be represented in written or verbal forms.

Tacit or informal knowledge is a widespread but still untangled and more difficult to anchor. Tacit knowledge can take the form of abilities, developed skills, experience, intuition, judgment or values (Hasnain, Jasimuddin, & Chowdhury, 2013). It has highly personal quality and it is hard to formalize (ElMaraghy, 2009) and to share among peers (Lee, Kim, & Koh, 2009). Tacit knowledge is a form of knowledge that is subjective, hardly articulated, documented, or developed from direct experience, and thus it is very difficult to be tranfered to others (Fadzil, Jaafar, Abdullah, & Murad, 2013). As a result, this informal knowledge requires interactions among peers in order to be transmitted. Lastly, according to (Dorairaj, Noble, & Malik, 2012), tacit knowledge is the action-oriented or "know how" knowledge that guides human behavior but it cannot be openly expressed to demanding peers to interact (Davison, Ou, & Martinsons, 2013). Table 2.1 below depicts the features of both tacit and explicit knowledge.

Table 2.1: Tacit vs. Explicit Knowledge

Reference	Tacit Knowledge	Explicit Knowledge
(Lee, Kim, & Koh, 2009), (Holste & Fields, 2010) (Fadzil, Jaafar, Abdullah, & Murad, 2013) (Nonaka & Takeuchi, 1995)	It is not easy articulated so that it is very difficult to transfer to others.	Easily documented, codified
(Lee, Kim, & Koh, 2009)	Collaboration tools and CoPs may facilitate access to the tacit knowledge of the team.	
(Hahn & Subramani, 2000)	Personal quality	It is referred as the codifiable component that can be disembodied and transmitted
(Hahn & Subramani, 2000)	Know-how	Know-what
(Hahn & Subramani, 2000)	Emerges from action in a particular context	It can be extracted from the knowledge holder and shared with other individuals
(Fadzil, Jaafar, Abdullah, & Murad, 2013)	Tacit knowledge is a form of knowledge that is subjective.	It is a form of knowledge that is objective
(Holste & Fields, 2010), (Grover & Davenport, 2001)	Primarily transferred through direct interaction between individuals	Easily codified
(Holste & Fields, 2010), (Scott, 2000)	Transferred through face-to-face interaction, observation, imitation, practice	

Knowledge Management Systems

The need of most organizations for right knowledge at the right time as well as the augmented demand for management of knowledge have resulted in the development of a number of technologies ranging from simple single-user tools, to more advanced enterprise systems for content management or data mining (Wagner & Bolloju, 2005). For example, data warehousing and document repositories may be linked to search engines to support Knowledge Management. Knowledge Management Systems refer to information systems established in organizations to facilitate the accumulation, integration and sharing of knowledge within these organizations (Sampson & Zervas, 2013).

There are various genres of ICT tools that can be used for KM purposes. These include Decision Support Systems (DSS), email, voice mail, teleconference, videoconference, web conference, virtual work space, threaded discussions, instant messaging, online learning applications, FAQ (Frequently Asked Questions) database, reporting tools, e-calendars, data servers for repository of documents and others (Alhawari, Karadsheh, Talet, & Mansour, 2012). KMS serve the purpose of information sharing, discussion, brainstorming, collaboration on tasks and collaborative decision making. KMS usually facilitate individuals, small groups or firms to innovate, construct new knowledge in the group, and/or enhance customer experience. Effective KMS should aggregate content from both internal and external sources and they should support classification of content using taxonomies as well as search of information. Capturing, organizing, debugging and editing, disseminating, transferring and sharing of knowledge are also some other characteristic successful KMS should include.

The first types of KMS coined IT-based solutions whose functions included codifying and sharing of best practices in a knowledge repository and the creation of corporate knowledge directories and networks (Standing & Kiniti, 2011). Follwing the advent of Web 2 tools and the evolution of technology, KMS changed focus towards more interactive, informal and conversational management of knowledge.

Forms of Knowledge Management

This section elaborates on the traditional and emerging models of Knowledge Management. The term ‘traditional’ qualifies the early period of research were knowledge was by and large considered in its codified form. More recent works progressively emphasize the social and informal aspects of Knowledge Management and as such they shift the focus towards novel mechanisms for creating and sharing knowledge.

Traditional or Conventional KM

Traditional knowledge management coins a method of accumulating knowledge and codifying it in centralized repositories (Lee & Lan, 2007; ElMaraghy, 2009). This type of KM had been the prominent method to handle large quantities of information since the instigation of World Wide Web. During this period, the main stream of research emphasized the development of Knowledge management Systems (KMS). Standing & Kiniti

(2011) define traditional KMS as IT-based applications which are responsible for codifying and sharing best practices through knowledge repositories, as well as creating corporate knowledge directories and networks. In most of the cases, such systems were aimed at capturing the knowledge of the experts in a community. Indeed, they featured a perspective which relies on the knowledge of a few experts who supply large quantities of knowledge (Majchrzak, Wagner, & Yates, 2013). By implication, only a few can contribute to the accumulation of knowledge, thus this type of KM is also called expert KM. Expert KM is also known as formal KM since it is largely focused on the explicit and formal representation of knowledge in computer-based KM systems so that it can be transferred from its creator to other people who can then benefit from it (Davison, Ou, & Martinsons, 2013). Systems developed under this paradigm rely on precise, impersonal and rational rules to standardize and codify knowledge that can be archived and retrieved. These formal KMS are rarely designed to support unstructured, implicit and often ambiguous human interactions (Davison, Ou, & Martinsons, 2013).

Shift from traditional to Conversational

Although formal KMS have been successful in their set targets, it is widely acknowledged that informal and tacit knowledge is equally of not more important for competitive organizations. Several scholars have attempted to quantify the role of tacit knowledge by arguing that 80% of the organizational knowledge is stored in people's head (tacit knowledge), 16% is stored as unstructured, while only 4% is formalized and structured data (explicit knowledge) (Chirumalla, Larsson, Bertoni, & Larsson 2011; Bell, 2006). Moreover, tacit knowledge may increase an individual's academic learning and experience (Smith, 2001) and it also leverages the overall quality of knowledge. For instance, employees who do not have sufficient education, training, or explicit knowledge, try to keep up by depending on their common sense and premonition, or tacit knowledge, to get through the day (Smith, 2001). Therefore, tacit knowledge obviously plays an essential role in a firm or an organization.

In spite of the importance of tacit knowledge, traditional Knowledge Management Systems, that is formal computer-based KMS which are based on exact, formal, impersonal and sensible rules, do not often support informal knowledge archival and retrieval. Phrased differently, traditional KM tools that support formal knowledge and knowledge based on expert's awareness, information and experience, are not designed to support unstructured, implicit and often ambiguous human interactions (Davison, Ou, & Martinsons, 2013; Majchrzak, Wagner, & Yates, 2013). On the other hand, tacit knowledge that resides only in the minds of people is not easily managed. Its wider availability and use depends on peers' decisions, relationships and interactions, and this makes it difficult for traditional or formal KMS to encapsulate (Holste & Fields, 2010). Informal Knowledge demands more personal and interactive means where questions and answers are processed during discussions and conversations whereas traditional knowledge management practices do not support dialogs but only the accumulation of information and knowledge. This process deviates from the rationale of the

most KM applications. Therefore, there is a need for a change in the area of Knowledge Management and their tools to more interactive methods.

Apart from the weakness of traditional KMS to cope effectively with sharing tacit knowledge (Davison, Ou, & Martinsons, 2013), (Lee, Kim, & Koh, 2009), (Holste & Fields, 2010), they are also challenged by certain social barriers, individual and organizational (Hong, Suh, & Koo, 2011). One barrier is internal resistance, trust, motivation and a gap in awareness and knowledge (Hong, Suh, & Koo, 2011). For example, passing on knowledge or information to colleagues using a knowledge repository may be regarded as a revelation, since it declares that this knowledge is uncommon and has certain value. Other barriers may concern lack of time or willingness by experts to contribute the required knowledge which may delay the compilation of knowledge (Majchrzak, Wagner, & Yates, 2013) or lack of trust makes impossible the use of knowledge (Barson, et al., 2000; Hong, Suh, & Koo, 2011). Besides, some peers may not believe that knowledge sharing may be beneficial for them, thus they do not disseminate their knowledge (Hong, Suh, & Koo, 2011; Disterer, 2001). In addition, some employees have knowledge and understanding on a specific domain so they do not want to get information about already known things (Bureš, 2003; Hong, Suh, & Koo, 2011).

On the other hand, there are organizational limitations. Language, conflict avoidance procedures, bureaucracy (Disterer, 2001) and distance (Hong, Suh, & Koo, 2011) are the most noticeable bottlenecks a company may face in Knowledge management. For example, some languages are spoken only in one country, department or division so it is inconceivable for others (Bureš, 2003; Hong, Suh, & Koo, 2011). Furthermore, there are people who avoid change or risk. This can result in loss of creating new knowledge, new ideas and innovative points of view (Bureš, 2003). Bureaucracy is another barrier that can also have negative effects on knowledge sharing (Disterer, 2001; Hong, Suh, & Koo, 2011). Finally, geographical separation can also lead firms to work in different linguistic, legislative or cultural environments (Nonaka, 1991; Hong, Suh, & Koo, 2011), thus impeding inter- or intra organizational knowledge management.

Table 2.2: Barriers to knowledge sharing

Barriers to knowledge sharing	Description	Author	Type
Internal resistance	Some may think as revelation the passing on knowledge to others. Employees are often unwilling to use KMS, supporting that even when knowledge is documented it may not be leveraged.	(Barson, Foster, Struck, & Ratchev, 2000), (Hong, Suh, & Koo, 2011), (Davison, Ou, & Martinsons, 2013)	Individual
Trust	If a person does not trust the knowledge they take, obviously they will be reluctant to use it. Essentially, workers may not confide their managers thus trust is tend to be the most essential precondition for knowledge exchange.	(Barson, Foster, Struck, & Ratchev, 2000), (Hong, Suh, & Koo, 2011), (Davison, Ou, & Martinsons, 2013)	
Motivation	Some persons do not receive reciprocal merits from sharing their knowledge	(Disterer, 2001), (Hong, Suh, & Koo, 2011)	
A gap in Awareness and knowledge	Some employees have largely only awareness of problems, but they do not know anything more They do not want to listen to things again that they already know	(Bureš, 2003), (Hong, Suh, & Koo, 2011)	
Language	Some languages are used only in one country, department or division, so it is unconceivable for	(Bureš, 2003), (Hong, Suh, & Koo, 2011)	

	others		Organizational
Conflict avoidance	The effort to avoid change and do not risk too much	(Bureš, 2003), (Hong, Suh, & Koo, 2011)	
Bureaucracy	High level of bureaucracy often inhibit knowledge sharing	(Disterer, 2001), (Hong, Suh, & Koo, 2011)	
Incoherent paradigms	The difference between personal views or intents and paradigms of company(values, strategy, mission, vision, etc.) makes difficulty in expressing and justifying opinions, which do not fit with the ruling paradigms of company;	(Bureš, 2003), (Hong, Suh, & Koo, 2011)	
Distance	Geographical separation may result in the companies working in different cultural environments Face-to face communication tends to be the most efficient method of communication	(Nonaka, , 1991), (Hong, Suh, & Koo, 2011)	

Table 2.2 summarizes the prominent knowledge sharing barriers, pointing to the need for a new, alternative models of knowledge sharing and reuse (knowledge management) that would address several of these challenges (Wagner & Bolloju, 2005) and (Majchrzak, Wagner, & Yates, 2013). The solution is more interactive IT applications facilitating sharing of informal knowledge and dialogs between individuals and groups.

Finally, since traditional KMS are referred to IT-based systems whose functions include codifying and sharing of best practices in a knowledge repository, they tend to be time consuming, laborious and costly (Standing & Kiniti, 2011). Besides according to (Meloche et al., 2009) and (Standing & Kiniti, 2011), these repositories do not effectively share knowledge because they are not updated regularly and are often ignored by knowledge workers.

Taking the above into consideration and in order to overcome all these issues it was imperative to revisit the available KM systems, assess their characteristics and new technologies to be proposed. The technology evolution facilitated this change. More specific, due to technology evolution as well as the web 2 tools (O'Reilly, 2007) advent there was a shift from more traditional approaches of knowledge to more conversational approaches (Hong, Suh, & Koo, 2011). This term was coined to declare the shift from the knowledge repositories like stand-alone websites to a more interactive system of inter-linked platforms in which many sites are connected (Bibbo, Michelich, Sprehe, & Lee, 2012). The difference from Web 1.0 tools is that Web 2.0 tools are dynamic, democratic, interactive, user-driven and collective environment where users both consume and contribute (Bibbo, Michelich, Sprehe, & Lee, 2012). The Web 2.0 era is fostered by the emergence of collaborative web applications, such as blogs, social networks, and Wiki (O'Reilly, 2007).

Conversational Knowledge Management

Conversational Knowledge Management (CKM) is a relatively new but widely used approach of knowledge creation and dissemination that has drawn attention as new and user developed approach prospered on dialogs, discourses and collaboration (Wagner C., 2006). It is also known as Collaborative Knowledge Management (Wagner C., 2006), since peers are working together collaboratively in order to create, share and

acquire new knowledge (Lee & Lan, 2007). In other words, CK management entails a more interactive and collaborative approach which relies heavily on an emergent process of creating and sharing knowledge through peer collaboration and communication (Lee & Lan, 2007;Davison, Ou, & Martinsons, 2013). Due to its nature, CK is typically embedded and retained in "conversational" patterns such as narratives, storytelling, or questions and answers where peers can raise issues and engage in argumentation. As such CK is profoundly evident and proliferates in "Communities of Practice" (CoP) - a term describing groups of people who are interested in the same topics and share a common practice (Wenger, 1990).

This new and alternative model of knowledge management emerged with the advent of Web 2.0 technology, namely with discussion forums, chat rooms, or blogs and wikis (Hong, Suh, & Koo, 2011). This model fostered dialogs around knowledge-which were previously one-to-one (e.g., via e-mail) and possibly not recorded (e.g., phone conversations) to become persistent discourse in which many peers could join and collaborate. For example, in a threaded conversation such as a discussion forum, knowledge was shared through conversation such as questions and answers, in blogs the knowledge was shared through the story telling and in wikis through the collaborative writing (Majchrzak, Wagner, & Yates, 2013).

CK management differs from more traditional knowledge management methods in the fact that CK is targeted on collective intelligence rather than the mere accumulation of knowledge as codified in repositories (Lee & Lan, 2007). Moreover, Wagner in 2004 states that CK creation model differs from other models where knowledge is for instance created through abstraction or aggregation of information, as in data or text mining. In addition, Contrasting traditional threads of research that focus largely on the explicit and formal representation of knowledge in computer-based KM systems (KMS), CK emphasizes the tacit and social aspects of knowledge management (Hong, Suh, & Koo, 2011;Davison, Ou, & Martinsons, 2013;Holste & Fields, 2010).

This focus is justified by the weakness of conventional models to cope with sharing tacit knowledge (Lee, Kim, & Koh, 2009;Davison, Ou, & Martinsons, 2013;Holste & Fields, 2010) as well as the barriers (both individual and organizational) preventing firms from effective knowledge sharing (Hong, Suh, & Koo, 2011). To remedy for these problems, CK management relies on informal mechanisms to capture the tacit, the situated and the circumstantial aspects of knowledge (Hong, Suh, & Koo, 2011;Davison, Ou, & Martinsons, 2013;Majchrzak, Wagner, & Yates, 2013). Informal KS involves a personal approach whereby questions and answers are processed during discourses and conversations (Davison, Ou, & Martinsons, 2013). Informal KM initiatives are widespread and important because they foster the abstraction of tacit, implicit, loose-structured but highly coherent knowledge from the knowledge holder (Davison, Ou, & Martinsons, 2013). Except for the above, CKM does have and other advantages. For instance, it can be low cost and technology undemanding. For instance, many on-line communities are developed on little more than a web- based discussion forum. Furthermore, Conversational knowledge creation is quick. As a result, conversational technologies are particularly useful for environments where ad-hoc knowledge creation is required. Also, Conversational

knowledge creation is remarkable for areas where the knowledge is not accumulated, but resides in many and different peers (Wagner, 2004), supporting the collaboration of people in distributed locations (Standing & Kiniti, 2011).

Taking everything into consideration we can conclude that although Conversational Knowledge Management is a relative new approach to management of knowlge, it tends to be a very promising technique, managing to gain its purposes for effective Knowledge Creation and sharing. In the following chapters, we review the prominent tools that foster the CKM, presenting, analysing and critically appraising them.

Chapter 3 - CKM patterns & technologies

Thus far we have argued for an alternative model for knowledge management favoring tacit, social and informal exchanges between peers. We have also claimed that conversations offer a natural metaphor for understanding what is being shared, promoted and negotiated by peers and through conversation we create, develop and share knowledge. In this chapter we set out to bring further insight into this claim by investigating the type of communicative patterns anchoring conversations (or else conversational patterns), the media types in which they proliferate and the genres of technology that best serve their enactment in virtual settings.

A conversation may be broadly defined as a series of related message exchanges between groups of peers which can last for seconds, hours or days. In case of multiple conversation instances active at the same time, then messages belonging to each instance of conversation are correlated typically through an appropriate identifier or social code. On the other hand, a pattern coins a chunk of information that expresses intent by anchoring a good solution to a common problem within a specific context. Patterns are typically observed from actual experience and may be useful in declaring what is known about a design problem or domain. Conversational patterns can therefore be conceived as structured contexts of related message exchanges. Depending on the messages and the medium through which messages are exchanged, it is possible to envision multiple (and frequently non-comparable) conversational patterns.

Conversational patterns

Word of mouth

Humans are accustomed to using various conversational patterns to share knowledge. One of the earlier methods of exchanging opinions is the Word-of-Mouth (WoM). Goyette et al. (2010) concentrate on definitions of word-of-mouth indicating that it is an exchange, flow of information, communication, or conversation between peers. They also state that most authors refer to WoM as an informal form of discussion. WoM firstly occurred in face to face exchanges in place-based neighborhoods as a means for exchanging news but now with the advent of technology means like phone, email, or mailing list can also foster WoM (Goyette et al., 2010). In addition due to the advent of Web 2 tools WoM can also be typified in conversational tools like discussion forums or web logs, or micro blogs.

Story-telling

Telling stories (about life, experience and work situations) is another pattern particularly suited for people to pass their knowledge to next generations. Stories are especially useful for sharing tacit knowledge (Smith, 2001; Hansen, Nohria, & Tierney, 1999) that prevails in Communities of Practice (Hafeez & Alghatas, 2007). Stories can also be particularly useful in an organisation since they point to different context (Hafeez & Alghatas, 2007). For instance stories and narratives serve to express complicated ideas and concepts thus

producing clear communication by converting knowledge into a form in is simpler for others to be conceived. Story telling can also be typified by web 2 tools. Blogs is a popular representative of tool that promotes a kind of dialoguing based on stories (Standing & Kiniti, 2011).

Argumentation

Frequently, stories invoke additional acts such as question and answer, argumentation, clarifications, etc. All of them may occur either in face-to-face, mass-mediated, computer-mediated contexts, or in oral and written discussion. Of particular interest to the present work is argumentative conversation, where people try to get to the core of the topic by putting forward different points of view, notions, claims, perspectives, arguments, and counterarguments and criticizing and exploring all of these (Laurinen & Marttunen, 2007). In other words, argumentation is the way that an individual may set an issue that requires further analysis or conversation and others can elaborate on the discussion by putting their claims, express their opinion, agree or disagree, counter argue and finally take a decision. Through such exchanges, points of view may be refined or contrasted, ideas may be elaborated, new suggestions may arise or existing may be dropped, etc., until peers finally decide on a common solution. Questions provide a popular means for sparking argumentation since they invoke constructive input on a topic while inviting for exchanges such as questions for explanations and clarifications that are most likely to elicit argumentation between people. Moreover, inviting opponents to contribute is another way to be considered as a spark for argumentation. In an argumentative conversation, provocative questions or claims are important and necessary to challenge one's opponent's opinions and views or to continue the argumentation (Laurinen & Marttunen, 2007). Moreover, disagreement and doubt can be considered as start for argumentative discussion since in a disagreement peers have a view to support. Argumentation tends to be a dominant pattern in face-to-face (FtF) discussions, though, it may also occur in mass-mediated, computer-mediated contexts, or in oral and written discussions. Inspired by these features there have been attempts to create frameworks and systems allowing for structured argumentation to be organized around claims, agreements and disagreements, thus aiding the process of decision making among the group's members (Stewart, Setlock, & Fussell, 2007).

Turn-taking

According to Sacks et al (Sacks, Schegloff, & Jefferson, 1974) whenever members of conversation start speaking, they take a turn defining the succession of speaking. If conversation participants are able to finish speaking without being interrupted, the turn ends and it passes to another participant, or the conversation finishes. In other words, the collaborative use of language results in the speech turn from person to person. There are many manners to turn the speech in a discourse. Sacks et al (1974) identify adjacency pairs as key turn types, which allow speakers to allocate and give up turns. For example, the most common way is through 'question and answer'. Another adjacent pair is 'offer and acceptance'. Besides, another example of turn taking

is in an argumentative debate where in order to keep on the debate or challenge the opponent's ideas, questions or claims are also exchanged (Laurinen & Marttunen, 2007). Moreover, turn taking may occur in collaborative completion where when one user presents an idea, the other extends or deepens that idea in his/her next turn (Laurinen & Marttunen, 2007). In addition, in recapitulation, where one partner restates the opinions expressed by the other or by both up to that point in the conversation (Laurinen & Marttunen, 2007). The literature points to several categories of turns depending on the turn relation. Some examples are: adjacent turn (Turn referring to immediately prior turn), non-adjacent turn (Turn that refers to other but the immediately adjacent turn), multiple reference turn (Turn referring to multiple prior turns), and mixed turn (Turn combining two or more of the above turn-types) (Berglund, 2009; Herring, 1999; Holmer, 2008; Zelenkauskaite & Herring, 2008; Bou-Franch, Lorenzo-Dus, & Garce´ s-Conejos Blitvich, 2012). Moreover, there have been research works highlighting turn-management devices such as cross-turn addressivity or naming (Honeycutt & Herring, 2009; Herring, 1999; Bou-Franch, Lorenzo-Dus, & Garce´ s-Conejos Blitvich, 2012), cross-turn linking through explicit expressions (Bou-Franch, Lorenzo-Dus, & Garce´ s-Conejos Blitvich, 2012; Herring, 1999; Lapadat, 2007) and cross-turn quoting through referring to previous excerpts (Herring, 1999; Lapadat, 2007; Bou-Franch, Lorenzo-Dus, & Garce´ s-Conejos Blitvich, 2012). A special category includes turn-entry and turn-exit devices which may be defined as linguistic markers indicating how turn is claimed and released (Sacks, Schegloff, & Jefferson, 1974; Bou-Franch, Lorenzo-Dus, & Garce´ s-Conejos Blitvich, 2012) in a conversation. Finally, it is important to mention that key role in turn taking plays the different roles speakers may have in a conversation (Harwood, 2006). That is, this conversational pattern of role taking determines the interaction between people.

Tagging

Tags have long been used as a code for categorization and indexing. Jacob (2004) defines this process as follows: "Categorization divides the world of experience into groups or categories whose members share some perceptible similarity within a given context. That this context may vary and with it the composition of the category is the very basis for both the flexibility and the power of cognitive categorization". Respectively, there are tagging systems that allow creation of tags suitable for travelling, food consumption, etc. Besides, tagging can be considered as a 'medium of communication' focusing on sociability and usability, exemplifying the unique characteristics of online communications (Wei-Ching Huang & Chuang, 2009).

Our interest in tagging stems from the fact that tags convey human intentions and thus they are useful in anchoring parts or entire conversations to certain principles i.e., the tags. Such a use of tags is common in web 2.0 where users annotate digital resources with keywords so as to describe these resources (Golder & Huberman, 2006; Kimmerle, Cress, & Held, 2010). Lately, the concept of tagging has been extended to encompass collaborative aspects where many and different users add tags to contents (Golder & Huberman, 2006), thus externalizing the users' cognition and declaring the association of users with this resource (Kimmerle, Cress, & Held, 2010). These resources may include photos, videos, websites, e-mails or any other

piece of digital information. The aggregation of these tags tends to be a set of metadata for this resource. Despite their use as metadata, tags may also serve the purpose of exploring new resources that are related through tags. In this vein, tags constitute a mechanism that inspires users to search for new information (Kimmerle, Cress, & Held, 2010), and as a result, they may lead to creating and sharing new knowledge. Indeed, Robu, Halpin, & Shepherd (2009) argue that tagging enables users to order and share data more efficiently. Another useful characteristic of tagging is that it fosters filtering and structuring of information and it facilitates the retrieval of relevant information (Kimmerle, Cress, & Held, 2010). As a result, tagging may be used to enhance both informal and formal knowledge sharing. For example, whenever a user adds tags to some resources, he also expresses his own cognitive concepts and point of view about the corresponding resource (Kimmerle, Cress, & Held, 2010). By this account, tagging can be conceived as a kind of common ground or shared social context that may bring about configurations of people, artifacts and social relations. This is evidenced by the increasing number of research studies that focus on tagging as a mechanism for studying online communities in social web sites and online platforms that support file sharing.

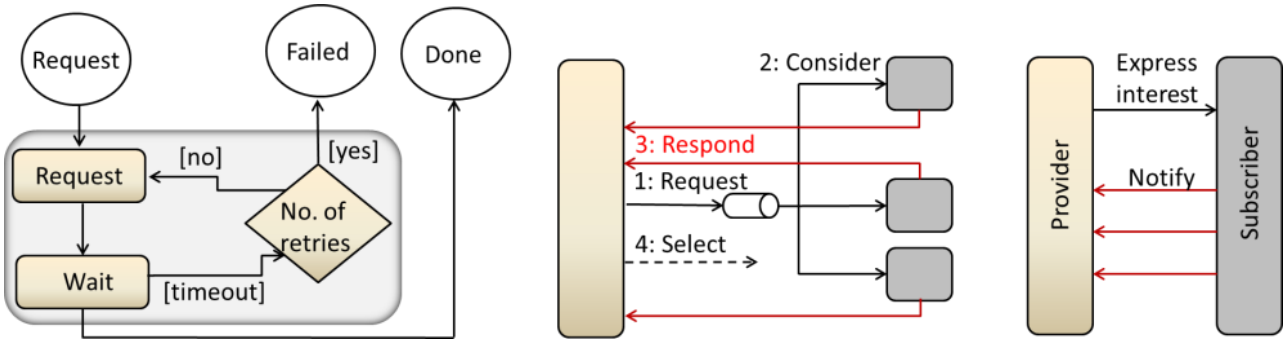
Rate/ Voting

Voting or rating is also another way to express ideas, opinions and cognitive bias, thus invoking conversations. Votes represent the users' impression of preference about resources. According to Sampson & Zervas (2013) ratings point out the users' actual impression and preference on a learning object, just as comments may do. Therefore, social widgets, 'like' buttons, rates, votes but also tweets and the hashtag can be conceived as linguistic conventions for expressing state of mind or opinion, sharing content, and rendering online discourse searchable.

Other classifications of conversational patterns

Another qualification of conversational patterns may be obtained by examining the sequence of message exchanges. Thus, for instance one common pattern is the 'Request-Reply' pattern that entails sending a request and waiting for a reply. This is the simplest form of conversation with a single conversation state (assuming no error conditions). An alternative pattern is known as 'Request-Reply with Retry' where the sender can repeat the request a number of times before giving up. Although, this pattern appears to be more flexible, it cannot avoid situations where the sender might receive responses after it gave up. Other more complex conversational patterns, the 'Dynamic Discovery', may also be devised as shown in Figure 3.1 where it relies on broadcasting requests for providers. Provider(s) consider whether to respond and those interested send their responses. Once the 'best' option is chossen, conversation proceeds between the requestor and the chosen provider. In the case of 'Subscribe-Notify', the subscriber expresses interest in receiving notifications until a condition is reached. Notifiers send their offers until they are notified otherwise by the subscriber.

Figure 3.1: Layered conversation (left); Dynamic discovery (middle); Subscribe-Notify (right)



Conceptual frames and technologies for CKM

Having reviewed the basic patterns in which conversations evolve, it is now worth investigating the types of tools and technologies which mediate conversational patterns. In the early period, technologies such as the telegraph, the telephone, radio, television or the tape recorder featured different genres of long-distance conversation (Erickson, Herring, & Sack, 2002). With the advent of the Internet a new generation of digital technologies (i.e., email, conferencing systems, etc.,) emerged to extend the type and scope of conversing. The web 2.0 signals yet another transition, only this time the fabric of conversation seems to be altered. Technologies for social bookmarking, social networking, blogging and micro-blogging have augmented conversational tactics by introducing new conversational constructs and linguistic conventions. The rest of this section elaborates on some the prominent frames of reference.

Technologies inspired by the Language-Action perspective

Early developments were influenced by the Language-Action perspective (LAP) on Information Systems as developed in the joint authorship of 'Understanding Computers and Cognition' by Fernando Flores and Terry Winograd in 1987 (Winograd, 1987-1988). They presented a new foundation for designing information systems by conceptualizing actions performed through communications as recurrent communicative patterns (Winograd, 1987-1988). During the last decades, this revolutionary perspective infused many researchers and triggered a great variety of LAP based applications.

The key concept in LAP is that language is not only used for exchanging information but also to perform actions like promises, orders, and declarations, etc. Accordingly, it is claimed that information systems should not be viewed as repositories for storing information and real facts, but instead as tools supporting communication among people who perform certain actions together (Schoop, 2001). For LAP, people are members of the community that coordinates their actions. Moreover, LAP emphasizes the communication between people, describing how language is used in order to create a common reality as well as how people coordinate their actions through communication. Hence, LAP rests on the linguistic and social rules that control the use of language.

LAP has been widely applied in a variety of fields such as CSCW, workflows management systems, e-commerce, virtual communities, etc. In the LAP, actions and argumentation can be depicted through the use of State Transition diagrams, communication for Action diagrams and Dialog for Action (DfA) diagrams that illustrate the various states through which the conversation or dialog undergoes. They are used to indicate a coordinated sequence of acts that can be interpreted as having linguistic meaning without the need of a spoken dialogue, or even involve the use of ordinary language.

Over the years the LAP perspective has matured and evolved to become very influential for a number of technology genres widely available today. Amongst the most common are computer-supported argumentation, discussion forums, chatrooms, Weblogs or blogs and Wikis.

Collaborative Computer-Supported Argument Visualization and Argumentation Map

Conversations have been of interest to the visualization community (McDonald, 2007). Methods such as Collaborative Computer-Supported Argument Visualization (CCSAV) represent a thread of research which has received substantial attention. According to Iandoli et al., (2014) the term argumentation has its antecedents in the Latin word 'arguere' which implies 'to clarify, emphasize, or demonstrate the reasonableness of a position', but also 'to discuss, debate, and persuade'. In a similar vein, concepts such as argument maps have been popularized with recent developments in argumentations systems (Walton, Reed, & Macagno, 2008), (Scheuer, Loll, Pinkwart, & McLaren, 2010). Argument maps enable users to visualize notions, concepts as well as the relationships among these concepts. Furthermore, they may include additional contents (e.g. annotations) and other knowledge resources. They also facilitate participants to clarify their thinking, present this thinking to the public or foster information and knowledge awareness (Iandoli, Quinto, De Liddo, & Shum, 2014). In other words, an argument map is a visual representation of the informal logical structure of an argument (Walton, Reed, & Macagno, 2008).

The relevant literature reports several research efforts aiming to support argumentations tools (Scheuer, Loll, Pinkwart, & McLaren, 2010). Representative systems include Belvedere, gIBIS, QuestMap, Compendium, Digalo, AcademicTalk, InterLoc, DebateGraph, and Collaboratorium. These are all systems with various supports for collaboration. On the other hand, Reason!Able, Rationale, Athena, Carneades, ArguMed, LARGO, SenseMaker and Convince Me are single-user systems. Scheuer et.al (2010) describes Belvedere as a multiuser, graph-based diagramming tool for scientific argumentation. Compendium is also popular argumentation system which recently has been used in schools for scientific argumentation. Compendium in (Brasher, et.al, 2008) is defined as "a software tool providing a flexible visual interface for managing the connections between information and ideas". QuestMap has also been used to teach legal argumentation (Scheuer, Loll, Pinkwart, & McLaren, 2010). In gIBIS, small groups of users collaboratively create a graph to solve design problems, while simultaneously capturing the design rationale (Scheuer, Loll, Pinkwart, & McLaren, 2010). Furthermore, Digalo

is an argumentation tool designed for classes in which small groups of three to seven students discuss an issue of controversy (Scheuer, Loll, Pinkwart, & McLaren, 2010).

CCSAV exhibit several desirable properties that make them particularly relevant for knowledge management. Firstly, one clear beneficial effect using CCSAV is the representational guidance (Suthers, Hundhausen, & Girardeau, 2003). Secondly, CCSAV systems enable users to clarify their views and thinking (Brna, Cox, & Good, 2001). Thirdly, they facilitate user's opinion expression by making thinking and rationale more visible to others (Bell, 1997). Fourthly, CCSAV tools foster criticisms and comparison of different opinions, thus promoting and enhancing critical thinking as well as evidence-based reasoning (Iandoli, Quinto, De Liddo, & Shum, 2014). Finally, they are appropriate and relevant for large groups seeking to systematically and comprehensively investigate and map an extensive debate on a selected discussion topic (Gürkan, Iandoli, Klein, & Zollo, 2010; Iandoli, Quinto, De Liddo, & Shum, 2014).

Nevertheless , inspite of the advantages described above, argumentation tools are not widely used in organizations or online communities since they face some drawbacks. According to Iandoli et.al. (2014), CCSAV tools require users to undergo steep training in order to use them. They require strong individual commitment and adequate argumentation skills. Therefore, users may face difficulties in using such a formal artifact to mediate conversations. Furthermore, the costs for coordination and moderation are relative high (Gürkan, Iandoli, Klein, & Zollo, 2010), (Iandoli, Quinto, De Liddo, & Shum, 2014). Particularly, tools based on graphical represantations may seem more unnatural and unacquainted than other familiar convarsational tools like forums or blogs.

Web 2.0 technologies and tools

The advent of web 2.0 was a turning point for conversational knowledge management technologies. This is not only due to the increased capabilities for social participation but also to the change in the fabric of collaboration. The term web 2.0 was first coined by Darcy Di Nucci, in 1999, while it was popularized by Tim O'Reilly at the O'Reilly Media Web 2.0 conference in late 2004. Web 2.0 coins a set of technologies and tools (see Table 3.1) that signify a paradigm shift in the way information is generated, codified, shared and ported.

Amongst the most common technologies are discussion forums, blogs and wikis. Wagner and Bolloju (2005) refer to these technologies as conversational knowledge management technologies to reflect that much of the knowledge creation and sharing is carried out through a process of discussion with questions and answers (discussion forum), collaborative editing (wikis), or through a process of storytelling (weblogs). In other words, these technologies promote, foster and capture discussions and conversational patterns, while accommodating contextualization, reflection, searchable discourse and sense of virtual community.

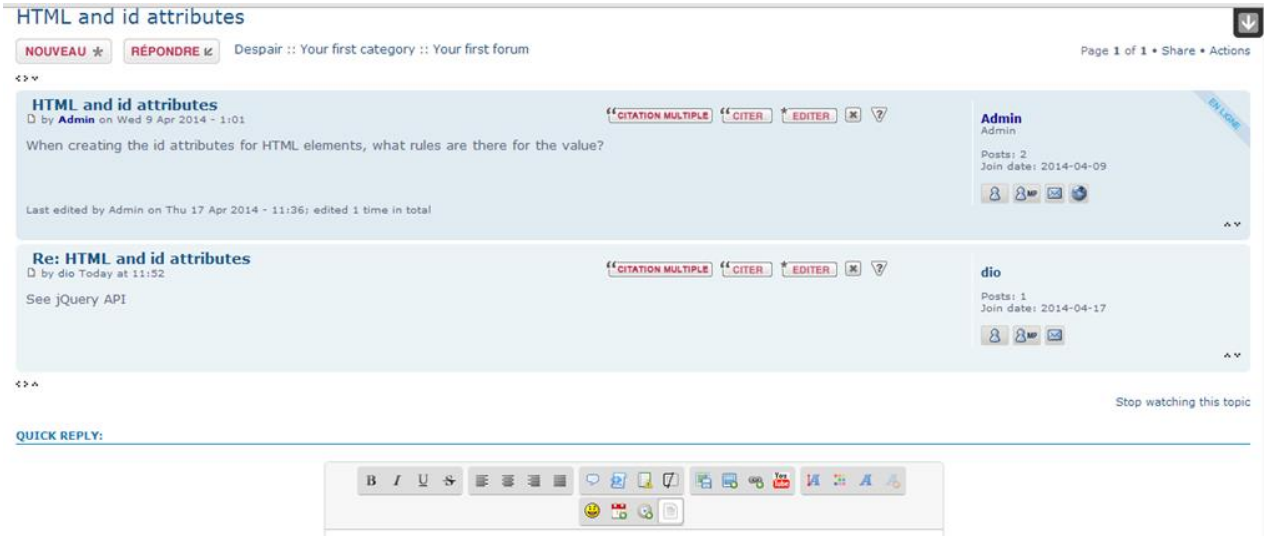
Table 3.1: Presentation of some web 2 tools

Tool	Brief Definition	Reference
AJAX	Acronym for ‘‘Asynchronous JavaScript and XML’’ and it is a group of inter-related web development techniques used on the client-side for creating interactive, asynchronous web application	(Hong, Suh, & Koo, 2011)
RSS	IT stands for ‘‘Really Simple Syndication’’. RSS is currently being broadly used in media companies on a subscription-basis to deliver real-time news as feeds to users	
Wikis	A Wiki is a tool, often web application that allows peers to create, add, modify, organize, delete and link contexts in collaboration with others.	
Web blogs	Or simply blog allows a person or group of peers to share personal thoughts, insights with online peers.	
Discussion Forums	Simple tools fostering question-answering as a means for tacit knowledge sharing as a means for tacit knowledge sharing	(Bibbo,Michelich, Sprehe, & Lee, 2012), (Standing & Kiniti, 2011)
Social Networks – Micro blogging (e.g. Facebook, Twitter)	web applications that create links between users that share the same interests, hobbies or other;	(Cervinschi & Butucea, 2010)
Instant Messaging (e.g. Yahoo!Messenger, GTalk)	text-based, real time communication channel between two or more users;	
Collaborative Tagging Systems:(e.g. Delicious)	Tools for annotation of digital resources with keywords	(Kimmerle, Cress, & Held, 2010).

Discussion Forums

The discussion forum also known as discussion board or bulletin board or simply forum has been one of the earliest technologies for collaborative knowledge creation and knowledge sharing (Wagner & Bolloju, 2005). It has become popular mainly due to its low cost and high impact as knowledge management tool (Wagner, 2004; Bibbo, et al., 2012). In the context of CK management, forums are particularly relevant because they combine codified as well as tacit knowledge sharing (Bibbo, Michelich, Sprehe, & Lee, 2012; Standing & Kiniti, 2011). Figure 3.2 depicts a forum where questions are posed from a user and other users are invited to give some answers.

Figure 3.2: An example of a forum



As shown, a Discussion forum can be both a knowledge repository as well as a communication tool that allows individuals to collaborate with others through posting or answering questions. Features of forums such as Web publication and message threading, provide an independent record of the content (independent from personal e-mail collections). Other characteristics of new forums are group support, statistics (e.g., number of reads), message approval ratings, and filters.

Despite the positive features, forums have some drawbacks. Firstly, inaccurate forum posts cannot be edited by other users, while posts are often difficult to locate because they are so frequently archived (Bibbo, Michelich, Sprehe, & Lee, 2012). Secondly, forums may lack organization or quality assurance. Thirdly, in discussion forums, relevance is frequently an issue as there are often numerous replies to any question, with different levels of usefulness and relevance (Wagner, 2004). Hence, to convey context a tool with advanced search engine and hyperlinking capabilities is beneficial (Wagner, 2004). Finally, in a forum issues may be discussed within multiple postings that belong to more than one thread, or where one message may shift the topic focus elsewhere, that is to cover more than one knowledge concept in one message (Wagner, 2004). Table 3.2 summarizes the above and highlights some of the advantages and disadvantages of forums.

Table 3.2: Advantages and disadvantages of discussion forums

Advantages	low cost	(Wagner C. , 2004)
	high impact knowledge management model	
	Flexible with unbiased content	(Bibbo, Michelich, Sprehe, & Lee, 2012)
Disadvantages	Inaccurate posts cannot be edited by other users	(Bibbo, Michelich, Sprehe, & Lee, 2012)
	Informal, unregulated discourse.	
	Forum posts are often difficult to locate, because they are frequently archived	
	may lack organization or quality assurance	(Wagner C. , 2004).

Blogs

A Weblog or usually known as just blog, is a web page, maintained by an individual, or group of individuals, to share a running log of events and personal views with online audiences (Wagner, 2004; Wagner & Bolloju, 2005). It is commonly referred to as story telling media (Wagner & Bolloju, 2005; Bibbo et.al, 2012) as it allows users to quickly and easily publish their diaries on the web, thus serving as a kind of broadcasting medium through which users can populate their opinion, expertise and comments (Moor & Efimova, 2004), (Wagner & Bolloju, 2005) or converse with a small group so as to share their stories. Figure 3.3 depicts a blog where the author can write his thoughts and stories and other members leave their comments.

Although typically blogs are intended for individual use, in practice they do foster distributed conversations (Moor & Efimova, 2004). From this point of view, a blog tends to be conceived as a medium for collaboration. Given the special characteristics of weblogs and their supporting applications, they may be well suited for a range of conversational purposes that require different forms of argumentation. For instance, an

important characteristic of blogs is that they have hyperlinked posts either on an individual blog or between blogs. Furthermore, there is a variety of secondary applications that allow weblogs to be searched, and navigated (Moor & Efimova, 2004). Commenting on posts, thus offering basic support for threaded discussions, is another useful characteristic (Wagner, 2004). In terms of implementation, blogs are both quick and easy to set up (Wagner & Bolloju, 2005). They do not necessarily need database backing but are frequently stored as flat files (Wagner, 2004).

On the other hand, blogs do have some drawbacks. To begin with, the basic feature of Weblogs, namely that it consists of many short posts time stamped and organised in reverse chronological order, may be a shortcoming (Moor & Efimova, 2004). For instance, the fact that newest posts usually come first and older posts disappear in archives is not the best format to communicate knowledge since the newest knowledge may not be the most relevant for the community at large (Moor & Efimova, 2004). In more recent installations, modern weblogs alleviate this drawback with indexed archives, which are search engine-friendly and enable the identification of knowledge by topic (Moor & Efimova, 2004; Wagner & Bolloju, 2005). Another shortcoming of blogs is that they are typically limited to one author, thus providing biased knowledge and perspectives since the author's views may be dominant (Bibbo, Michelich, Sprehe, & Lee, 2012). Furthermore, despite the fact that blogs can be used as a brainstorming tool with sequential posts, feedback on blogs is limited to comment sections mostly controlled by the author in order to reflect their own views and maybe deviating from the topic (Bibbo, Michelich, Sprehe, & Lee, 2012). Table 3.3 summarizes advantages and disadvantages of blogs.

Figure 3.3: An example of blog

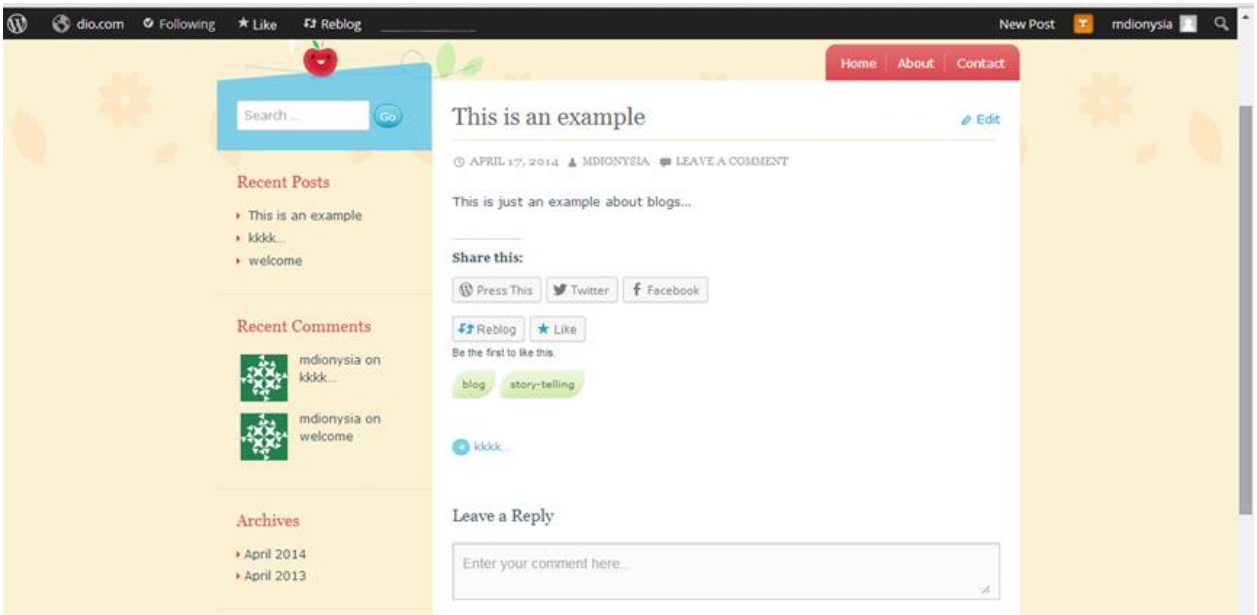


Table 3.3: Advantages and disadvantages of blogs

Advantages	low cost	(Wagner C. , 2004)
	they do not necessarily need database	
	they support hyperlinked posts either on an individual blog or between blogs	(Moor & Efimova, 2004
	Easy and quick to setup and maintain	(Wagner & Bolloju, 2005)
	Support search and navigation	(Moor & Efimova, 2004
Disadvantages	Typically limited to one author	(Bibbo, Michelich, Sprehe, & Lee, 2012)
	Provide knowledge and opinions on array of issues, or on a single idiosyncratic one	
	May convey bias perspectives	
	Feedback is limited to a comments section, often controlled by the author reflecting his or her own opinions	

Wikis

Wikis, from the Hawaiian word wikiwiki (which means "fast"), are a technology that supports "conversational" knowledge creation and sharing (Leuf & Cunningham, 2001; Wagner, 2004; Wagner & Bolloju, 2005). The first Wiki was developed by Ward Cunningham in 1995 (Wagner, 2004) and is defined as a set of linked web pages, created through the contribution and collaboration of a group of peers (Leuf & Cunningham, 2001). Lee et.al, (2007) states a definition of wiki from Wagner & Bollojum (2005) which refers to wikis as "incremental knowledge repositories" where anytime user can view previous versions of web contents namely a history is kept. Furthermore, Hasan and Pfaff (2006) define Wikis as a collection of interlinked web pages that maintain crosslinks between internal pages and each page can be edited, keeping a history of such changes thus any change can be easily reverted to any of its previous versions. Majchrzak, Wagner, & Yates (2013) argue that Wikis allow many users to collaboratively work on the same content without overwriting each other's changes keeping track of each other's contributions by a history of versions. This version control thus facilitates collaboration and integration of work products, but also fosters fail safing and recovery from errors. Besides, Wikis are very simple to set up as well as to be accessed since they are disposable from any web browser without needing any other special tools or programs (Hasan & Pfaff, 2006).

Today basic wiki management functionality is embedded into platforms that allow users not only to merely participate in computer-mediated communications but also to contribute to the content (Hasan & Pfaff, 2006). According to Majchrzak, Wagner, & Yates (2013) a Wiki contributor can access a wiki page; edit it, change the existing content or add new data, namely knowledge. Moreover, Wiki platforms implement built-in mechanisms for partial locking and warnings to avoid knowledge loss due to concurrent modifications by different users (Majchrzak, Wagner, & Yates, 2013). These technical characteristics of wikis along with social engineering rules often referred to as the "Wiki way" (Majchrzak, Wagner, & Yates, 2013) that foster a form of collaboration that maintains the merits of conversational knowledge management, while also leading to the creation of a single, integrated knowledge product with minimal redundancy and few errors.

Wikis have many applications in different domains. A research group with members dispersed across geographical boundaries, like users located in different nations or regions with different time zones is an example of application that Wiki could facilitate (Hasan & Pfaff, 2006). The Wiki technology permits peers to collaborate and contribute their ideas to the Wiki platform without geographical or temporal limitations. Other applications would be wikis as groupware or Wikis as a technology to implement help systems (Wagner, 2004). Another application domain is in organizations and companies where workers may exchange opinions and knowledge and collaboratively create new knowledge (Hester, 2010), (Standing & Kiniti, 2011). Learning and education is another domain where wikis may be applied (Parker & Chao, 2007). Students with instructor can easier collaborate and collaboratively construct and build a review or a document. It can also be a repository of resources created by many and different peers.

The most prominent Wiki application is the "Wikipedia" (see Figure 3.4). Wikipedia is a shared knowledge repository where every Internet user can contribute to the knowledge by providing contents. In such architecture, all users either peer or experts can equally participate in the knowledge creation (Lee & Lan, 2007). There some other Wiki based applications providing the functionalities similar to Web blogs. For example, Tiddly Wiki enables users and/or groups to concentrate ideas, notes, opinions, diary activities, and events in a non-technical environment (Figure 3.5).

Figure 3.4: Wikipedia

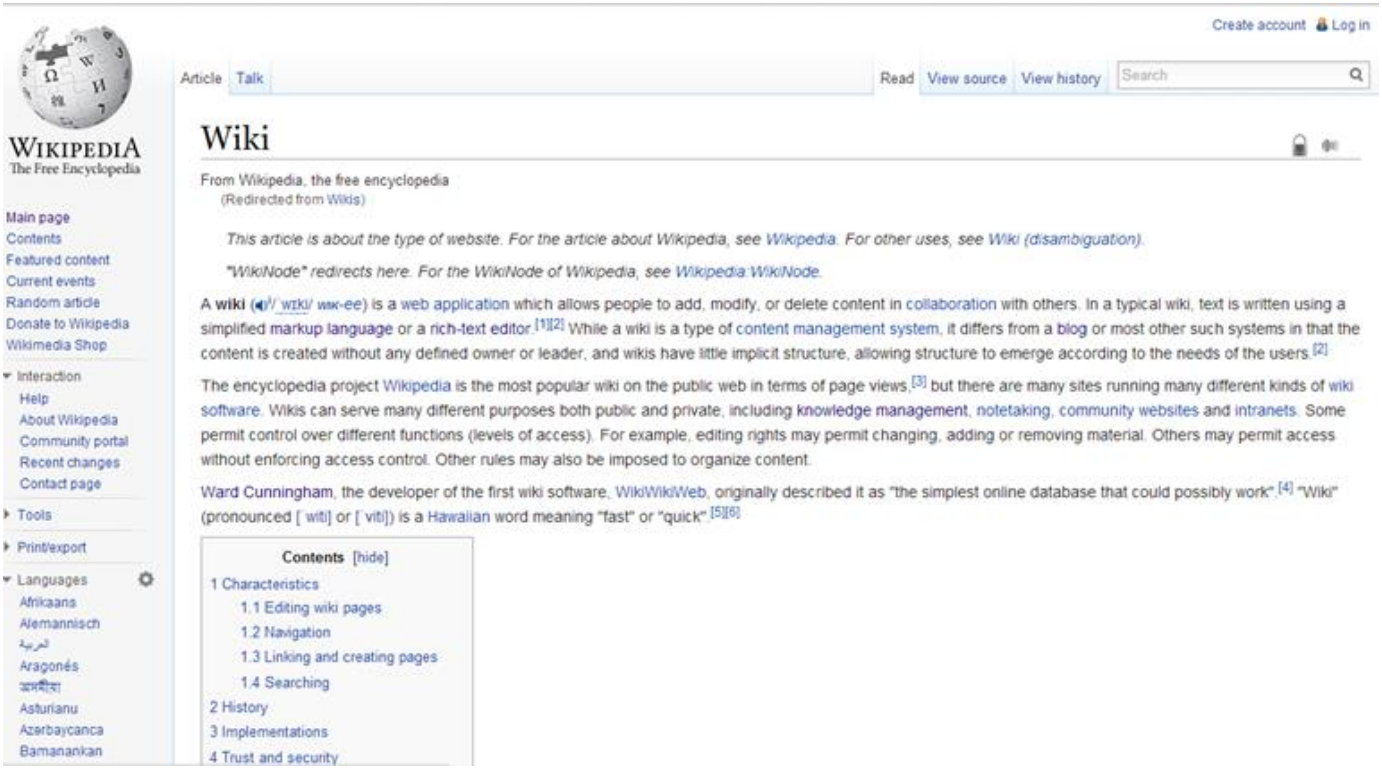
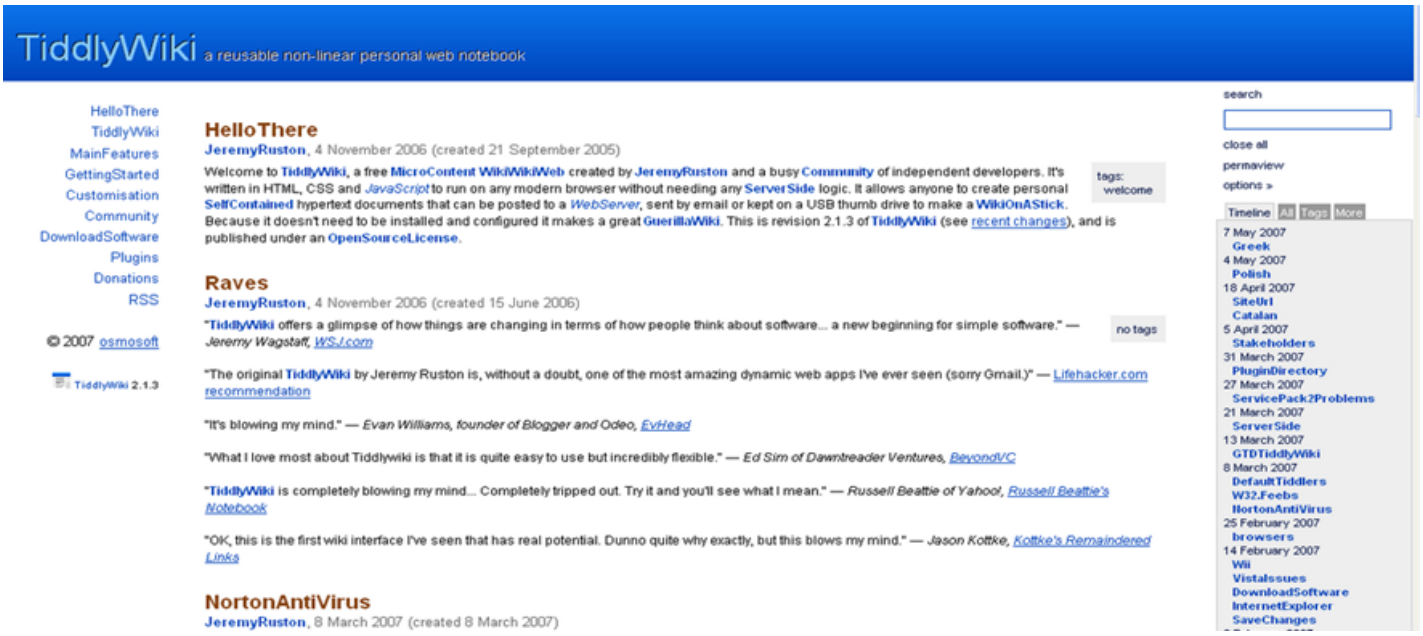


Figure 3.5: Tiddly wiki



Wikis provide merits for organizations offering a powerful and flexible collaborative platform for communication (Wagner, 2004). Since Wiki contents are created, maintained, verified, and updated by peers, the cost for maintenance is low (Bibbo, Michelich, Sprehe, & Lee, 2012). Furthermore, Wikis collect relevant information in a central location, thus reducing both the time and effort needed for collaboration across different areas and by users in geographically dispersed locations (Bibbo, Michelich, Sprehe, & Lee, 2012). Additionally, by concentrating data, Wikis reduce data redundancy and eliminate outdated and inconsistent data. Wikis can also enhance knowledge sharing by supplying users with resources to solve shortcomings as soon as they arise, with chances to receive user reviews, and to acquire the acknowledgement and esteem of the management (Bibbo, Michelich, Sprehe, & Lee, 2012). Consequently, workers face less frustration and enjoy more their contribution to knowledge. There are also some merits referred to the usage of wikis including time saving improvements (Hester, 2010) in training employees to use of them, in traveling long distances to collaborate, reducing e-mail traffic as well as less in dealing with customers (Hester, 2010). Moreover, wikis are easy to use and straight forward to customize which makes it possible even for novice users to contribute to the knowledge acquisition process in an organization.

On the other hand, wikis do have some shortcomings. Firstly, there are security issues on wikis operation (Bibbo, Michelich, Sprehe, & Lee, 2012; Hasan & Pfaff, 2006). Standing and Kiniti (2011) claimed that the open nature of wikis makes them vulnerable to vandalism. Moreover, the complete disclosure of knowledge may prove problematic for companies that rely heavily on confidential documents (Bibbo, Michelich, Sprehe, & Lee, 2012). Furthermore, there are not clear guidelines or policies for the use of wikis, thus this may make people unwilling to contribute to a wiki (Standing & Kiniti, 2011). Another challenge of Wiki is that it represents the collective notion of the group that contributes to it (Bibbo, Michelich, Sprehe, &

Lee, 2012). Furthermore, as Wiki is democratically self-governing, it lacks of hierarchical supervision or a support team to address problems that may occur (Bibbo, Michelich, Sprehe, & Lee, 2012). Table 3.4 summarizes some of advantages and disadvantages of wikis.

Table 3.4: Advantages and disadvantages of wikis

Advantages	Low cost for set up and update. Lowers the costs for communications and collaborations across geographically dispersed teams	(Wagner C. , 2004), (Bibbo, Michelich, Sprehe, & Lee, 2012)
	Eliminates data redundancy	(Bibbo, Michelich, Sprehe, & Lee, 2012)
	Wiki facilitate knowledge sharing:	
	Easy and quick to setup and maintain	
	Wiki facilitate knowledge sharing	
	save time	(Hester, 2010).
	ease in use as	
	easy to customize	(Hasan & Pfaff, 2006).
Disadvantages	Potential security issues - vulnerable to vandalism	(Bibbo, Michelich, Sprehe, & Lee, 2012), (Standing & Kiniti, 2011)
	May evolve chaotically	(Bibbo, Michelich, Sprehe, & Lee, 2012),
	Can be ineffective when there is a lack of consensus.	
	K Potential lack of supervision and support if problems occur	
	collaborative bias	

Micro-blogging

Micro-blogging platforms which are a relative new phenomenon are another medium for conversational knowledge management. They resemble WoM and story-telling (Kwak, Lee, Park, & Moon, 2010) in the sense that they allow people to publish and share information, through brief text updates about their activities, opinions and status, with subscribers that they likely would not do otherwise with existing channels (e.g., email, phone, IM, or weblogs) (Zhao & Rosson, 2008). This anchors the main functional difference between micro-blogs and conventional blogs. Specifically, whereas normal blogs allow users to write down thoughts or even short essays, micro blogs are intended for easy and fast exchange of character-constrained textual exchanges (Ebner & Schiefner, 2008). Moreover, whereas blogging features knowledge saving, coherent statements and conversation, micro blogging is used largely to raise awareness of an audience about one's thoughts and reflections. This basic capability has been received very favourably by end users communities and has made micro-blogging a popular means for informal conversation and communication at work (Zhao & Rosson, 2008) as well as a practice for social participation and engagement (Ebner & Schiefner, 2008). According to Java et al. (2007), such use of micro blogging facilitates primarily information sharing, information seeking and friendship-wise relationship.

Micro blogging has been popularized with the Twitter platform, although the key notion of short, quick and easy notifications is also found in other tools for computer-mediated communication (CMC) like Jaiku, Pownce, or Facebook (Zhao & Rosson, 2008). Twitter's basic concept is that users can be followed by an

audience, but also follow others. In Twitter, unlike other social networks such as Facebook or MySpace, the relationship between followers does not require reciprocation. For example, a user can follow any other user, and the user being followed need not follow back. As for the exact meaning of following this is bound to receiving all the messages, known as tweets, from those the user follows (Kwak, Lee, Park, & Moon, 2010). Discussions can then emerge by re-tweeting one's tweets.

Although micro blogs are widely used and thoroughly studied by researchers, they pose several challenges (or problems). Privacy is a basic concern when people use micro blogging at work (Zhao & Rosson, 2008). Micro-blogging is also vulnerable to getting off topic (or target) quite easily with implications on individual performance and work targets. Additionally, integration of microblogging inside and outside a company is another shortcoming (Zhao & Rosson, 2008).

Collaborative tagging systems

Collaborative tagging systems offer another genre of technology fostering conversational knowledge management. This time the conversation exploits meta-data (i.e., keywords) that users attach to shared digital resources. Tagging is the term that coins the annotation of digital resources, such as photos, videos, websites, e-mails or any other piece of digital information, with keywords (Kimmerle, Cress, & Held, 2010). Annotating content with tags is a typical and easy way of organizing content for future navigation, filtering or search, spam detection, reputation systems, and personal organization while introducing new modalities of social communication and opportunities for data mining (Golder & Huberman, 2006; Marlow, Naaman, Boyd, & Davis, 2006). Tagging enables users to order and share data more efficiently (Robu, Halpin, & Shepherd, 2009). Lately, collaborative tagging or socially tagging as it is also known (Marlow, Naaman, Boyd, & Davis, 2006) has been very popular method on the web as a common practice on sites allowing users to tag bookmarks, photographs and other content (Golder & Huberman, 2006).

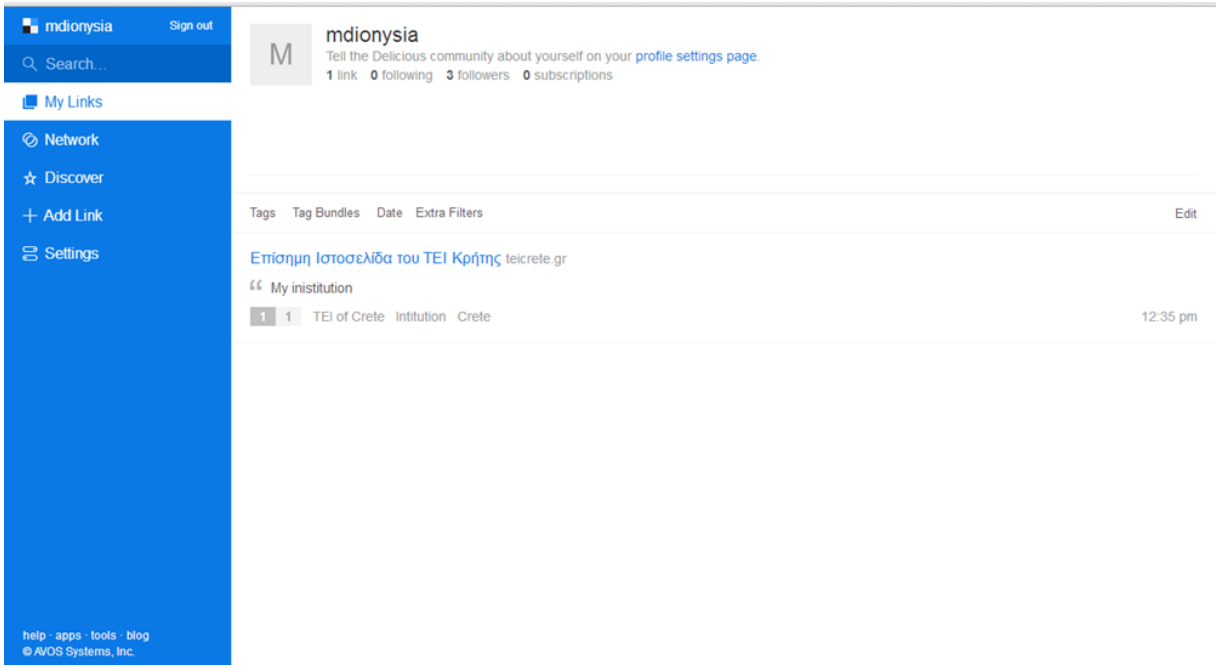
There are a number of websites including the social bookmarking site del.ici.ous (https://delicious.com/ - a "social bookmarking site" founded in 2003 that allows users to save and add tags on web sites and resources), Flickr (https://www.flickr.com/ - a photo sharing system created in February 2004 that allows individuals to save and tag their photos, as well as have a network of contacts and tag others photos), Technorati (http://technorati.com/ - weblog aggregator and search tool allowing blog authors to tag their posts), Furl (it was a free social bookmarking website founded in 2003 that allowed members to store searchable copies of webpages and share them with others), Connotea (http://www.connotea.org/ created in December 2004 and discontinued in March 2013) and Amazon which allow users to "tag" objects with keywords (Robu, Halpin, & Shepherd, 2009; Marlow, Naaman, Boyd, & Davis, 2006). Maybe the most significant formal study of tagging systems according to (Marlow, Naaman, Boyd, & Davis, 2006) is in the work of Golder & Huberman (2006) where the authors study the Del.ic.ious system to ascertain information dynamics (i.e., how tags by individual

users are used over time, and how tags for an individual resource change or stabilize over time) in "collaborative tagging systems".

Del.icio.us (see Figure 3.6) is a collaborative tagging system for web bookmarks which allows users to save bookmarks within their browsers. E bookmark records the web page's URL, its title and the time the bookmark is created. Users can also choose to tag the bookmark with multiple tags, or keywords. Each user has a personal page on which their bookmarks are displayed in reverse chronological order along with a list of all the tags the user has ever added to a bookmark. By selecting a tag, one can filter one's bookmark list so that only bookmarks with that tag are displayed. Delicious is considered 'social' because, not only can one see one's own bookmarks, but also the bookmarks of others. Moreover, it displays a list with the most recent bookmarks, along with their tags, the creator, and the number of users who have that bookmark in common (Golder & Huberman, 2006). In a similar way, the other collaborative tagging systems work.

Collaborative tagging systems have multiple benefits (Marlow, Naaman, Boyd, & Davis, 2006). For instance, a shared pool of tagged resources enhances the metadata for all users, potentially distributing the workload for metadata creation amongst many contributors. Moreover, a unified user-tag-resource approach might be useful for many key web technologies, including search and information retrieval, information organization, discovery and communication, spam filtering, reduction of effects of link spam and improving on trust metrics, identification of trends and emerging topics globally and within communities, as well as locating experts and opinion leaders in specific domains. Nonetheless, tagging has its drawbacks as it is prone to ambiguity in the meaning of tags or the use of synonyms which creates informational redundancy (Robu, Halpin, & Shepherd, 2009).

Figure 3.6: Delicious platform



Critical appraisal

The technologies reviewed in this chapter constitute a rich design space for knowledge management engineering. Although, there are no widely accepted benchmarks to qualify 'best-practice' solutions, it appears that the synergistic use of different technological genres may offer substantial benefits for organizations, groups and individuals. As the focus of the present thesis is on conversational knowledge management, we consider important to conclude the chapter by critically appraising each technology in an effort to highlight their potential complementarity.

Starting with structured argumentation systems, it is important to recall that their wide adoption by organizations is constrained despite their support for managing large scale negotiations over complex dilemmas (Iandoli et.al. 2014). This may be due to their inherent complexity that may demotivate users' active contribution. Having said this, it is widely acknowledged that such tools foster a more critical thinking and evidence-based reasoning and grounding, by representations which highlight notions, ideas and conceptual relationships between contributions. In recent years, they have also been augmented with additional capabilities for computational analytics that assess the structural integrity of the network (Iandoli, Quinto, De Liddo, & Shum, 2014). Web 2.0 technologies and tools are grounded on ideals such as enhanced social participation, wide accessibility and open standards. They present distinct advantages, but again designers should pay attention to certain drawbacks (see Table 3.5).

Table 3.5: Advantages and disadvantages of Web2

Advantages	Ease of use	(Boulos, Maramba, & Wheeler, 2006)
	Availability of many Open Source/free or low-cost software and hosting options to run them.	
	Rapidity of deployment	(Parker & Chao, 2007)
	Facilitation of collaboration and information sharing	
	Relatively inexpensive	(Wagner & Bolloju, 2005)
	Lightweight	
	Support open and informal communities	
Disadvantages	Prone to vandalism Web 2.0 tools may be sensitive to serious quality and credibility issues, because of their free and open nature and the (relative/potential) lack of control over their content.	(Boulos, Maramba, & Wheeler, 2006)
	Anyone can easily post copyrighted material without the permission of the copyrighted author	
	Anonymity (which may not be desirable)	

Although general assessments of different technologies are both inappropriate and prone to error, we can broadly attempt to anchor the suitability of certain tools in the context of conversational knowledge management. In this vein and without claiming to be exhaustive Table 3.6 consolidates the relative merits of wikis, blogs and forums in terms of designated criteria represent core concepts in the knowledge management scholarship. Needless to mention that (a) for different contexts of use and knowledge engineering applications,

different criteria may be more or less conductive to success; and (b) limitations and shortcomings in one technology genre could be easily overcome or by-passed by synergistic use of another technology.

Table 3.6: Comparative assessment of Forums, Blogs and Wikis

	Blog	**Wikis**	**Forum**
Focus	Author centered	Document centered	Topic centered
Control	Administrator	All	Administrator
Content	Content is displayed in reverse chronological order and scrolling is required	Content is not permanent, it can be revised by any one	Content is considered to be static: once posted the posting doesn't change (answers are provided by others)
Comments	Encouraged but not focus	No real comments	Comment driven
Purpose	Share a log of events and personal insights	Creation documents, projects, resources	Provide support, discuss topics
Organization	Content displayed with most recent posting first	As participants decide, can have multiple pages or one	Threads
Ownership	Posting owned by poster	Topics considered public space and owned by all	Threads and posts owned by group with equal responsibilities
Privacy/ Security	Choice, but not guaranteed private or secure	Choice, but not guaranteed private or secure	Private to class/instructor
Type	Personal	Open to collaboration	Open to collaboration
Tagging	+	+	-
Quote	-	+	-
Argumentation	Not explicit	Not explicit	Not explicit
Ask/Answer a question	Not immediately	Not immediately	+
Content creation	Only owner	All	All
Story-telling	+	-	-
Ask/answer Question	-	-	+
Collaboratively writing	-	+	-
Invitation	+	+	+
Link	+	+	-
Filtering	+	+	+
Track of changes	-	+	-

In the context of the present work and in spite of the variety of technologies available for conversational knowledge management, there are aspects of conversations that are still inadequately addressed, either because of the peculiarities of the digital medium or because of preconceptions and constraints inscribed in technology. Thus, for instance although proximity and co-presence are no longer pre-requisites for taking part in a conversation, the right to co-engage (in conversational patterns through digital media frequently assumes some sort of registration (under certain terms and conditions) to create a representation (i.e., an account or profile) that stands for the users. In turn, this may replace direct and explicit contributions by operations *with* the designated representation. Such a computer-based mediation limits conversational exchanges to what is explicitly expressed by the users' virtual referents. It also dismisses 'implied' intentions or indirect status

notification and other forms of civic inattention as in situations where lack of interest in the on-going discussion is manifested by switching attention to another object or topic or by whispering to another colleague while co-present in a face-to-face discussion. Additionally, access rights may not be evenly spread to or claimed by registered participants. These medium-specific inscriptions may lead to misconceptions as in many cases a position taken by a peer may not be the position intended or even the position interpreted by audience.

Consequently, in cases where dialogue and co-engagement are mediated by digital representations, it is of paramount importance to pay attention to certain affordances that determine outcomes. Thus, representations standing for users (i.e., their voice, text on screen or highlighter) or inviting certain uses (i.e., pressing a button to convey state of mind or opinion, introducing tags as external cognition, etc.) while constraining others (i.e., dismissing the importance of reputation, turn-taking, use of metaphor, indexing, etc.), may need to be tailored to the task at hand by injecting affordances that may not have been foreseen or designed into the medium (e.g., transparency, activity awareness, etc.). In the case of CKM systems it is argued that these affordances should feature the situated and the local rather than the global and the general.

Chapter 4 - Case study methodology

Motivated by the shortcomings in currently available technology genres, the present research aims to revisit the premises of conversational acts in an effort to create tools that capture the social and collaborative aspects of knowledge management in small group activities. The methodology used to approach this target is the exploratory / formative case study. Case study research is considered to be an appropriate research method for organizing an empirical inquiry to explore a phenomenon within its real-life context. For the present research the phenomenon under investigation is knowledge management in small group collaborative work where geographically dispersed peers co-engage with the intention to analyze and make sense of qualitative data. For purposes of illustration the qualitative data set depicts interview transcripts compiled and made readily available to the author. An example of such a transcript interview is depicted in 0. In this context, our specific interest is to conceive peer exchanges as purposeful online conversations in which codified and tacit knowledge are intertwined to determine outcomes. It is important to notice that such a collaborative setting involves peers with different skills and expertise who join forces in an effort to negotiate and build common ground. Such a common ground is typically depicted in the form of an agreed set of codes derived through qualitative data analysis.

In terms of methodological phases, the research evolved in three steps. Firstly, detailed literature reviews into CKM laid out a set of desirable conversational patterns such as creating arguments, raising issues, making claims, inviting participation in interviews. Once this set was identified, it was used to screen data from a set of interviews. In a second step, we modeled the identified conversational patterns as state diagrams in the tradition of the Language-Action perspective (Winograd, 1987-1988). The final step was devoted to building a prototypical implementation of the required functionality into portlets of the Liferay portal exhibiting the LAP model.

Background and research focus

Analyzing qualitative data involves reading and analysis of empirical samples (i.e., process descriptions, manuals, interview transcripts, video-taped sessions, etc.) with the aim to identify relevant data items, draw connections between discrete pieces of data and ultimately code the data in a hierarchical coding scheme. This is a demanding and knowledge-intensive task which requires substantial preparation and expertise. Research teams tasked to undertake such exercises will most likely join forces over a period of time to carry out on-site visits to collect data, data screening and filtering, data analysis and coding. As these steps may be allocated to different members of the group, certain coordination is needed to streamline efforts towards a common goal. The present research focuses on activities framed in the data analysis phase, assuming that the steps of data collection and data preparation have been completed. Moreover, it concentrates on a particular medium of

codified data, namely the interview transcript, and the dialogue that surrounds such transcripts when being analyzed by expert analysts.

Data samples and analysis

To gain the required insight, we examined conversational patterns in a set of materials that comprised transcripts of five semi-structured interviews as well as narrative descriptions of processes followed by a regional cooperative active in organic farming in the southern part of the region of Crete. Each interview transcript was 4 to 6 pages long and represented work undertaken by actors within the cooperative. Appendix A provides an example transcript of one of the interviews (interviewee #4) for purposes of illustration and the narrative description.

Figure 4.1: Illustrative coding

Initial screening for identifying relevant data items relied on highlighting phrases from the text and assigning them with appropriate codes. Analysis of transcripts was iterative, aiming to identify user roles and affiliation, human intentionality, choice of technology, computer-mediated tasks, as well as communicative patterns. This is a typical open coding exercise where textual extracts are ragged to externalize the analyst's perception of the data. Figure 4.1 depicts an extract of an interview transcript and indicative codes assigned during the open coding phase. As shown, at this level of fidelity, codes may be used to assign meaning to different concepts, including artifacts, user roles, technology genres, boundaries and ties (Appendix B). A typical example is the phrase *"…wholesaler"* which implies an *affiliation/ role.* Similarly, the phrases "…keep records" is *data representation/ artifact* In Table 4.1 we present the findings per codification category and in Appendix B we present the result of this phase for both the interview as well as the narrative text. Second-level

analysis focused on qualifying conversational patterns either explicitly encoded or suggested in the text. For instance, our extract points to patterns such as role taking (moderator vs. participant), raising issues and making claims, add a position, explicit or implicit invitations for contributions, taking decisions, argumentations etc. as they have been recognized in bibliography. A typical example is the phrase *"… we had to reduce the price"* which implies that price is an issue to be negotiated and set. In a similar vein, the phrase *"…we can both conclude and propose how many tons we may need for a month"* which implies taking a decision/ agreement while the phrase *"… to advise me that it would be better if I had 15 tons"* suggests making a *proposition/ taking a position*. Along these lines, we analyzed the set of five interview transcripts and documented the designated conversational patterns. Appendix C summarizes the results of this work, indicating the specific phrases and the derived codes. Besides, Table 4.2 below concentrates all the phrases marked along with their indication.

Table 4.1: Findings from first phase coding of interviews and narrative description

Codification	Interpretation	Findings
Data representation and artifacts	Phrase that shows artifact or data representation of a specific type	Last year results Next year schedule, flow diary, excel ,images, quantities, prices
User roles and affiliations	Phrase that shows a role or occupation or organizational affiliation	Company manager Philip, president, director, wholesalers, German partners, Agriculturists, Producers (those who cooperate absolutely with the company, the others)
Boundaries	Phrase that shows boundaries	Geographical(*Germany*), Temporal(*take us two days, From May until the end of June etc., procedure lasts two weeks, visit lasts one week, next year, 40 days later etc.*)
Ties	Phrase that shows ties and relationships	Previous cooperation and collaboration (*they have been working for years*), negotiations, comments of consumers, initial plan for orders, economic agreements, definition of next year order
Digital settlements and traces	Phrase featuring online collaboration	email
Technology genre	Systems and technologies	Telephones, and systems used

Table 4.2: Extract of coding interviews

He does not sell directly	Responsibilities of roles
…he sells to other wholesalers who sell to shops and schools.	Responsibilities of roles
Based on the results of last year…	Reference to past/ Quote of last year results
…due to the lack of product or surplus	Issue(quantities)
…a plan for the new season	Issue (Schedule)
We meet each other…	Get people to involved
…together we do this stuff	Negotiation, collaboration
…to reduce the price	Issue (price)
… last January we sold 10 tons of cucumber	Quotes of quantities
…since it was difficult to sell that entire amount	Issue Quantity
…he tells me instead of 10 tones to have only 8	Cross turn quote
So there is a negotiation	Negotiation

…both conclude and propose how many tons we may need for a month.	Proposition/ take a decision
… I ask the agriculturist and Philip	Question/ answer
..say in order to ensure the «bunch»	Claim
…we will need 10 acres, three of which should be planted in August, the other 2 should be planted in September and in October we will plant others...	Proposition
..in order to have this flow	Claim
..what to ask from the producers.	Get producers involved
..I meet the producers.	Get producers involved
We meet first our producers,	Give priority to some producers
..to join us in the program	Producers accept the invitation
..after we have taken the okay I start	Agreement
..the result is not always what we want	Disagreement
…sometimes I want ten acre	Quotes acres
…may have problem with these two extra acres.	Issues
…finished I inform the agriculturist about the result, what we wanted but eventually this is the result because sometimes...	Information about the result
..give priority to producers who bring the 100% of the product	Preference to some producers
… I will talk with the producer	Conversation
..prefer a producer from another.	Preference to some producers
..he may buy more expensive	Price Issue
…what and how many acres one have planted how many acres have grown up to whom I put the acres they wanted, in which codes we had lack) we discuss with the agriculturist about each acre when it will have grown up	Attributes of acres
….have a large deficiency he must be informed, namely I sum up the whole season	Issue quantity deficiency
…discuss them with agriculturist	Conversation
Because of the change in weather conditions	Claim
…something the system cannot support	Issue system weakness
…and every week I send also a report (I will show it to you – what I will send, where I will put it). And a third thing we do is that we try to check every 2 weeks , I say for example , I say here , in field with peppers , we are in week 48 now, I say 50,51,52 week from 48 I try to see how the fields are and it they are normal we will get these quantities.	narration
mid-spring (in May), from September to April, about two months, visit lasts about a week	Temporal boundaries: duration of negotiations. Negotiations have duration
excel files ,, mobiles, images, emails	artifacts

Having assigned codes to excerpts of the interview transcripts, the next phase concentrated on phrasal analysis in order to identify conversational patterns. For this purpose it was deemed appropriate to further decode the role of certain codes. For instance, the presence of explicit references to affiliation types such as "wholesaler", "retailer", "super wholesaler", "agriculturist", etc., suggests a multi-party negotiation with role taking acting as a qualifier for certain activities, pre-requisites and outcomes with each role to have different responsibilities. For example, the phrase *"From May until the end of June, I ask the agriculturist and Philip that if German wants these products and these quantities how many acres should be planted and when. Then, we conclude all together...For example we say in order to ensure the bunch we will need 10 acres, three of*

which should be planted in August…." suggests a collective decision making which results through the use of turn-entry and turn-exit devices, adjacent and non-adjacent turns as well as argumentative discourse. The turn begins with *"I ask the agriculturist and Philip".* Through the question about the acres should be planted, the manager links his turn with a next turn and ends with his own proposition. In a similar vein, the excerpt *"Based on the results of last year, that is what we have sold, if we had problems due to the lack of product or surplus, we can do a plan for the new season. We meet each other and together we do this stuff. It takes us two days."* implies an argumentation between different people (manager and German partner) on a specific issue through use of turn-entry and turn-exit devices, adjacent and non-adjacent turns, adding positions and claims to decide collaboratively. Turns change between manager and German partner by posing their positions until they reach a decision. Another example of argumentation is in the phrase *"Then, I meet the producers. We meet first our producers, namely those who give us the 100 % of their product and we tell them: Guys we want these, the one who has let's say 5 acres says okay for me put two acres of cucumber, one acre of August brunch, one acre of December tomatoes. I start writing down all this info (I will show you) let's say I want ten it comes... you say I will put two; I say I will put another one acre. Thus I need some more to complete them".* Similarly, we also identified additional conversational patterns that can easily be qualified through indexing, qualifying or tagging elements. For instance, times anchors indicating start of production or quantity (expected or actual) can be considered as conversational patterns in this category. Moreover, the phrases *"…I meet the producers", "…ask from the producer", "…I ask the agriculturist and Philip..."* suggests that the manager of company gets other people to become involved in a conversation implying thus invitations to contribution through Cross-Turn Quoting, Turn-Entry Devices. Another pattern recognized in the transcript is the story-telling and narratives. The manager of the company describes the way of cultivating as well as the report they give to partners in German (*"Well, every week, I give a report to Germany, that is I sent a general, overall anticipation and every week I send also a report -I will show it to you – what I will send, where I will put it. And a third thing we do is that we try to check every 2 weeks , I say for example , I say here , in field with peppers , we are in week 48 now, I say 50,51,52 week from 48 I try to see how the fields are and it they are normal we will get these quantities."*). Besides, word-of-mouth is also identified when the manager informs Philip and producers about the acres needed to be plant and then, they inform about that the producers. Therefore, it is implied an oral passing of information from person to person. We also found that there is the rating/voting pattern where the manager expresses preference for a specific group of producers, In particular, the phrases "*We meet first our producers*" and *"give priority to producers who bring the 100% of the product"* shows preferences to some producers thus it is implied that they have greater rating. Another conversational pattern identified in the transcripts refers to quotes and cross turn quote. For instance, the German partner repeats an excerpt from manager's sayings. Manager quotes that *"last January we sold 10 tons of cucumber"* while German partner repeats the excerpt about *10 tons of cucumber* (*"he tells me instead of 10 tones to have only 8"*). By using cross-turn quotation the German explicitly identifies the parts of the information the manager gives and wants to

express his opinion. Finally, we pinpointed cross-turn linking where with a specific expression the turn changes as well as cross-turn addresivity which means that explicitly a name the turn changes towards him. The cross turn addressivity is realized through expressions like *"Guys we want these…."* or *"I ask Philip and agriculturist"* which implies that the manager call them namely *"Philip, how many acres should be planted for these quantities German asked?"* whereas cross-turn linking through expressions like *"difficult to sell that entire amount"* or *"if German wants these products and these quantities".* In these examples a user resorts to these expressions (e.g *that* or *these products and these quantities*) to indicate that the message is linked to previous turns e.g *German (cross* turn addressivity).

The results of this analysis are summarized in Table 4.3 that consolidate the prominent conversational patterns embedded in our interview transcripts.

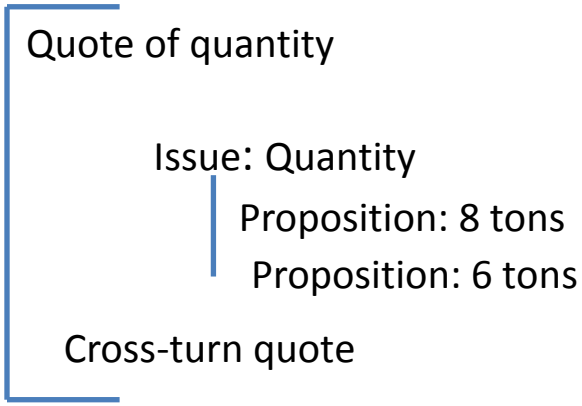
Table 4.3: Conversational Patterns

Role taking (moderator vs. participant)	Interviewer vs. Interviewee
Inviting contributions	Getting people involved
Adjacent and non-adjacent turns	Turns that point to something stated in that last (i.e., adjacent) turn or during a previous non-adjacent thread of the discussion
Word-of-mouth	Passing information from person to person
Creating narratives/ story-telling	Using text to express an idea, state of mind, or opinion
Cross-turn quoting	Referring to earlier / subsequent conversations
Turn-entry and turn-exit devices	Linguistic markers that indicate how turn is claimed and released
Cross turn linking	Expressions that link a turn to a previous turn
Cross turn addressivity	Explicitly using a user name to change the turn
Indexing, qualifying and tagging	Externalizing cognitive bias
Rating/ voting	Show preference, externalizing bias
Argumentation	Posing issues and invoking dialogue
Taking a decision	Expressing a point of view in favor or against

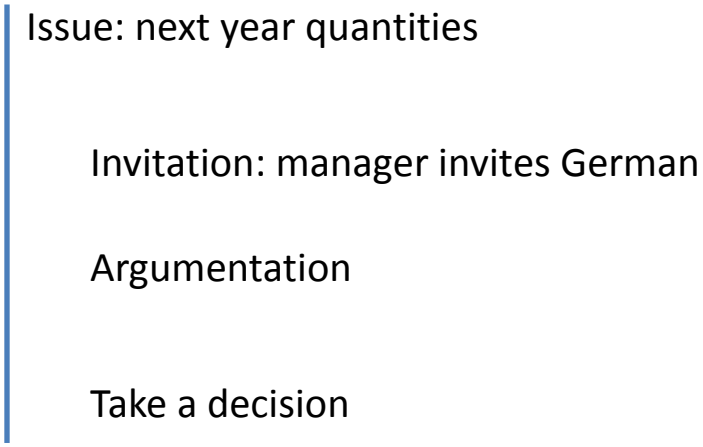
During the analysis some interaction patterns like nested or serial patterns have also emerged except for the simple patterns we referred before. Example 1 depicts pattern nesting of cross-turn quoting, issues and propositions. To be more specific, the phrase "10 tons of cucumber" is a quote about quantities and referred by manager. German uses manager's sayings to propose quantities to be planted this season "he tells me instead of 10 tones to have only 8," thus this is a cross turn quoting pattern. Moreover, between these patterns there is also an issue along with the positions. A serial of patterns has also identified in example 2 where an issue about next year schedule has arisen and manager invites German partner to contribute. Then they, negotiate and finally to take a decision. Another example of interactional pattern (example 3) is also nested and represents a set of questions and answers nested in an issue. The issue is the number of acres to be planted and a set of questions about the acres is set until users to take a decision. Finally another interaction pattern we recognized is depicted in example 4 where manager sets an issue that who producers and how many acres will plant. Then, he invites

the producers to get involved by cross turn addressivity. They make propositions about the acres to plant and finally they take a decision.

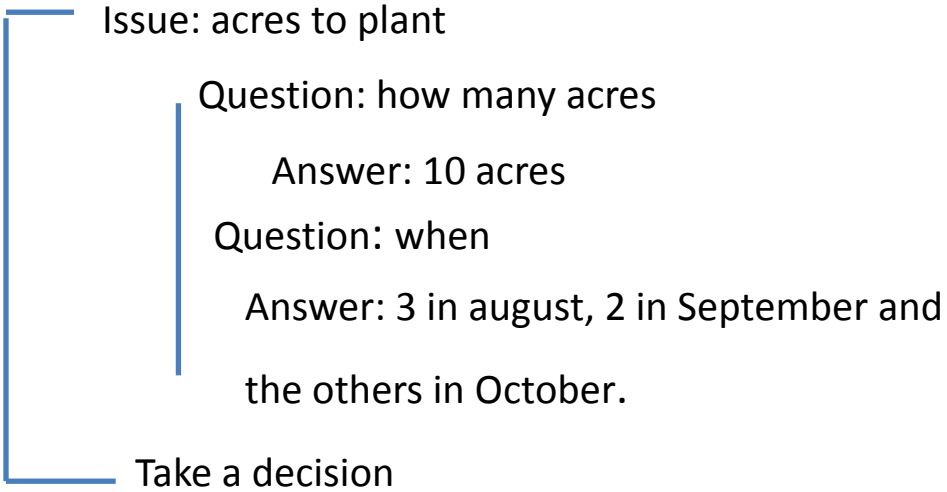
Example 1: First nested pattern



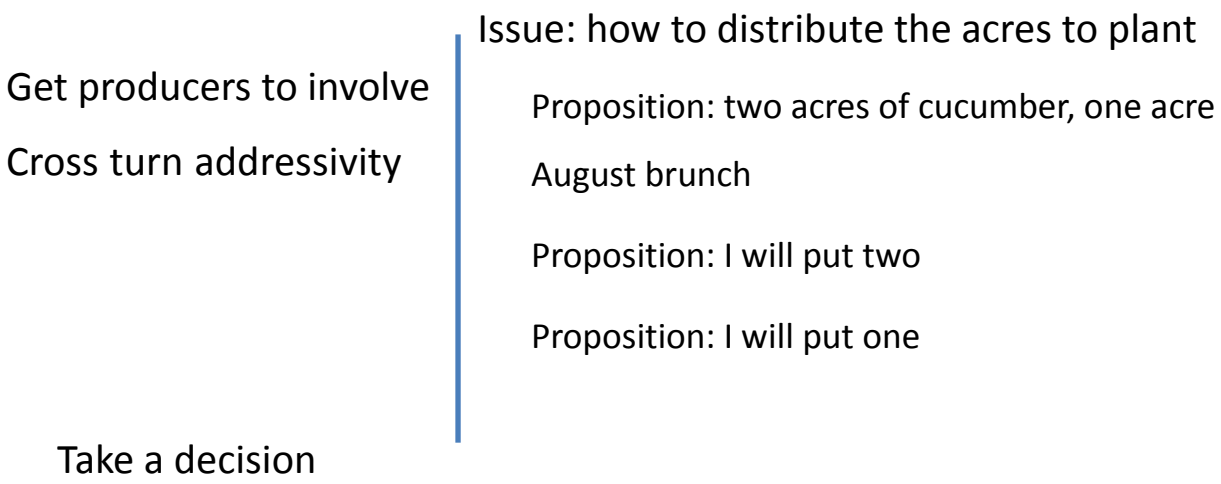
Example 2: A serial pattern example



Example 3: Another nested pattern



Example 4: Another interaction pattern



Language – Action models

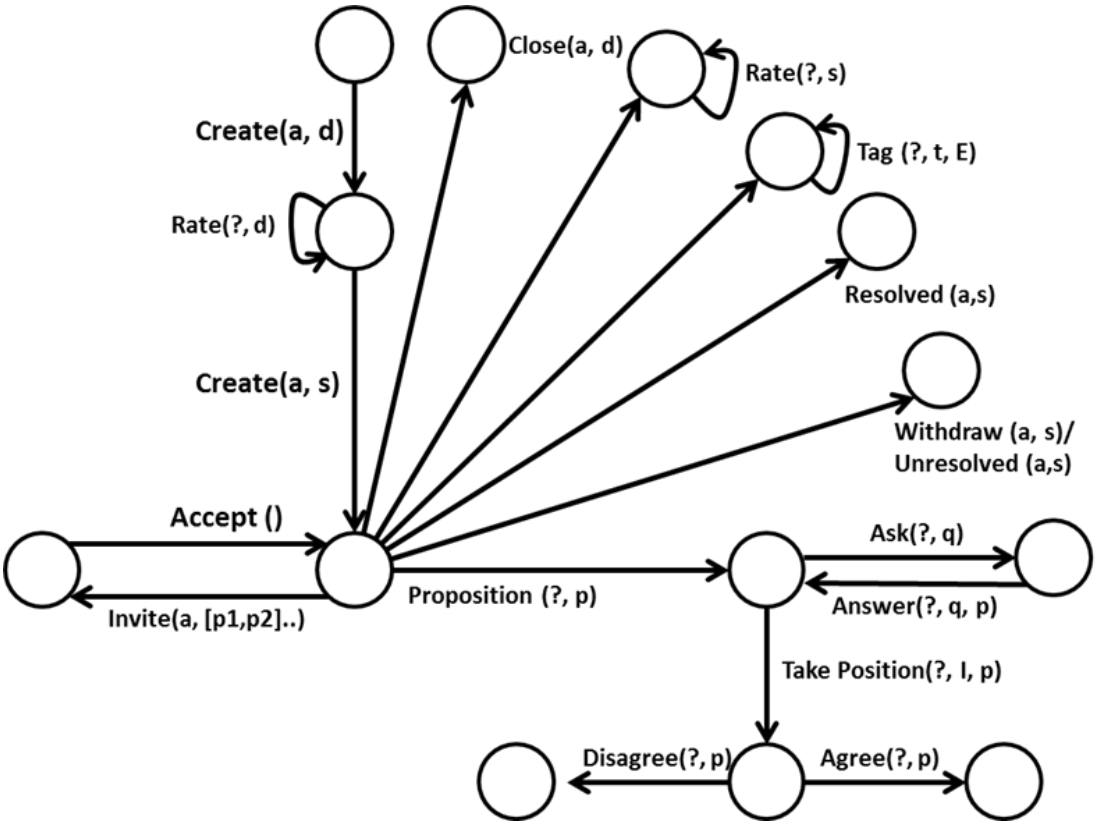
Once the key conversational patterns were identified, the Language-Action perspective (Winograd, 1987-1988) was recruited to model them as parts of a coherent online discourse. In the tradition of LAP, actions and argumentation can be depicted through the use of state diagrams to anchor a coordinated sequence of acts that can be interpreted as having linguistic meaning without the need of a spoken dialogue. An initial model was developed with a minimal set of clauses which was subsequently aligned with the requirements of a document-based system. The resulting scheme which was implemented is summarized below:

- **Create**(a, d) Actor a creates a new document d and claims ownership
- **Create**(a, s) Actor a creates an issue s
- **Invite** (a, [p_1, … p_n]) Owner of a document invites a list of participants who Accept / Reject invitation
- **Propose** (a, s) Actor a make a proposition on issue s.
- **Agree** (*a*, *s*) Actor *a* accepts statement *s* as a valid statement; it may eventually become part of its internal model *M*a. A statement can only be accepted after it is proposed.
- **Disagree** (*a*, *s*) Actor *a* rejects statement *s*, because *a* finds *s* unacceptable even for further consideration. Reject is the counterpart of accept.
- **Ask** (*a*, *q*) Actor *a* asks question *q*, to be answered by some actor. Queries can be withdrawn or answered.
- **Answer** (*a*, *q*, *s*) Actor *a* answers question *q* with statement *s*; an answer functions as a special **Propose**.
- **Withdraw** (*a*, *d*) Actor *a* withdraws document *d*.
- **Accept** (a, d) User a accept to contribute to document d
- **Reject** (a, d) User a do not contribute to document

- **Take position** (a, I, p) User a for an issue I takes a position p
- **Tag** (a, T, E) A user a attaches a tag T to resource E
- **Comment** (a, C, E) Actor a comment on a resource E
- **Rate** (a, R, d) Actor a rate a document d
- **Vote** (a, V, p): An actor a votes a position p

For the clauses indicated above the Dialog for Action (DfA) developed is illustrated in Figure 4.2. In order to provide details about the DfA it is worth considering three illustrative scenarios detailing how the clauses can be used to model negotiations in small group activities. In all cases, it is assumed that (a) the creation of a document signals the start of a conversation between peers with the aim to code the document; and (b) the conversation is between peers in two roles, namely the owner of the document and the peers who are invited to contribute by setting issues, positions, rating and voting them, adding tags, agreeing and disagreeing, adding their opinions and claims, asking and answering questions and finally reaching consensus on open issues. The first scenario will depict the typical exchanges between the owner of the document and the peers leading to resolving an issue by committing to one of the alternatives raised during the online discourse. The second scenario will highlight parts of the DfA that allow a user to create a structured document and invite participants to refine and update its meta-data. And the last one will highlight the part of the diagram that allow a user to add metaTags to the document, tags to an issue and assign tags to metaTags.

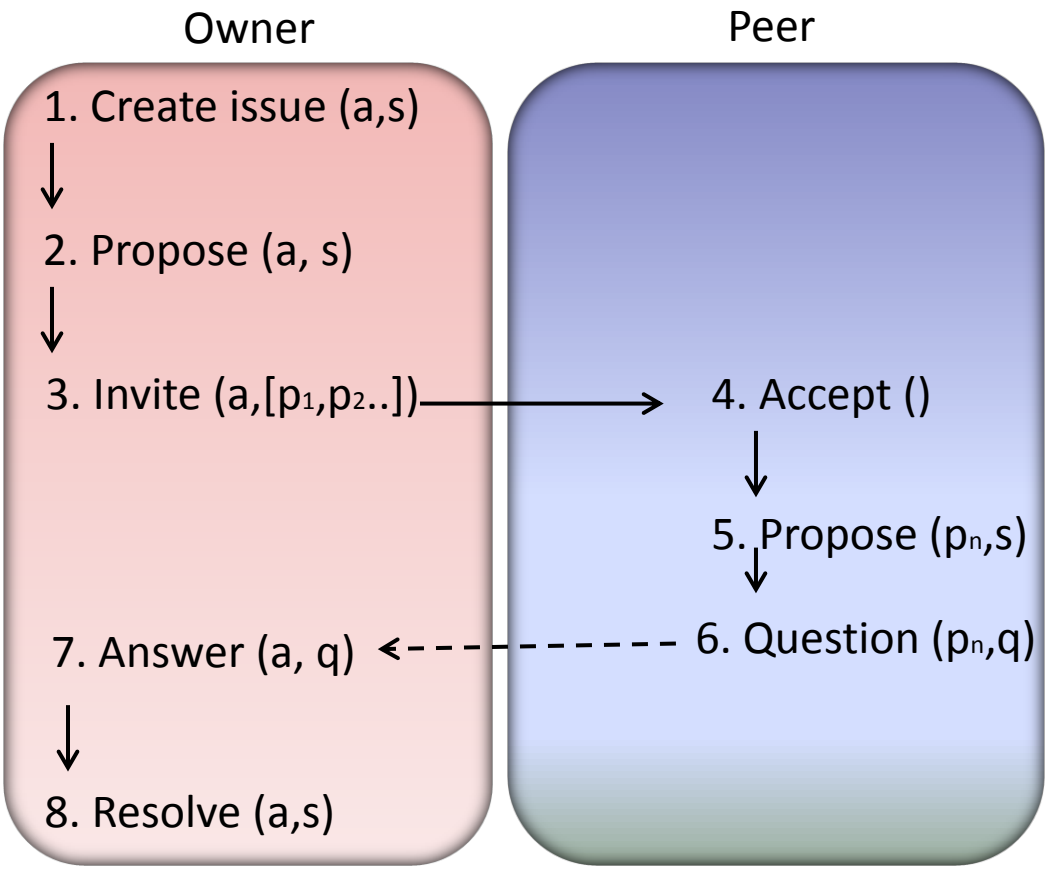
Figure 4.2: Basic model for Dialog for action



First Scenario - Exchange between peers leading to issue solution

This scenario assumes that a document has been created. At a certain point, the author of a document creates an issue and populates it with a certain proposition. Then, the author invites other users to contribute to this issue by proposing their own positions. Once peers become involved, they may attempt to disambiguate the issue by posing questions which are responded by the author. This process may take place iteratively, over a period of time, until contributions are solicited. At a certain point, the author decides to resolve the issue by selecting one of the propositions as the preferred solution. Figure 4.3 depicts this scenario as bulleted sequence of actions between the document's owner and a number of group members.

Figure 4.3: Constituents of first scenario



By referring to our interview transcript, we can easily identify such a scenario in the exchanges between the interviewee (i.e., the manager) and colleagues. Then, the bullet sequence can be translated to the following clauses:

- **Create issue** (manager, next year schedule): manager creates an issue about the quantities they have to produce for next year
- **Propose** (manager, the last year quantities): manager proposes to produce the same quantities as last year.
- **Invite** (manager, [German]): manager invites German partner to declare his position.
- **Accept ():** German accepts to contribute**.**

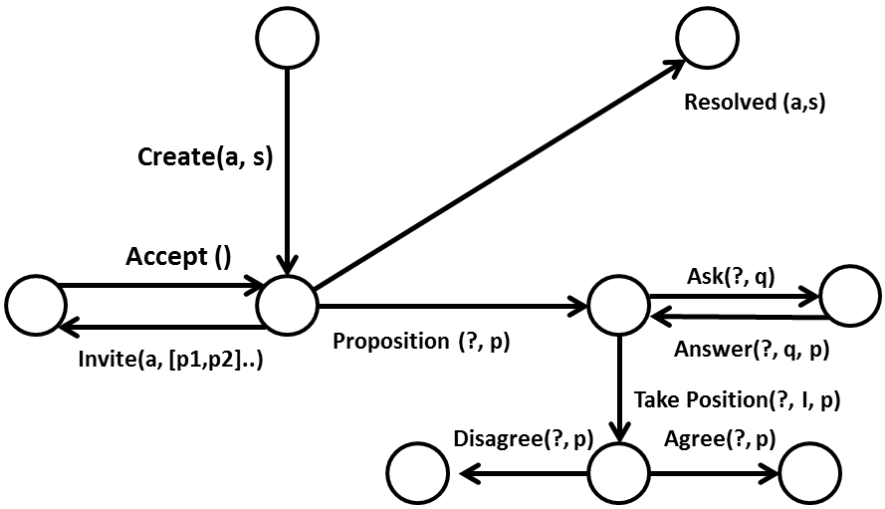
- **Propose** (German, increase quantities due to increased demand): German partner proposes an increase in quantity for next year.
- **Agree** (manager, agree with German): manager agrees with German partner and find his position as most suitable
- **Resolve** (manager, issue): thus the issue is now solved.

In a next part of the interview the manager of document creates another issue about the acres they have to plant for the quantities requested by the German partner. The corresponding clauses are as follows:

- **Create issue** (manager, acres to plant for the proposed quantities of German partner): manager posts an issue about the acres that should be planted in order to meet the quantities agreed.
- **Propose** (manager, the quantities proposed by German partner): manager proposes the quantities agreed with German partner
- **Invite** (manager, [Philip, producer]): manager invites Philip and producer to express their opinion.
- **Accept ():** Philip and producer accept to contribute.
- **Ask** (manager, how many acres to plant): manager wants to know how many acres should be planted
- **Answer** (Philip, ten acres): Philip replies by specifying the number of acres
- **Ask** (manager, when to plant the these acres): manager inquiries on the appropriate period to plant
- **Answer** (Philip, 3 acres in August, 2 in September and the others in October): Philip responds by designating quantities per period.
- **Resolve** (manager, issue): The issue is solved since they agree.

For the clauses above the corresponding dialog for action is pictured in Figure 4.4. As shown a user "a" creates an issue "s" and then he invites peers P_1, P_2, $P_3 \ldots P_v$. Peers accept the invitation. Members of the group formed to address issue "s" make proposition "p" on issue "s", ask/answer a question "q" or agree/ disagree with certain propositions. Finally, user "a" resolves the issue.

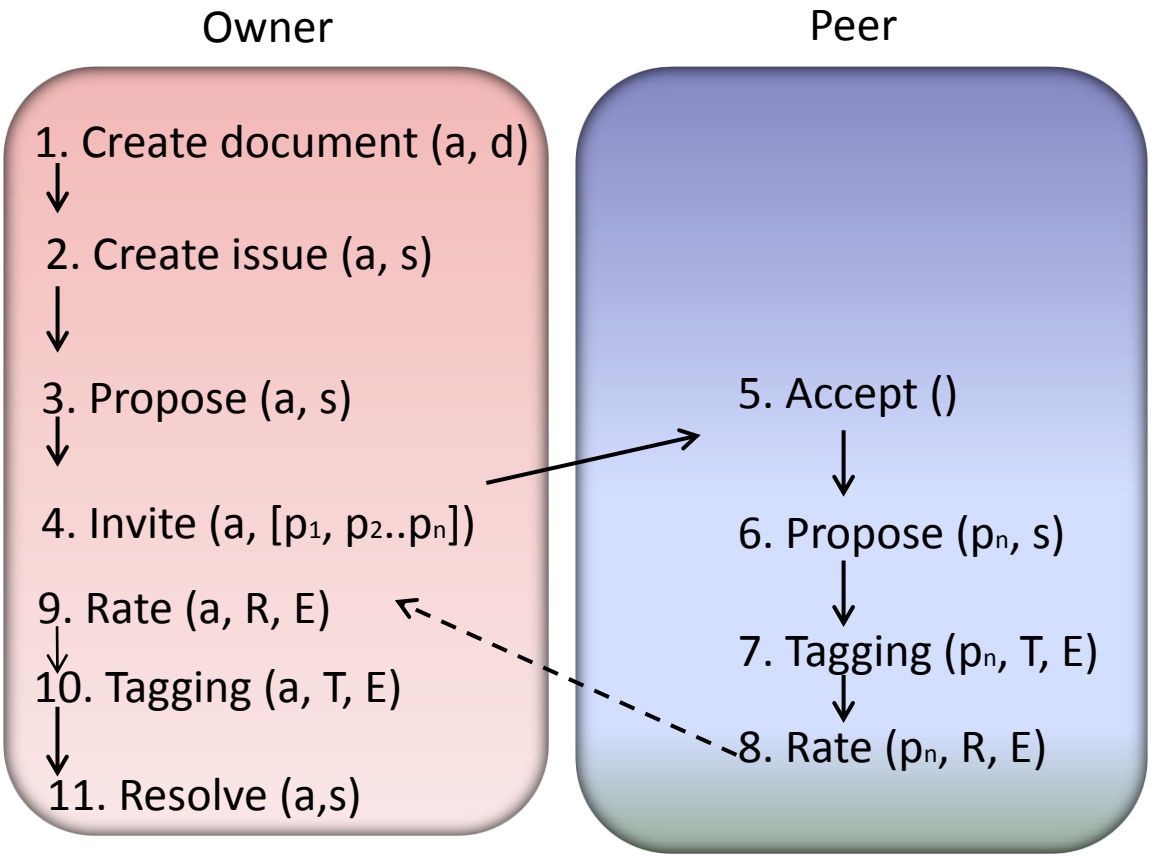
Figure 4.4: DFA for exchange between peers and owner



Second Scenario – Refinement and update document meta-data

The second scenario refers to the case where a user, which is the author of a document, creates a document, invites peers and together they start to refine the document by adding propositions, tags or rates. This time the bulleted sequence is depicted in Figure 4.5.

Figure 4.5: Constituents of second scenario



As in the previous scenario, we can easily pinpoint this scenario in our interview. Specifically, in the interview transcript, the interviewee who is the manager of the company sets an issue for consideration by other users. The meaning of the clauses entailed is as follows:

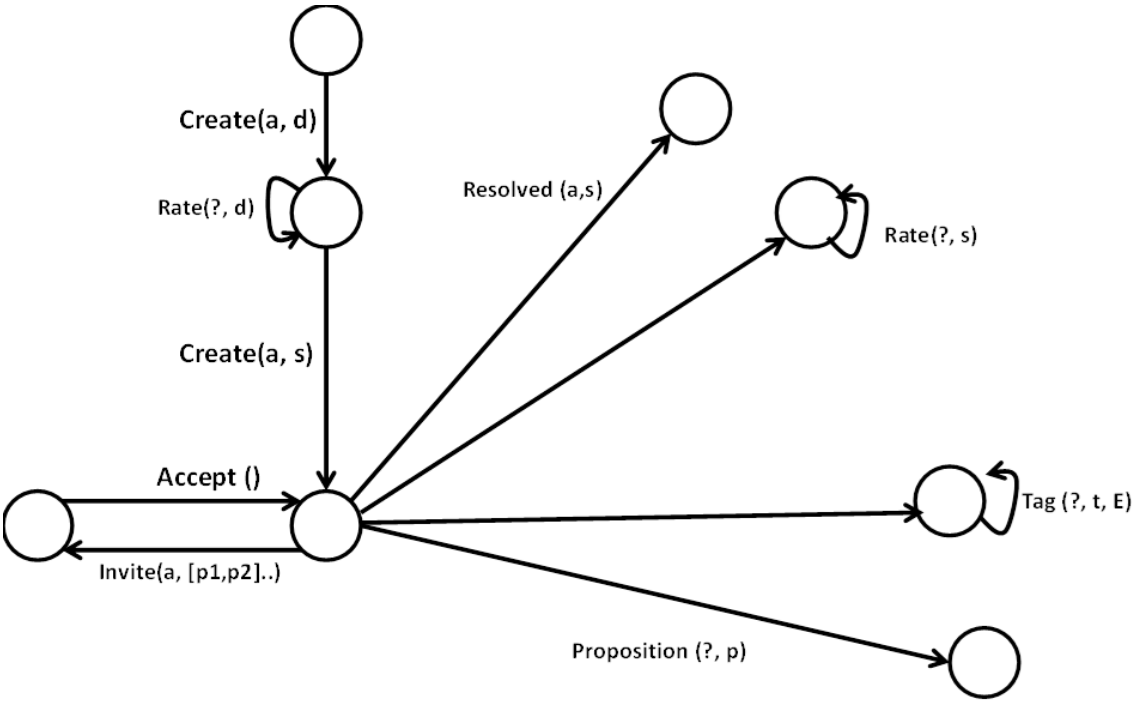
- **Create document** (manager, document about the acres needed to be planted based on the quantities requested by the German partner): manager creates a document.
- **Create issue** (manager, decision on what producers are needed to cover the demand above): manager posts an issue about to determine the number of producers needed to meet certain demand.
- **Propose** (manager, statement of preference in favor of producers within the cooperative): manager's preference and proposition is to give priority to producers within the cooperative.
- **Rate** (manager, priority to producers who give to the company the 100% of their product): this declares a preference on producers that satisfy the threshold / rating.
- **Invite** (manager, [producers]): manager invites producers to contribute with their position statements.

Then, each producer undertakes the following:

- **Accept():** producers accept the invitation for contribution
- **Propose** (producer1, take from me 1 acre of bunch): A producer declares a specific quantity of a certain product
- **Propose** (producer2, take from me 2 acre of cucumber): A producer declares a specific quantity of a certain product
- **Propose** (producer3, take from me 1 acre of tomatoes): A producer declares a specific quantity of a certain product
- **Tag**(manager, acres, what plant): They add information about what to plant in these acres
- **Tag** (manager, acres, and the time plants will give us fruits): Manager adds information about the time plants will start to produce fruits.
- **Tag**(producers, acres, the period of planting): they add information about the time to start planting
- **Tag**(producers, acres, the production/output per field): They add information about the output that is the quantities a field can produce
- **Resolve** (manager, issue): finally the acres are shared among the producers

The corresponding DfA is depicted in Figure 4.6. As shown user "a" creates a document "d" and then creates an issue "s" on document "d". Then, peers P_1, P_2, P_3…P_v are invited who accept the invitation. Any user can rate the document "d" either the author a or the invited p1, p2...pn. Members of the group that is formed make propositions on issue "s". They can add tags on issues and rate. Finally, user "a" resolves the issue "s".

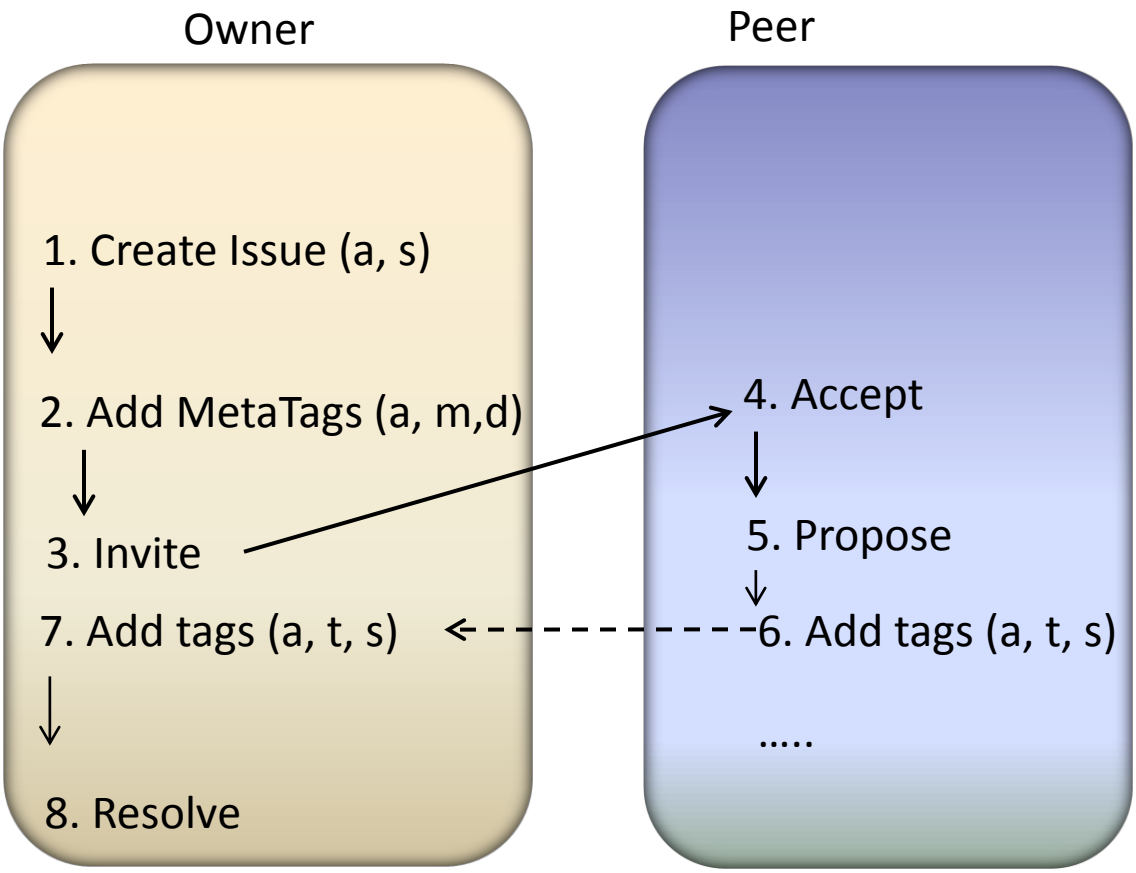
Figure 4.6: DfA Refinement and update document meta-data



Third Scenario –Tags, MetaTags and the difference

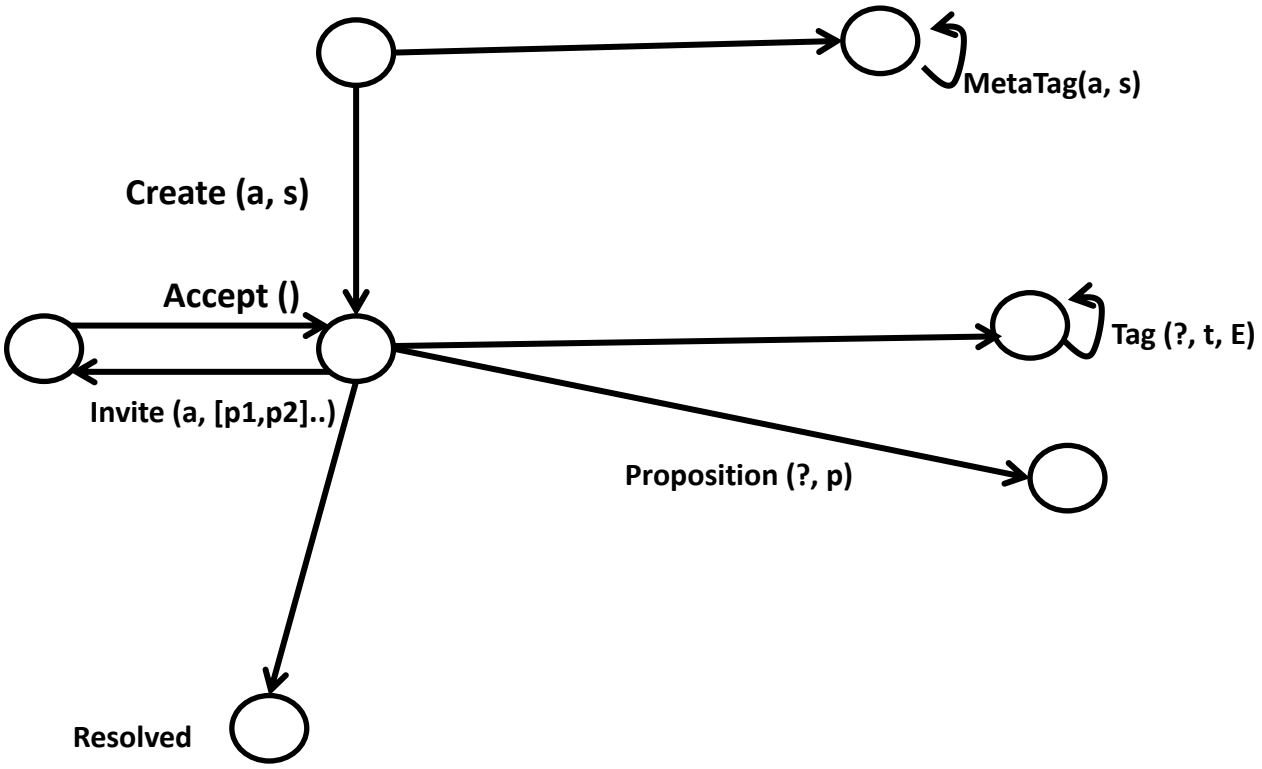
The third scenario refers to the case where a document has been created. At a certain point, the author of a document (User A), refines the document by adding tags (let's call them metaTags to be distinguished from issue tags) to the document, issues and populates it with a certain proposition. He then invites peers who after accepting, add tags to issues and then assign them to metaTags. Figure 4.7 depicts this scenario as bulleted sequence of actions between the document's owner and a number of group members.

Figure 4.7: Constituents of third scenario



As in the previous scenarios, we can pinpoint this scenario in our interview. Specifically, we pinpointed this scenario in the narrative document, cited in Appendix A, which describes the procedure of negotiations where the wholesaler meet the director and the president of the organization set some issues in order to find a solution. The meaning of the clauses entailed is as follows in Figure 4.8:

Figure 4.8: DfA Tags, MetaTags and assignment of tags



- **Create issue** (manager, delivery flow) : manager posts an issue about the price, that is what will be the price of products.
- **Create issue** (manager, delivery quantities) : manager posts an issue about the delivery quantities,
- **MetaTag** (manager, trade agreements, Analysis of last year cooperation) trade agreements refer to the analysis of last year cooperation.
- **MetaTag** (manager, trade agreements, determination of next year order): trade agreements refer to the determination of next year order.
- **Invite** (manager, [wholesaler]): manager of BIANAME invite the super wholesaler to meet, discuss some issues of the organization.
- **Accept** (): the wholesaler accepts the invitation and meets the members of BIANAME.
- **Tag**(wholesaler, delivery flow, per month): he adds information about the price per month
- **Tag** (wholesaler, delivery flow, per type): he adds information about the price per type.
- **Tag** (manager, delivery quantities, per month): they add information about the delivery quantities, how many per month
- **Tag** (manager, delivery flow, per type): they add information about the delivery quantities, how many per type.

Consolidation

The three scenarios illustrated above are indicative of how data embedded in interview transcripts can be encoded using clauses of DfA. Using the above as guiding lens, it is now possible to infer the required functionality of a system whose primary purpose is to support the above social exchanges between peers. Our development strategy evolved in the direction of inscribing the designated functionality into an enterprise portal such as Liferay so as to make the system an integral component of a virtual partnership. To this end, subsequent efforts concentrated on designing and implementing two Liferay portlets exhibiting the featured indicated by the LAP model. The following chapter describes the design as well as the implementation of the working prototype that was implemented within the scope of the present research.

Chapter 5 - Design and Implementation

In this chapter, we describe the implementation of a system based on the design concepts elaborated earlier. Specifically, we will briefly reflect on the development tools chosen, the logical design devised and the specificities deemed appropriate for conversational knowledge management. The following chapter presents an elaborate illustration of the system's features and capabilities using a structured walkthrough.

General description and functional scope

The general purpose of the system is to facilitate Conversational Knowledge Management in the course of small activities. As prime design target we consider the capability for an incremental dialoguing pattern fostering negotiation of contents and reaching collective consensus. Such 'collectivity' is made to be made explicit and explored by dedicated provisions for issue tracking, tagging, assessing related documents, etc. The core artifact for structuring dialogue is the document. As documents, we envision any form of codified knowledge which is shared, negotiated and augmented by a peer group. Access to documents is regulated by roles. At present, users become involved in two distinct roles. The role 'author' or 'owner' allows users to create a document, raise issues for conversation, set positions and invite other users to contribute with their opinions. The role 'peer' depicts colleagues invited by document authors in order to express opinion, add positions to an existing issue, raise their own issues and agree or disagree with the state of the online discourse. It is also assumed that such a process is iterative and recurrent until certain goals are met through peer collaboration. This state is reached when the author of the document takes decisions on pending issues and declares preference on the best positions.

Such a functional purpose may be relevant to multiple reference domains that rely on intensive knowledge sharing. One such case is qualitative data analysis where peers are required to work with empirical findings compiled either through interviews, questionnaires or other qualitative data collection instruments to solicit the required insight into the phenomenon being described and the context in which it occurs. Although such a focus is specific and targeted it offers an appropriate and challenging test bed for experimenting with several of the concepts presented in earlier chapters. This is easily deduced by briefly assessing what is actually entailed in conventional qualitative data analysis and how knowledge proliferates as structured conversations between members of the peer group.

Specifically, qualitative data cover a broad range of empirical evidence frequently embedded in transcripts of structured or semi-structured interviews, documented procedures, informal notes, inspection of work practices, video-taped episodes, etc. Confronted with such rich data sets, analysts recruit various techniques to combine data sources, identify codes and devise hierarchical schemes capable of explaining the phenomenon under investigation. Such a process is frequently grounded on established theory that offers appropriate theoretical constructs. Alternatively, it may be tuned towards the development of new theory on the

grounds of the 'tells' of the empirical findings. In most cases, such exploratory work is may be organized as a collaborative effort with responsibilities for data collection, analysis and validation spread out to different people. It is therefore plainly evident that conversational practices proliferate in multiple modes (i.e., conversing with field experts to solicit data, conversing with colleagues to set agendas or make sense of the data) and settings (i.e., conversing in situ and face to face, engaging in online discourse, etc.).

For our purposes, empirical data are transcripts of interviews appropriately codified in structured documents or narrations coming from a) indexing of video content, (b) indexing of video materials, (c) handwritten notes during field observations, (d) data from discussions with the method of video conferencing and (e) photographic material. Such documents can then form the baseline for data analysis by a peer group in order to either test an existing or create a new and appropriate coding scheme. Such a coding scheme is then a typical example of knowledge refinement or even new knowledge created and shared between the parties involved. Needless to state that, for our purposes it is equally important to facilitate situations where codes are being developed from scratch as well as the case where established codes are to be validated by independent coders. In the former situation the research group collaborates to analyze a set of interviews in order to establish certain codes. In the second situation, the codes are established and the actual work entails verifying the codes by independent experts. In other words, the "author" of the document is assumed to have a coding scheme which is encoded in the document so as to be used by peers for further development and/or verification in the absence of relevant theory.

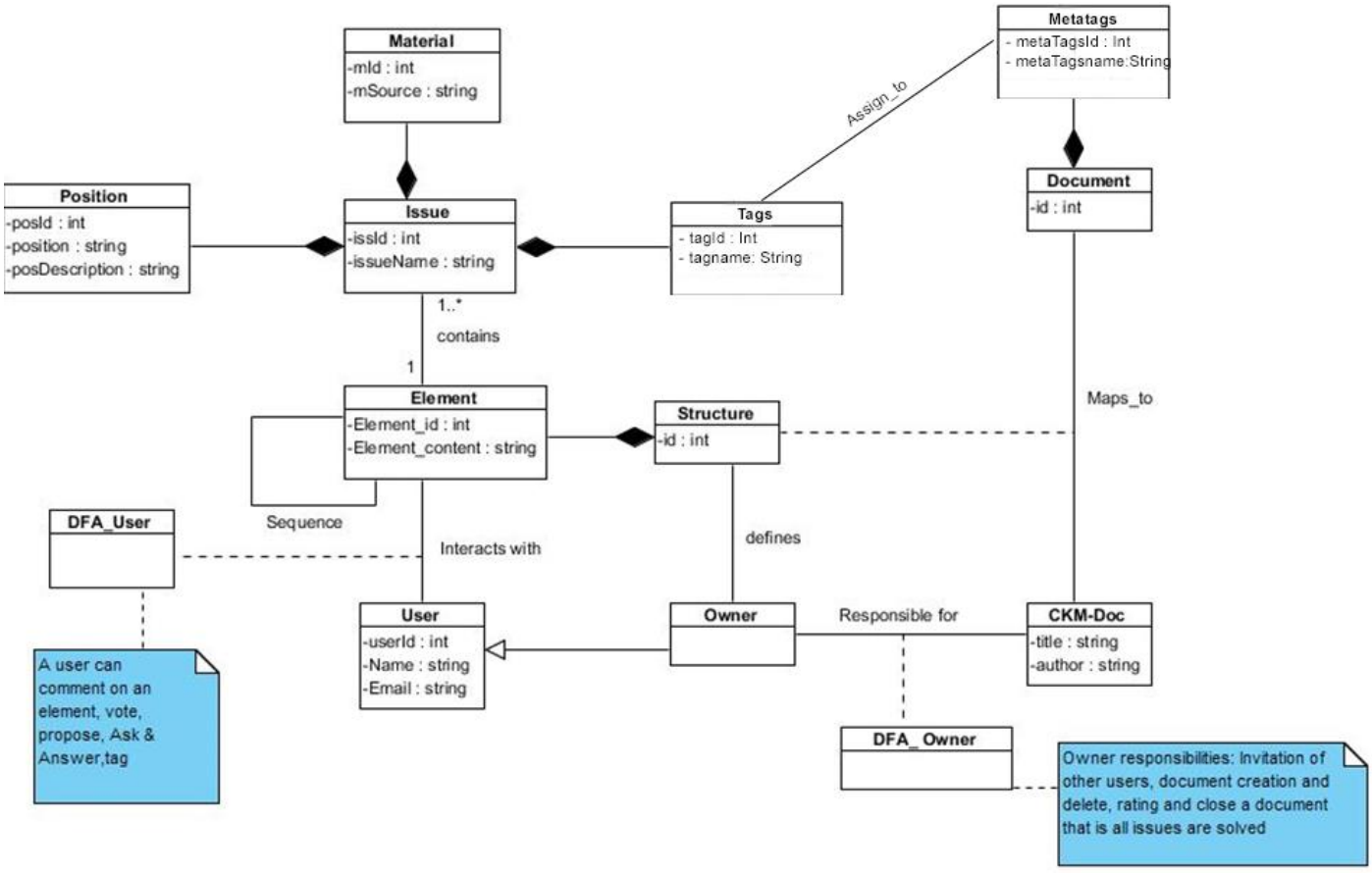
System overview

Logical design

For the purposes of this thesis, we have re-engineered two portlets to provide the required functionality. At core, our system makes provisions for document authors (owners) and peer users who are typically invited by document owners. In the first portlet, owners create documents (Figure 5.1) that exhibit specific structure (CKM-Doc) and may be made up from several of content. Documents are based upon transformable information templates (Akoumianakis et.al., 2012) that provide the means for assembling structured content. Elements are components hosting designated pieces of content. Simple documents may contain just one element. Once a document is defined, author can invite other users to engage in a variety of dialogues representing the DfA introduced earlier. In the second portlet, authors and contributors can interact both we document, elements and issues engaging in a variety of dialogues. Voting, tagging, rating, commenting, withdrawing a document and link to related documents are some of the activities peers and authors can do. Moreover, author can define the coding scheme of document, namely it's metaTags as well as to define tags to issues that can be assigned with metaTags. Our system is connected to relational Data Base (DB) which is

responsible to operate the information and data of the system, namely storing, retrieving, deleting and managing them. In the next sub – chapters both portlets and data bases are analytically described.

Figure 5.1: Basic elements of the document structure



Description of Portlets

This section provides a pictorial illustration of our system with the focus set on an analytical description of the Portlets designed to the dialog for action presented earlier. The basic portlet allows users to create a document as the basic object invoking CKM. In our case study, each interview transcript is mapped into a separate document. The main components of this portlet are the 'editor' component where authors can codify their documents and the 'add meta Tag' component where authors can add metaTags to the document namely the coding scheme. This document may contain both simple text and images. As collaboration proceeds, the document may be augmented with additional resources such as issues, proposals, comments, etc.

Since documents are the core constituent of our application, easy access to the information related to each document and mainly its metadata, is of paramount importance. Thus, appropriate visualization techniques and tools are necessary in order to facilitate users in understanding the contents and features of a document, while discovering hidden information. To this effect, we have tried to design our application on serve certain visualization rules (Gan, Zhu, Li, & Liang, 2014). Document visualization coins a set of techniques and

procedures that transform textual information such as words, sentences, documents, and their relationships into a visual form, facilitating users to easily understand documents, thus lessening their mental workload and time. In other words, document visualization has significant advantages over helping people to analyze and control big quantities of textual information, since it shows the necessary content and knowledge from a collection of documents (Gan, Zhu, Li, & Liang, 2014). An effective information visualization tool should follow the principles above: Overview, zoom and filter, details on demand, relate, history, extract. The design of our prototype tends to focus on these principles (Gan, Zhu, Li, & Liang, 2014).

Figure 5.2: Document Creation - Document Format

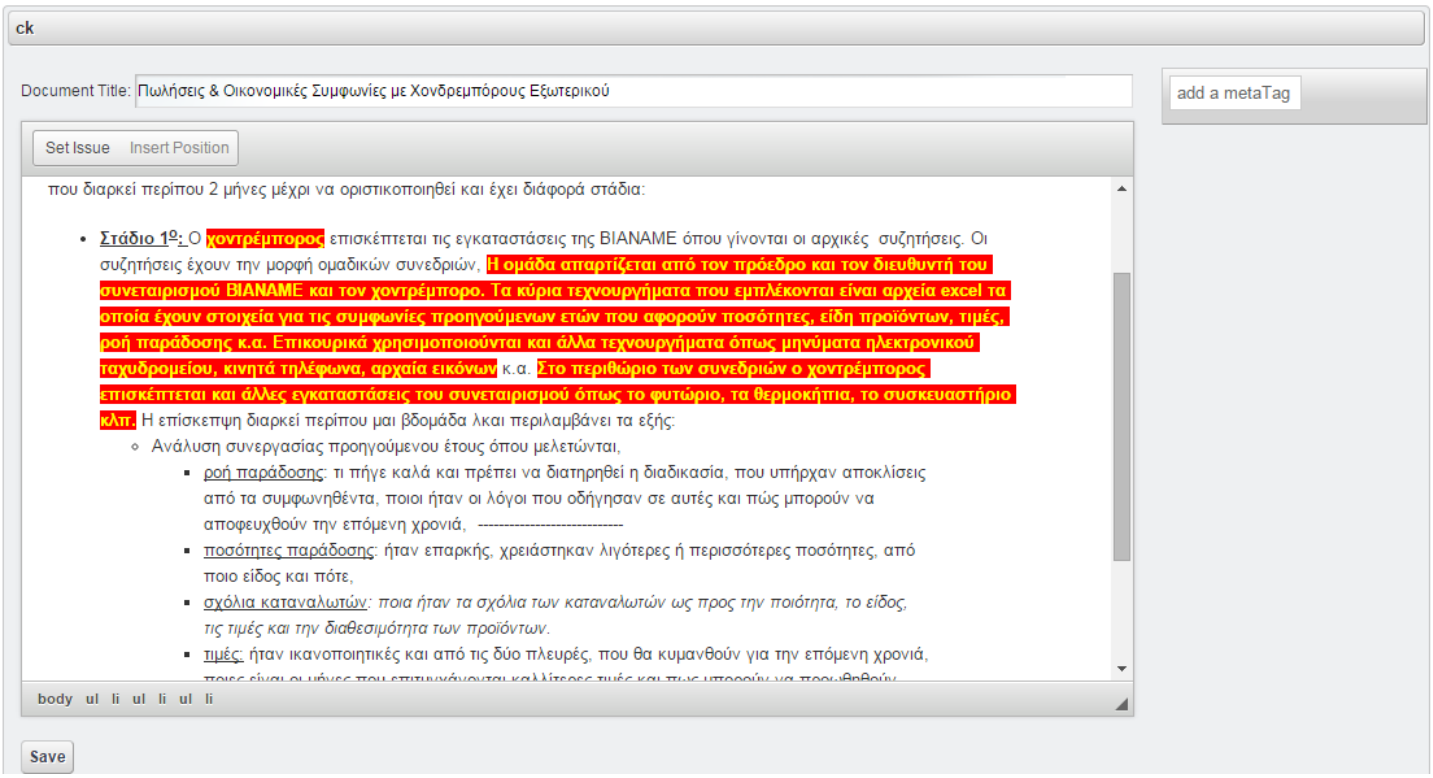


Figure 5.2 (editor in the left) depicts a typical document as created by the author. Highlighted text in an element depicts issues designated by the collaborators. Owner's issues are colored red to be distinguished from the issues contributed by the participants which are marked blue. Since it is indifferent who contributes the issues, as they depict the group's collective wisdom, all issues raised by contributors are blue. The issue demarcation is facilitated using a plug-in which is activated by the "Set Issue" button. This plugin marks a phrase of the document as an issue highlighting it red (in case or document owners/authors) or blue (in case of participating peers). When working on a document, each issue (and only the phrases marked as issues) can be elaborated by defining properties (i.e., a brief description, attaching user positions, supporting materials and tags) as shown in Figure 5.3. We support this procedure by implementing a plugin in CK editor named "Insert Position" which opens the corresponding dialog. Only if a phrase is issue and the issue has been set by the specific user this plugin (button) is active. Otherwise, it remains inactive (faint and not clickable). In order to

have a more convenient, useful and time saving procedure this dialog offer authors the chance to select already set issues by the select option in Figure 5.3 left or autocomplete fill in. When the author selects a predefined issue then all properties (i.e., brief description, attached user positions and supporting materials) are filled in automatically. Then, the owner may add his position (Figure 5.3 middle), tags (Figure 5.3 right) or enhance his position with material (links - pdf) in Figure 5.4 left. Once a document is created and saved, the document owner may invite peers (see Figure 5.4) right to take part in the argumentative discourse by raising their own issues, taking a position on an issue, add tags, commenting etc.

Figure 5.3: Issue settings (left), position settings (middle) and tag settings (right)

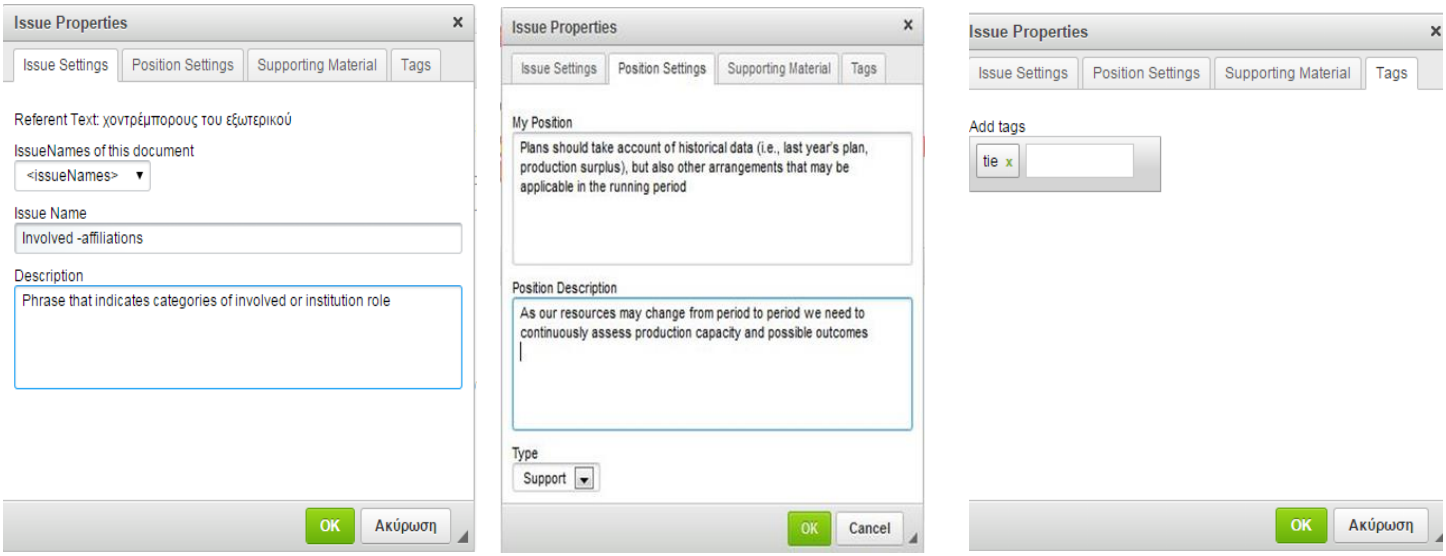


Figure 5.4: Material Setting (left) and invite peers (right)

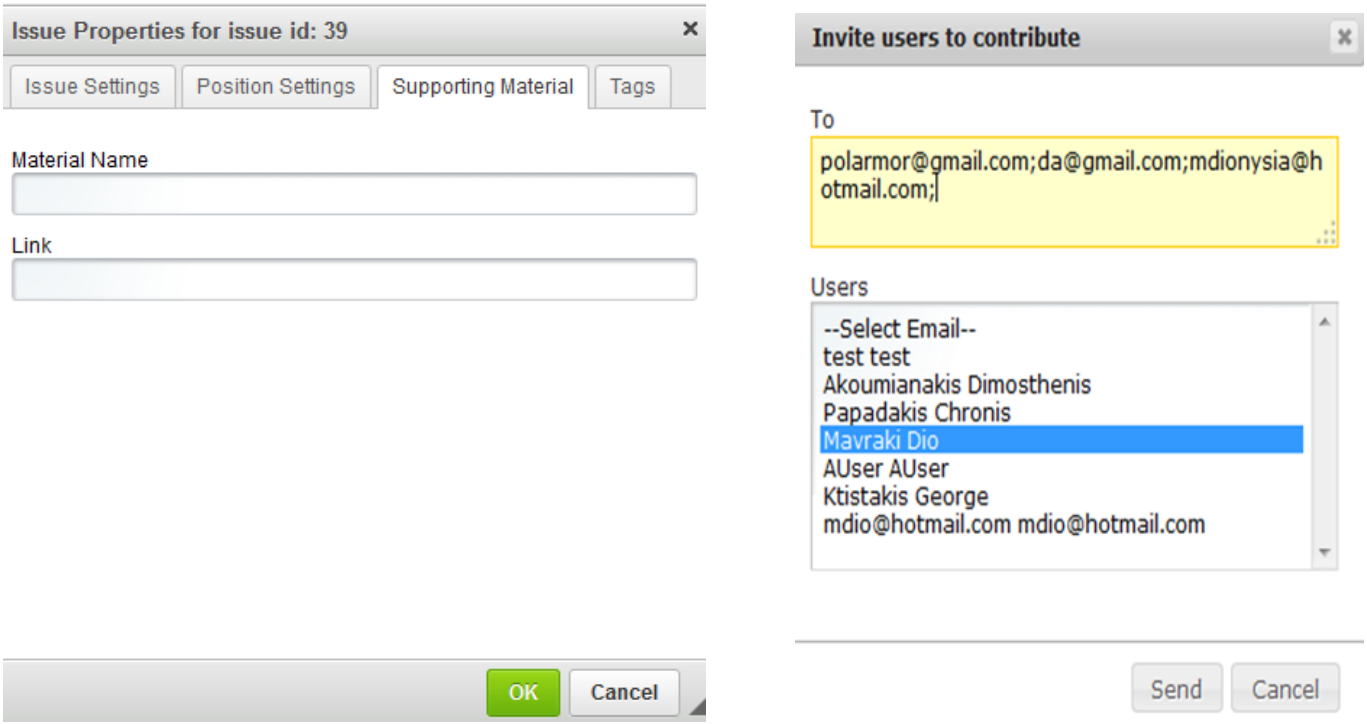
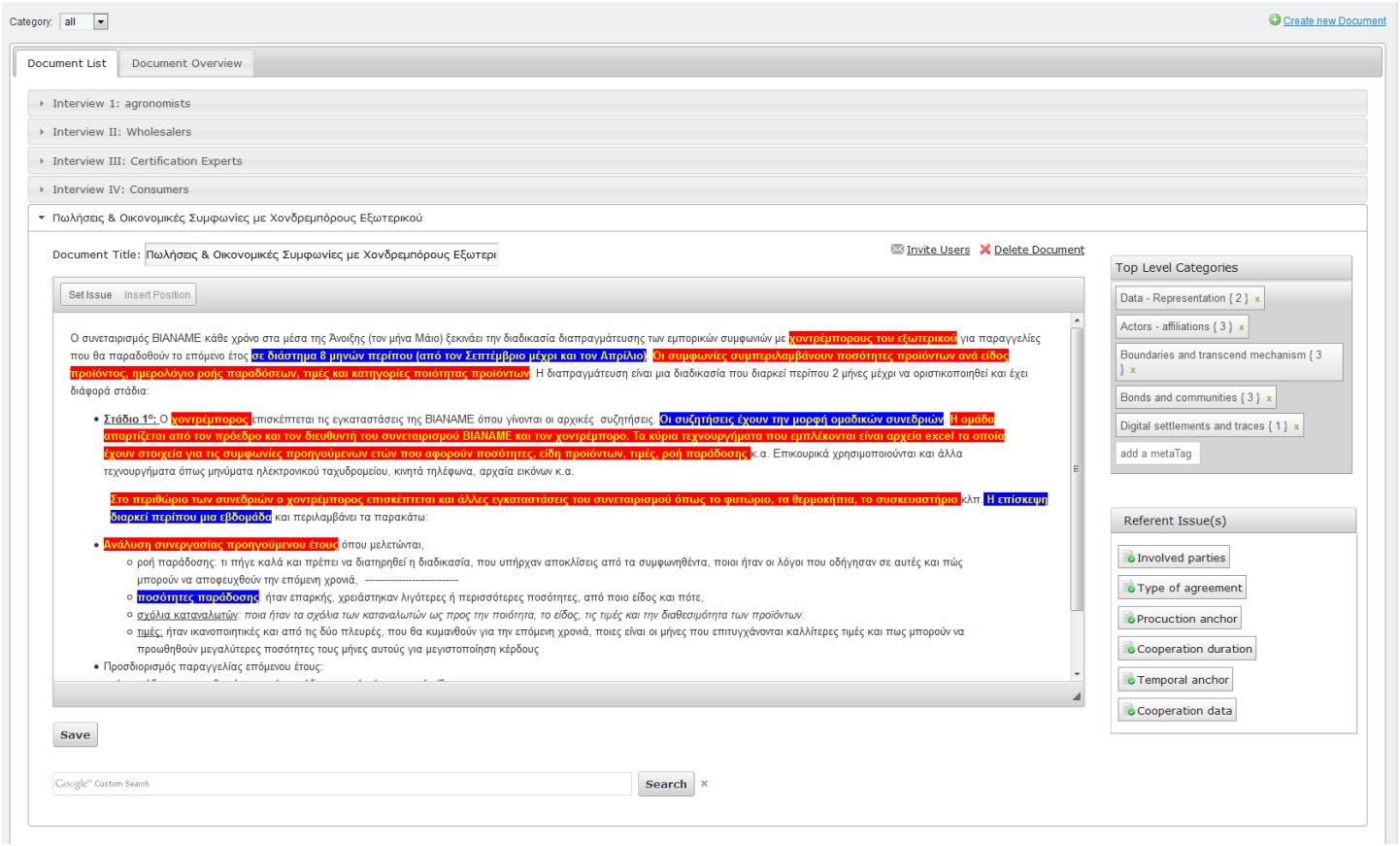
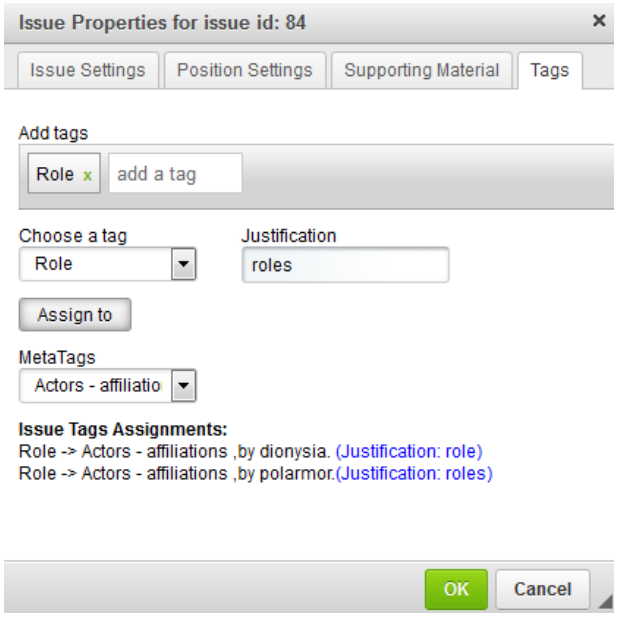


Figure 5.5: Document with issues and tags (up), tag assignments (down)





A second portlet was designed to facilitate summative lists of documents and detailed document overview. This portlet consists of two modes. In the first one, we can see the list of documents where if you click on a document its author and the invited contributors (peers) can edit the document (CK editor with the implemented plugins is also available for the user and the invited participants) by adding new issues, take a position on an already existing issue, or add tags. More specifically, in case of a new issue, users should provide

the necessary details to define the issue. For issues already contributed (by others), it is possible to contribute new position statements and codes. An interesting feature is the way in which semantically equivalent tags are negotiated and mapped to metatags or top-level categories (see Figure 5.5, bottom). Detailed analysis of these linguistic conventions can provide useful insight to the collaboration that takes place, agreements and disagreements between group members as well as who teams up with whom on specific issues. In Figure 5.5 up, we can see an example of document with issues raised both by author (red) and by contributors (blue). From this portlet the user can also extend invitations to other peers to collaborate on a specific document. With respect to the marking scheme used, highlighted text in an element depicts issues designated by the collaborators. Peer issues are colored blue so as to be distinguished from the issues contributed by the owner which are marked red. A Google search form is also available at the end of the document in order to search terms during the document editing. An interesting qualification of this portlet is that it represents the wisdom of the document. As shown in Figure 5.5 and in Figure 5.7, user can select a specific document from the list (top) and review the wisdom available (bottom). Such wisdom comprises issues, sub-codes (or tags) and top level codes (or metatags). The word cloud provides an overview of the current set of issues, thus allowing users to filter documents that contain a specific issue. Once a document is selected it reveals the accumulated wisdom (see Figure 5.7 bottom). Therefore, we can achieve search based on documents collection visualizing. This operation is important since except for search between documents we manage to pinpoint relationships and similarities between documents by common issues. The right hand side of the first mode of this portlet summarizes also the collective wisdom attached to the document by highlighting the set of meta Tags namely the top level categories have been defined as well as the referent issues have been pinpointed in the document (in left Figure 5.5, right columns) and facilitate users to have an overview and zoom in the core of the document by listing all issues, metaTags and tags of the document in one side (Gan, Zhu, Li, & Liang, 2014). Besides, clicking on a metaTag from top level categories box user can see which subcategory tags have assigned to this Figure 5.5. Simultaneously, the referent issues above have been filtered both in referent issues box and in text editor Figure 5.6. Also, author can click on an issue pinpointing it in editor facilitating thus the search in a document. In other words, users can use tags, metatags and issues to explore either a specific document or the entire collection of documents. For instance in Figure 5.6 the user has selected the issue ‘Involved parties’ and filters the document to highlight all referents assigned to this issue, including the tags. In this manner, it is possible to assess consistency of referents but also the rationale behind each occurrence. Therefore, the two components on the right hand side summarize the collective consensus of the peer group regarding the specific document. As shown, tags and metatags are scented to depict strength of each entry as coded by members of the peer group.

Figure 5.6: Filtering issues when clicking on a metaTag

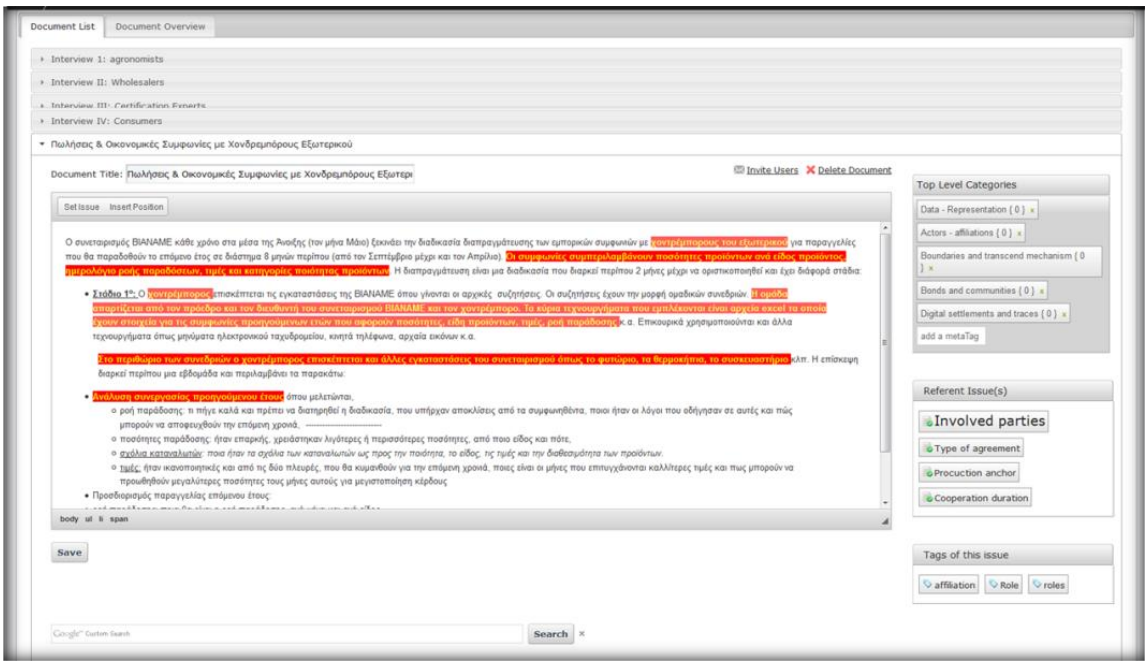
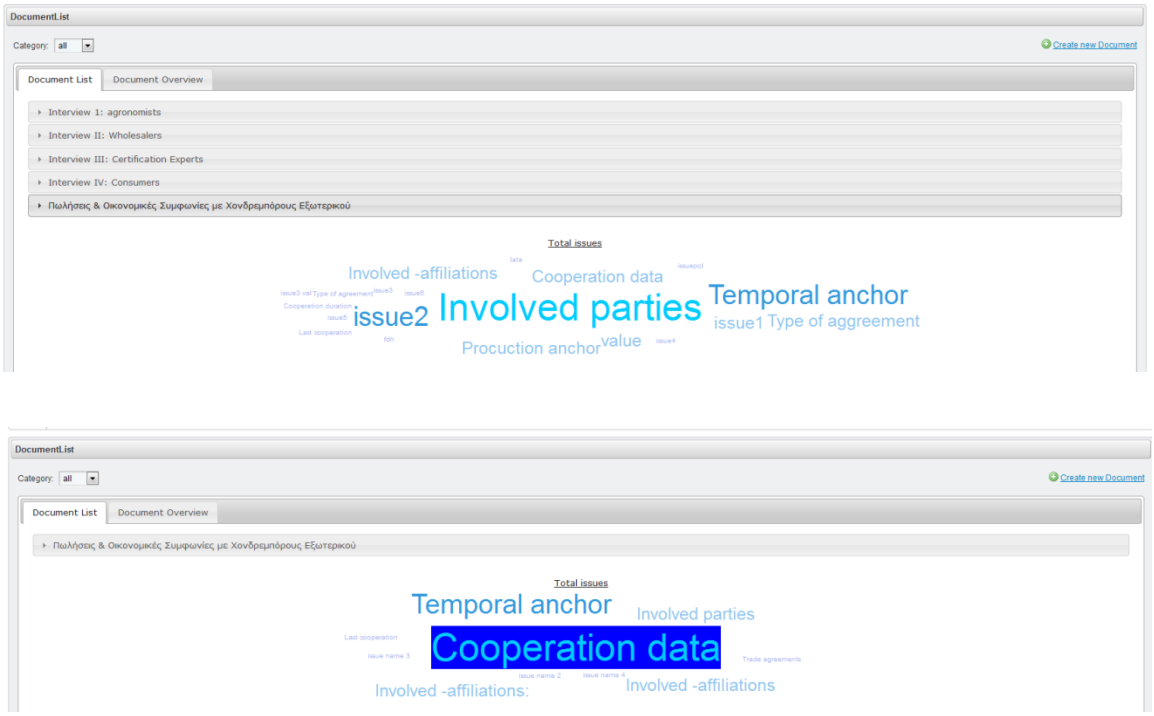
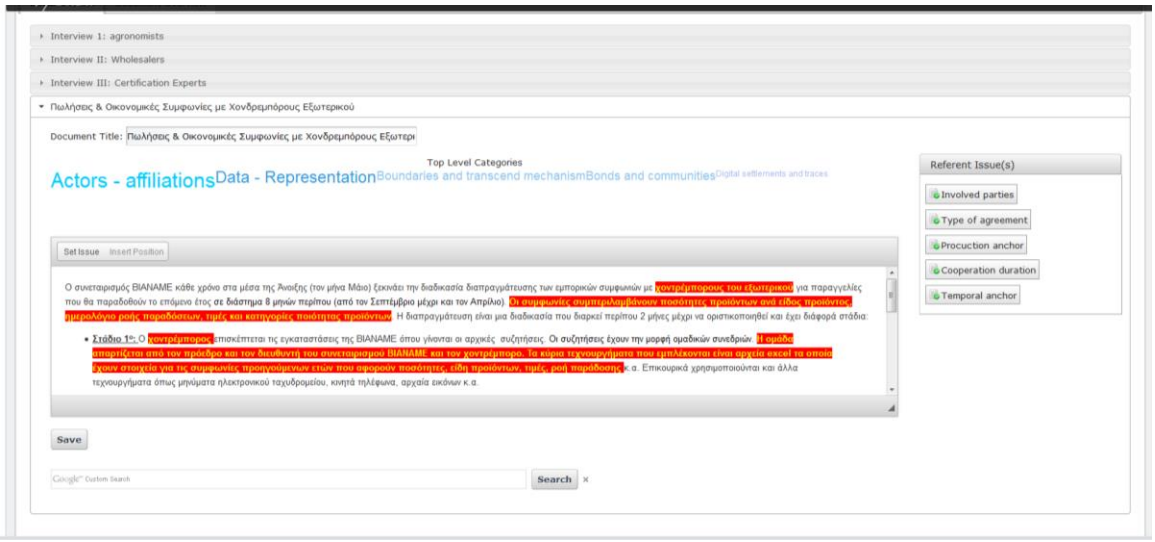


Figure 5.7: Word cloud for issues (up) filtering documents when click on an issue (down)



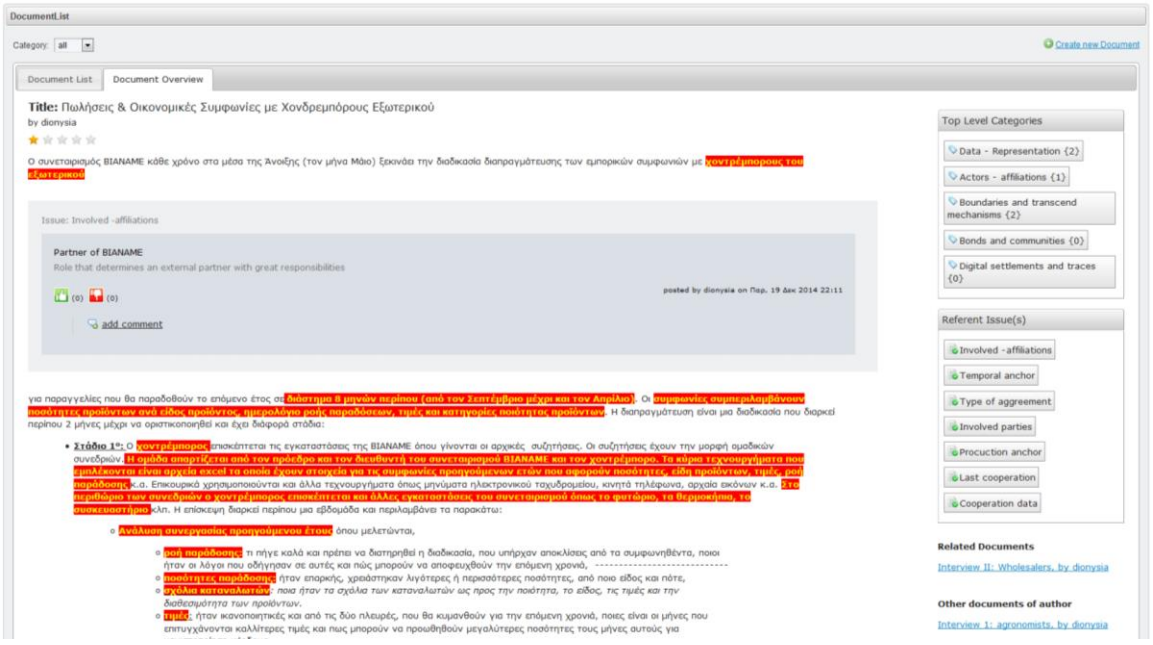
This mode has different environment for authors and participants. While author can add metaTags of document in metaTags box participants can just see which metaTags have been set from authors as well as the frequency that have been assigned Figure 5.8.The other operations about filtering of issues, pinpointing issues in documents and tags are common with author environment.

Figure 5.8: Invited peers environment



Since this application supports two occasions (with existing theory or developed from scratch) the environment of the tool is formed depending the occasion. In the first occasion with the existing theory, namely the author sets a coding scheme inviting peers to verify it; both peers and user collaborate on only one document. On the other hand, when there is no coding scheme author send the document to other participants and each one elaborates on a separate document by employing qualitative data analysis techniques (i.e., open coding, inductive coding, etc.) and finally author decides on the coding scheme. When each user has his own version the author has a document with nested peers' documents under the initial document.

Figure 5.9: Overview mode, list with positions posted in an issue



The second mode, the overview, allows the author and participants to briefly elaborate on document by rating (Figure 5.9, left corner), exposing all the positions added to an issue as well as gaining insight to the

argumentative process of consolidating the issues raised (Figure 5.9). That is to say users can have an overview of the document. For instance, users can vote on positions (i.e., like/dislike) (Figure 5.9) and raise and respond to questions. For the document owner, it is also possible at some point in time to resolve an issue by making a decision (Figure 5.9). Resolving an issue entails the owner's commitment to a proposal, either because the proposal is deemed appropriate or because it is the most popular position among the participants (Figure 5.10). When all issues of a document have been solved, the document is considered closed, allowing no further contributions to a close document. Open and closed documents may be distinguished by color (Figure 5.11) with open documents assigned a light color while closed documents are assigned dark color.

Figure 5.10: Set a position as solution

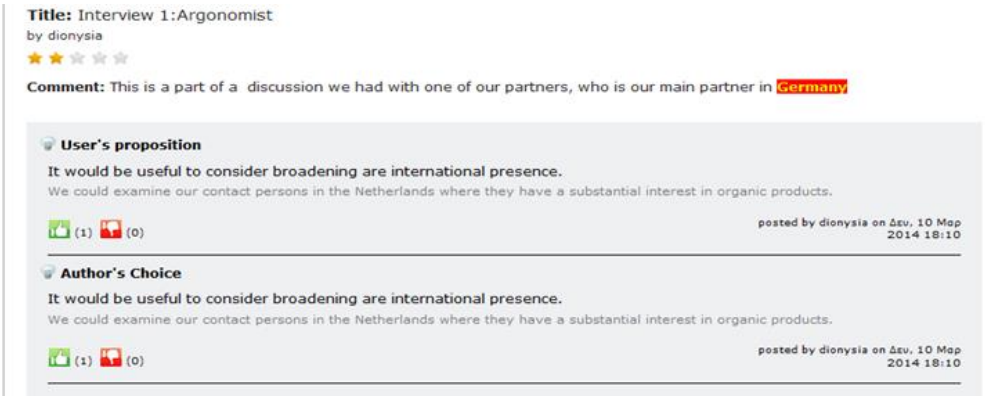


Figure 5.11: Close a document

In the overview mode users can also spot other documents that may be of interest or somehow related to the current context of use. Thus, participants can link to a document of the same author or to documents containing the same set of tags or issues (Figure 5.12). To this effect, on the right side there are some columns with relevant documents, namely a column with documents relevant to the current (same tags and issues), documents of same author with the current. Finally, owners of documents may also obtain a variety of statistical information and graphs about the online discourse for each document, including contributions per participant, issues resolved / unresolved, number of positions per issue, total number of positions, etc. (Figure 5.13), but

also cross-document comparisons and user comparisons which is useful for documents of the same type and scope (as in the case of the five interview transcripts of our case) like in Figure 5.13 (third row).

Figure 5.12: Related documents

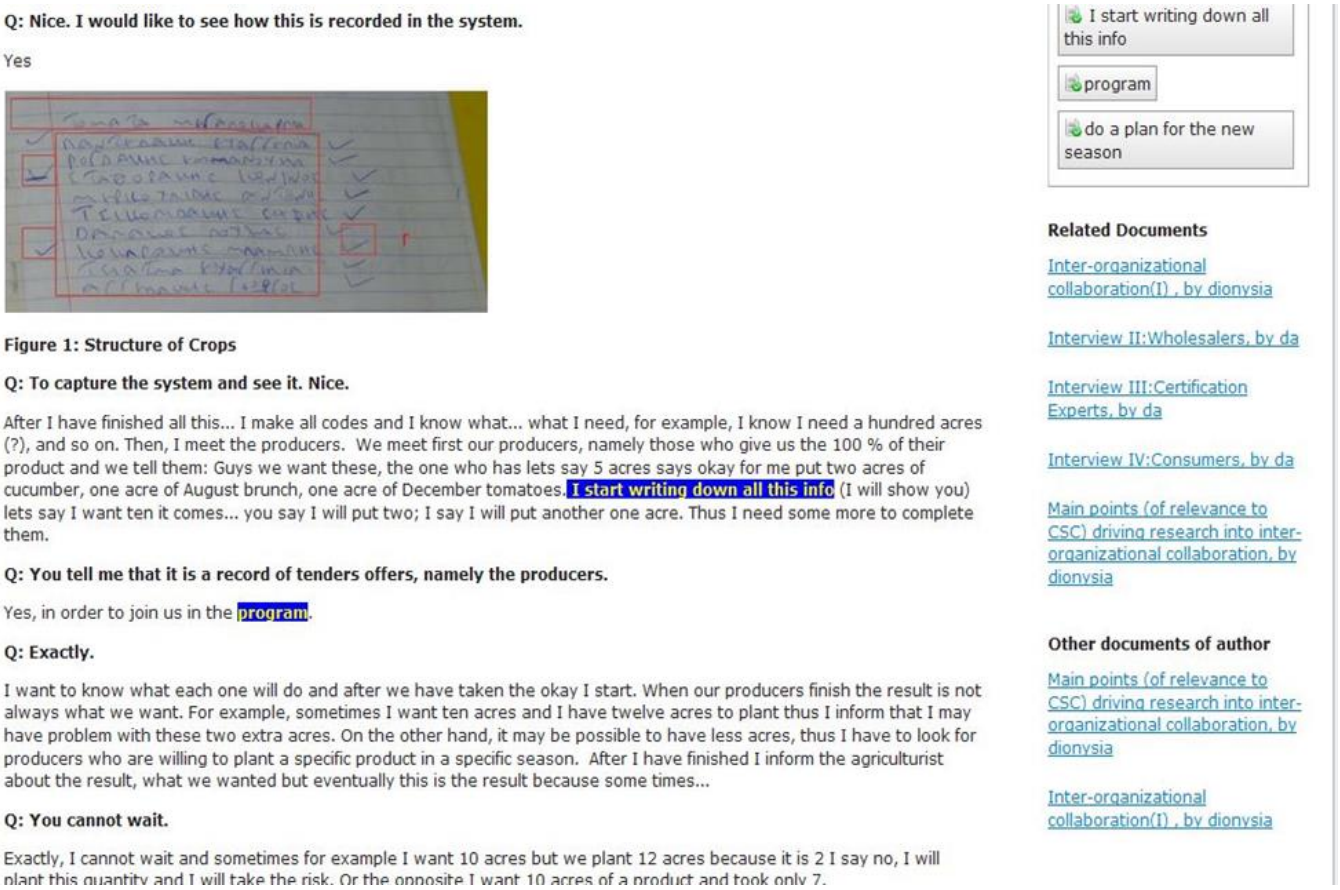
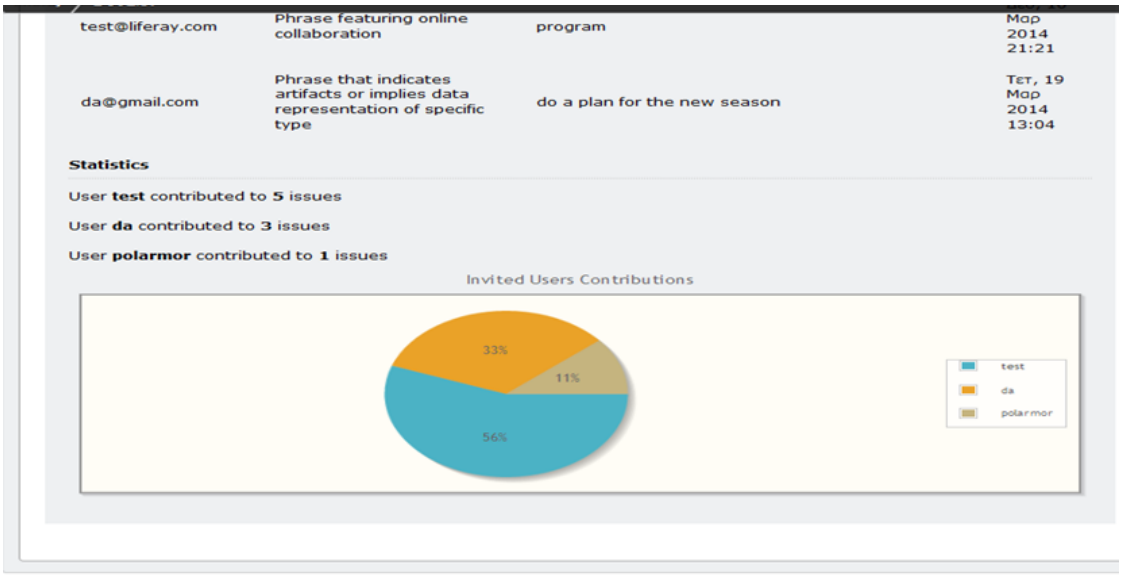


Figure 5.13: Statistics invited-users contribution (first row), contribution timeline (second row) and documents comparison



Contributors Details

Top contributors of Document:
User **dionysia** (the author) with **6** contributions and **test** with **5** contributions.

User's Action Review

Invited user	posted about	on issue	attaching file	on
polarmor@gmail.com	Usually this data are in a excel file	Based on the results of last year, that is what we have sold, if we had problems due to the lack of product or surplus,		Δευ, 10 Μαρ 2014 21:27
da@gmail.com	Phrase that yields boundary existence and operating either inhibitory or creating new opportunities	From May until the end of June,		Δευ, 10 Μαρ 2014 18:23
da@gmail.com	Phrase that indicates categories of involved or institution role.	agriculturist		Δευ, 10 Μαρ 2014 18:23
test@liferay.com	Phrase that indicates artifact or implies data representation of specific type	we say in order to ensure the «bunch» we will need 10 acres, three of which should be planted in August, the other 2 should be planted in September and in October we will plant others...		Δευ, 10 Μαρ 2014 21:21
test@liferay.com	Phrase that indicates artifact or implies data representation of specific type	notes		Δευ, 10 Μαρ 2014 21:21

Compare documents and users contributions

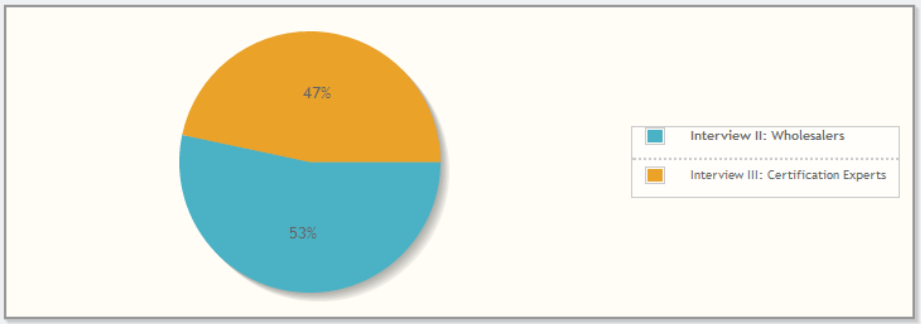
Choose the document you want to compare

--Choose documents to compare--
Interview 1: agronomists
Interview II: Wholesalers
Interview III: Certification Experts

Numbers of total issues

--Choose Comparison Type--
Numbers of total issues
Number of solved issue
Number of issues by invited

Numbers of total issues



Choose the invited peers you want to compare

-- Choose invited peers --
test test (test - test@liferay.com)
Akoumianakis Dimosthenis (da - da@gmail.com)
Papadakis Chronis (polarmor - polarmor@gmail.com)

Πωλήσεις & Οικονομικές Συμφωνίες μ

Numbers of issues added by a user

Show the graph

CK editor

CKEditor is an HTML ready-for-use text editor designed to simplify web content creation. It's a WYSIWYG (What You See Is What You Get) editor that brings common word processor characteristics directly to the web pages. Since CKEditor is an Open source application, it can be modified in any way that is deemed appropriate.

In our system we have implemented two plug-ins, namely two buttons in the CKEditor menu, to create our document format. The first button is called “Set Issue”, while the other “Insert Position”. The “Set Issue” button is activated when a user selects a part of the text to set an issue. By pressing the button, the chosen phrase is marked red (for the author), or blue (for the participants). This extract of the text is highlighted to convey that it is set as an issue. Clicking on an issue, the “Insert Position” button is activated. Clicking on this button a dialog opens with four tabs which allows a user to fill in the issue features (using the first tab, Figure 5.14, left), fill in the position settings (second tabs, Figure 5.14, right), material settings (third tab, Figure 5.15, left) and fill in the tags that corresponds to an issue (fourth tab, Figure 5.15, right). It should also be noticed that the tab ‘Tags’ presents different options in the two portlets.

Figure 5.14: Issue settings (left) and position settings (right)

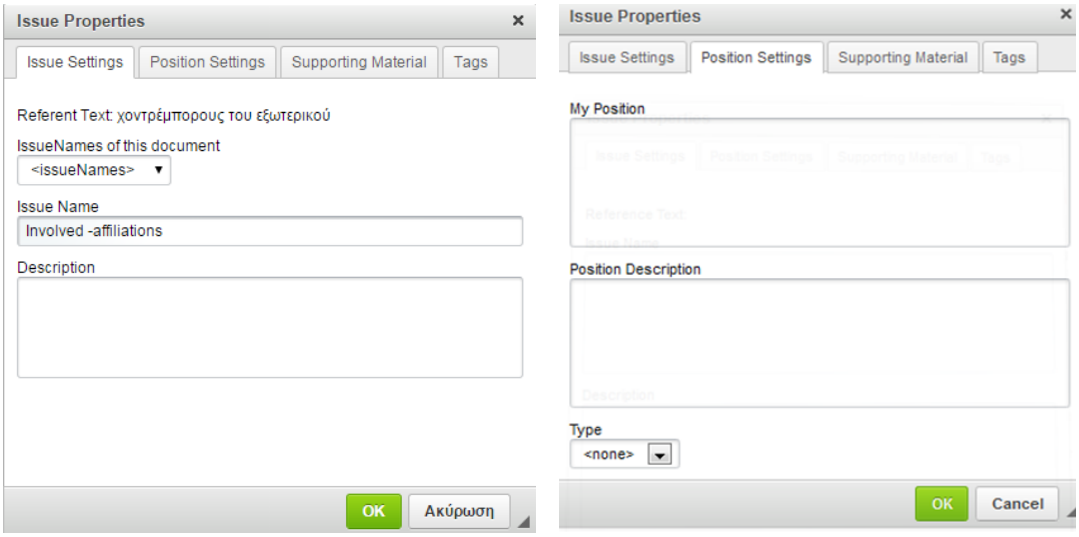
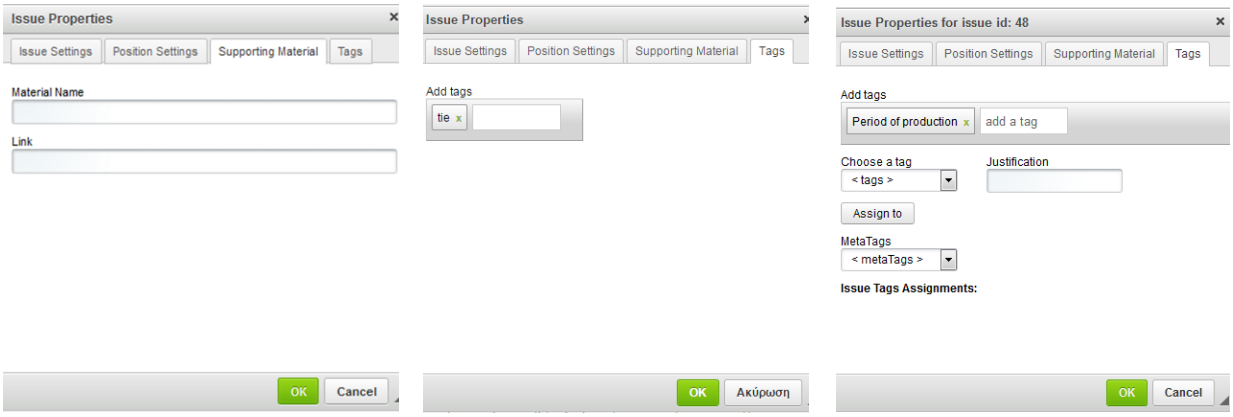


Figure 5.15: Material settings (left) and add tag (middle) tag assignment (right)



Development platform and tools

In order to address the problem outlined above, we have set out to implement a Web Application featuring established standards and capabilities of Web 2 tools. The main technologies used for this purpose include Java and AJAX as well as standards such as JSON, HTML and CSS.

The Liferay portlet technology

The application comprises two main Portlets. Portlets are pluggable user interface software components that produce fragments of markup (HTML, XHTML, and WML) code that are aggregated into a portal. Our portlets have been developed and embodied into the Liferay portal. Liferay is a free and open source Java-based enterprise portal supported by Liferay Inc. – a professional open-source company that provides free documentation and paid professional service to users of its software.

Languages (Technologies) used

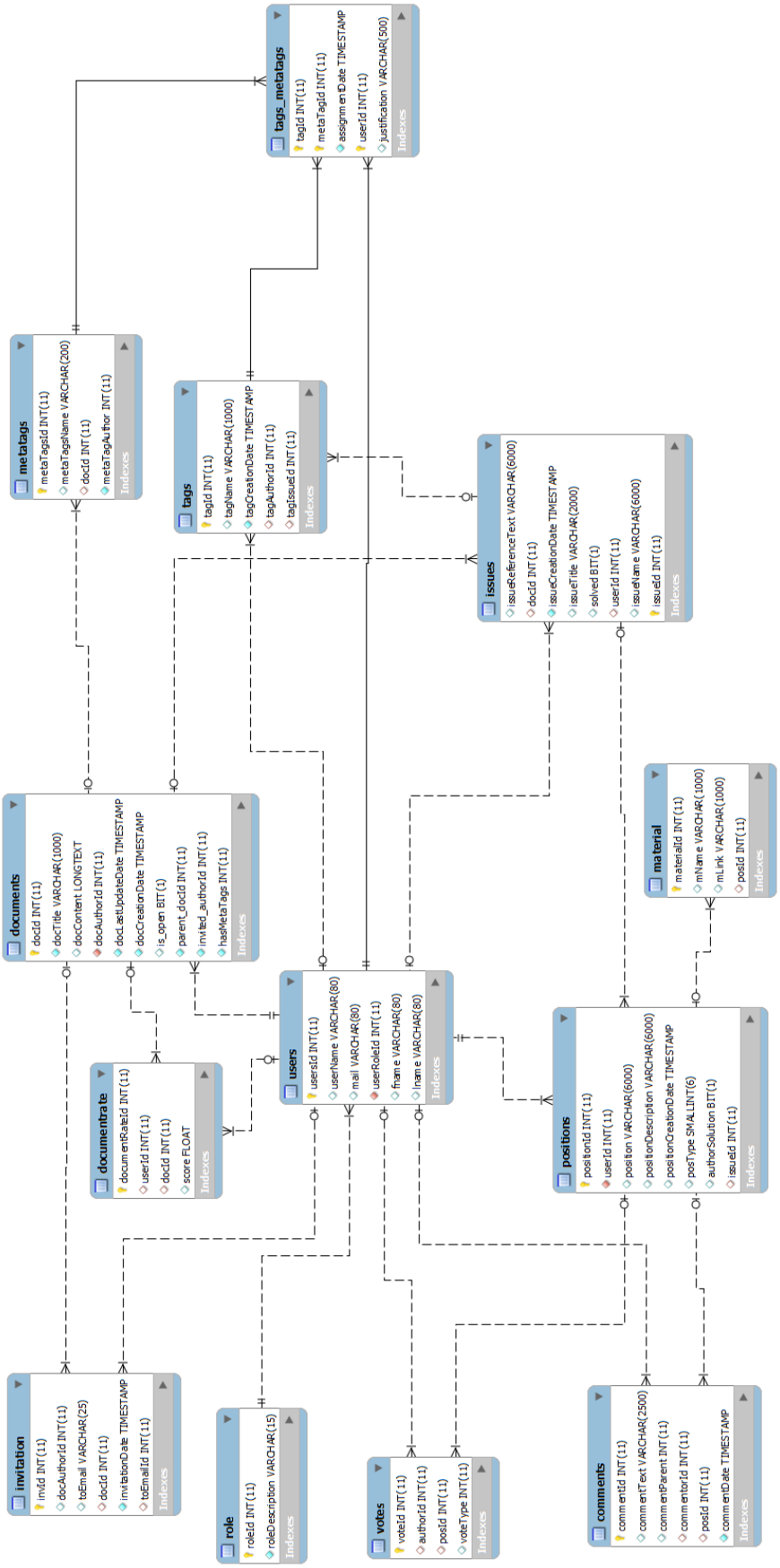
The implementation strategy recruits a variety of technologies, briefly outlined below.

- HTML Markup Language to create web pages and structured content.
- CSS to control and style web pages and interfaces written in HTML
- Java Servlets – Java Server Pages in order to create dynamic pages with dynamic content that interacts with MySQL database
- JavaScript to create highly responsive interfaces in order to enhance user experience and create interactive web content
- Jquery for document traversing and manipulation, event handling or animation.
- AJAX to create asynchronous web pages that is to exchange data with the server without changing or hindering the web page itself.
- JSON in order to store information in an organized, easy-to-access manner used for serializing and transmitting structured data.
- Mysql is used to store and retrieve web site data.

Database management system

Our database scheme which shows the tables, are depicted on the database scheme, Figure 5.16. From the scheme we can see that there eleven tables: *comments, documentrate, documents, invitation, material, positions, role, stags, issues, users, votes.*

Figure 5.16: Data Base scheme



The first table is the “comment” which stores the comments post a user (either document author or invited contributor) on position. That is foreign keys are the primary keys of tables users and positions. The second table is “documentrate” which contains the rate of each document. Namely it contains the number from 1 to 5 a user (document author or invited contributor) has rated a document. Related tables are the “documents” and the “users”. Another important table is the “documents” which stores all the documents a user may create. As we can see in Figure 5.16 a document is characterizes from an id, title, content, date of creation and update, the user who created and a flag that shows if document is open or not. Related tables according to the Figure 5.16 are “*users”, “documentrate”, “invitation”, “issues”, and “metatags”*. “*Invitation”* is another table which stores all the invitation that is when a document author invites other users to get involved in this document. Therefore, this table relates with tables “users” and “documents”. “*Material”* is also a table which contains information about the material (URL) posted to support a position. Related table is “*position”*. “*Positions”* contain the proposition of a user on issue. Related tables are the “*users”, “comments”, “votes”, material* as well as the table “*issues”* Figure 5.16. A position should be characterized from the content of position, a description of position, the date it is posted and the type of position (support, oppose, indifferent). “*Role”* is another table which refers to the role and responsibilities and capabilities a user has according to the group he belongs to. Author and invited contributor are the two roles. Of main importance is the next table “*Users”* which contains the features and data of a user take part in or system either he is an author or an invited contributor. Related table is the *role. “Votes”* is another table that concerns the votes namely the preference users may show on a position. A vote may be positive or negative and this table is related to “*users”* and to *“positions”. “Issues”* is also an important table that contains and stores all the issues can be raised in a document. Related table are the *“documents”* and the *“users”, “positions” and tags* that means an issue can be raised in a document by a user as well as the a user can set a position on an issue or a tag. IssueId, reference Text, docId, IssuecreationDate, IssueDescription and whether an issue is solved or not (solved), IssueName and userId are features that may describe an issue. Another table is “*metaTags”* which stores all the tags may be add in a document. These metaTags make up the coding scheme or the top level categories of the document thus *“Document”* is the table related to *“metaTags”. Two final tables are the tags and the resulting one tags-metaTags. The tags table store all the tags, namely codes refer to the issues therefore it has two foreign keys the tagIssueId (related table the “issue”) and the tagAuthorId (related table “users”). In our system a user can assign a tag to metaTag then this assignment is stored to “tag-metaTag” (tagId, metaTagId, assignmentDate, userId, justification) with the “metaTagId” and the “tagId”are foreign keys.*

Chapter 6 - Use Cases

In this chapter we present an illustrative overview of our system by reflecting on a concrete use case. We will describe a real scenario concerning a researcher who wants to analyze a set of interviews in order to create some codes. The procedure is described step by step, quoting all the screenshots of our system.

Scenario

Imagine a researcher responsible for the encoding of a set of interviews or documents. In order for the codification to be valid, the researcher would have to check and confirm his codes by asking independent coders to analyze the data and make their own contributions. Then, our researcher would have to reflect on the experts contributions to finally select the most suitable coding scheme. Let's now describe step by step the qualitative data analysis process as it can be accomplished using our system. Firstly, the researcher, who is a user of the system with username "dionysia", creates a document that is a narrative description of use cases, which came out from a set of interviews, images, descriptions or video tapes, with title "Περιπτώσεις Χρήσης & Σενάρια Μελέτης". Figure 6.1 depicts the initial page, the area where our author "dionysia" writes down the document (see Figure 6.2)

Figure 6.1: Portlet 1 - Create a document

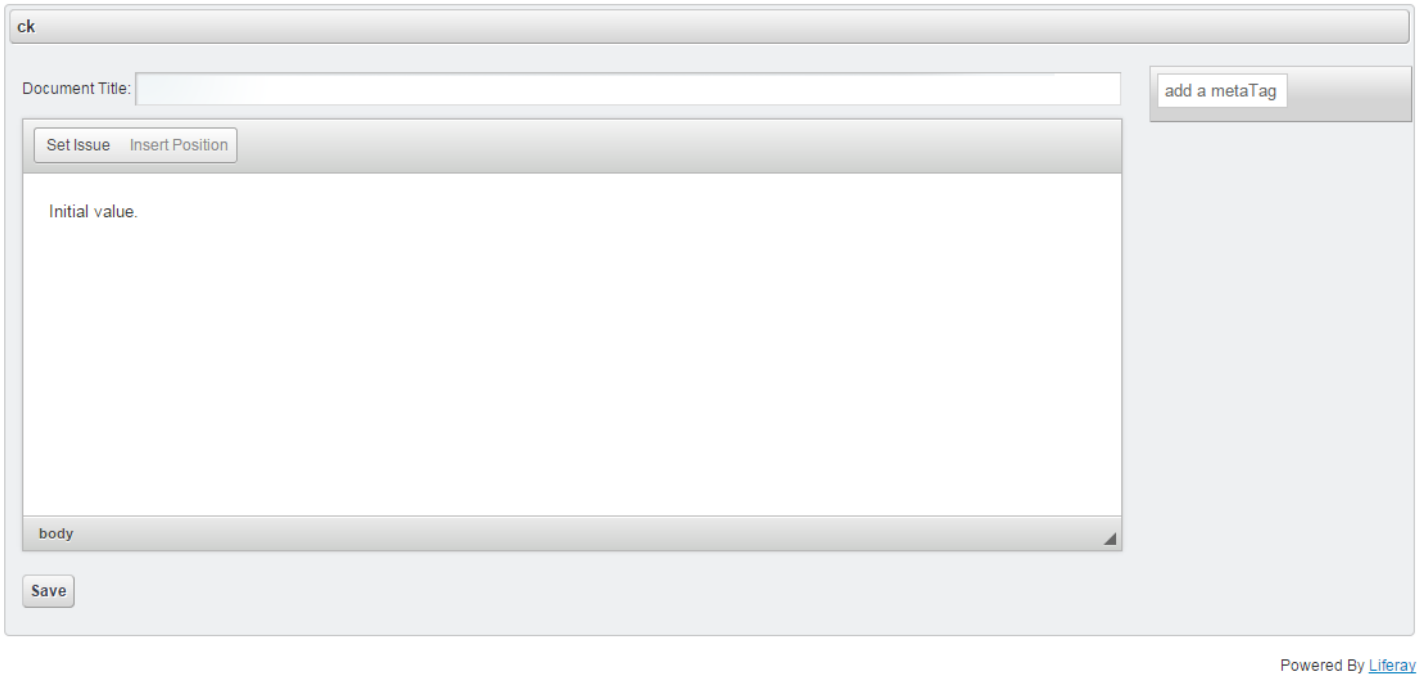


Figure 6.2: Type your document

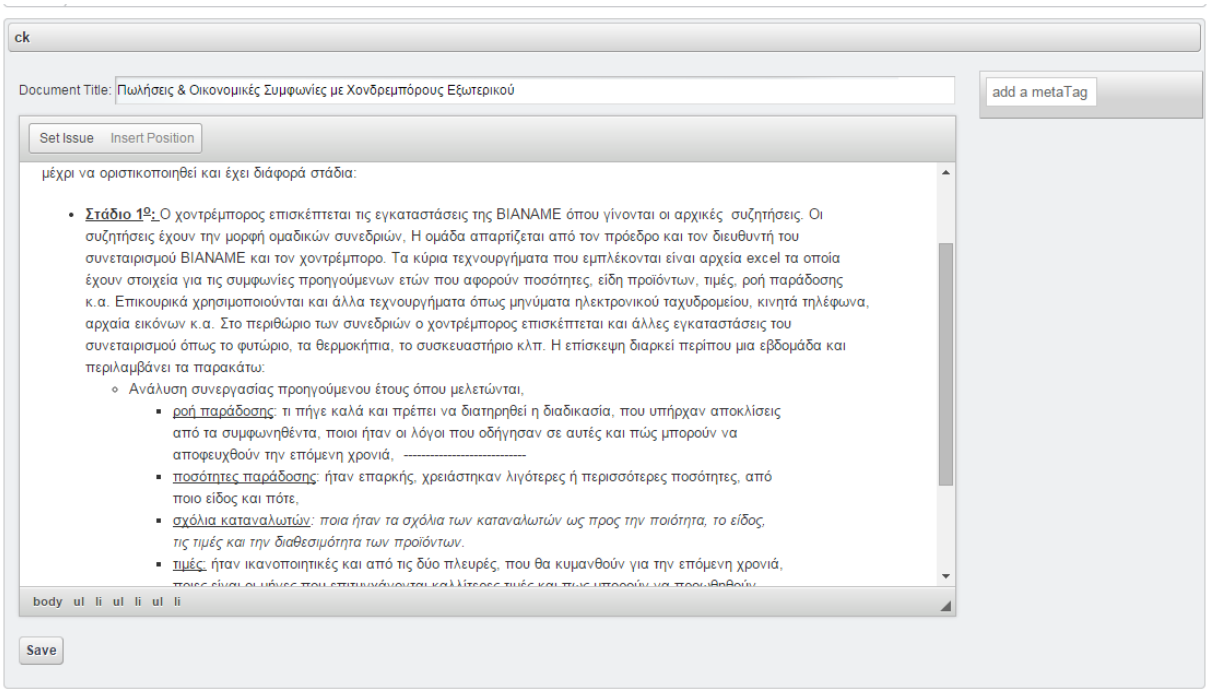
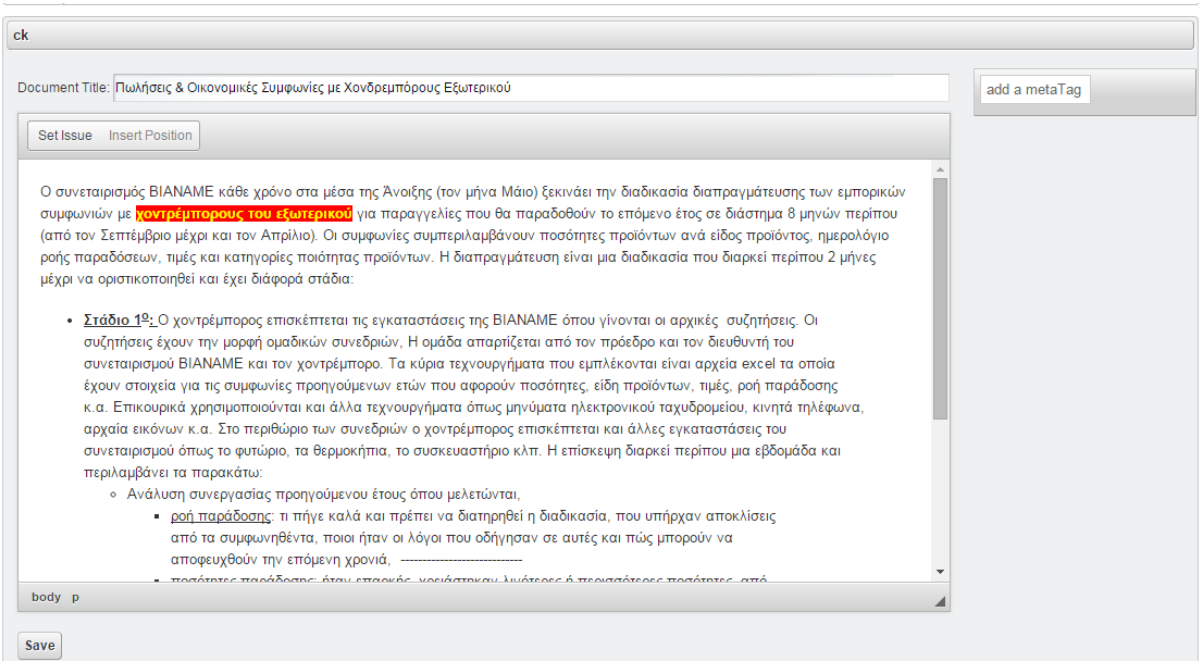
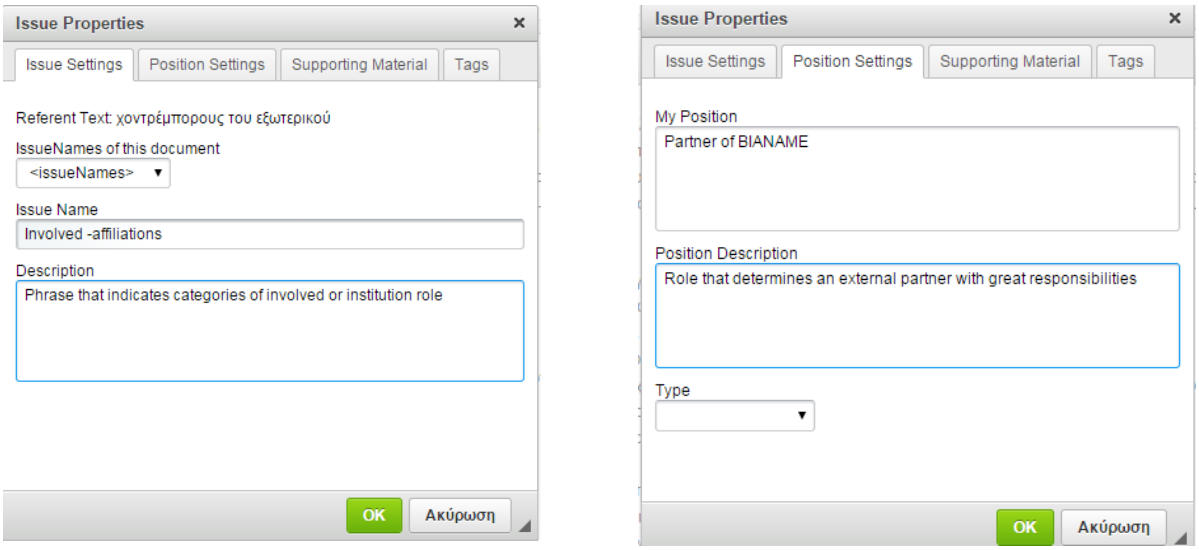


Figure 6.3: Mark "Χοντρέμποροι του εξωτερικού" as an issue



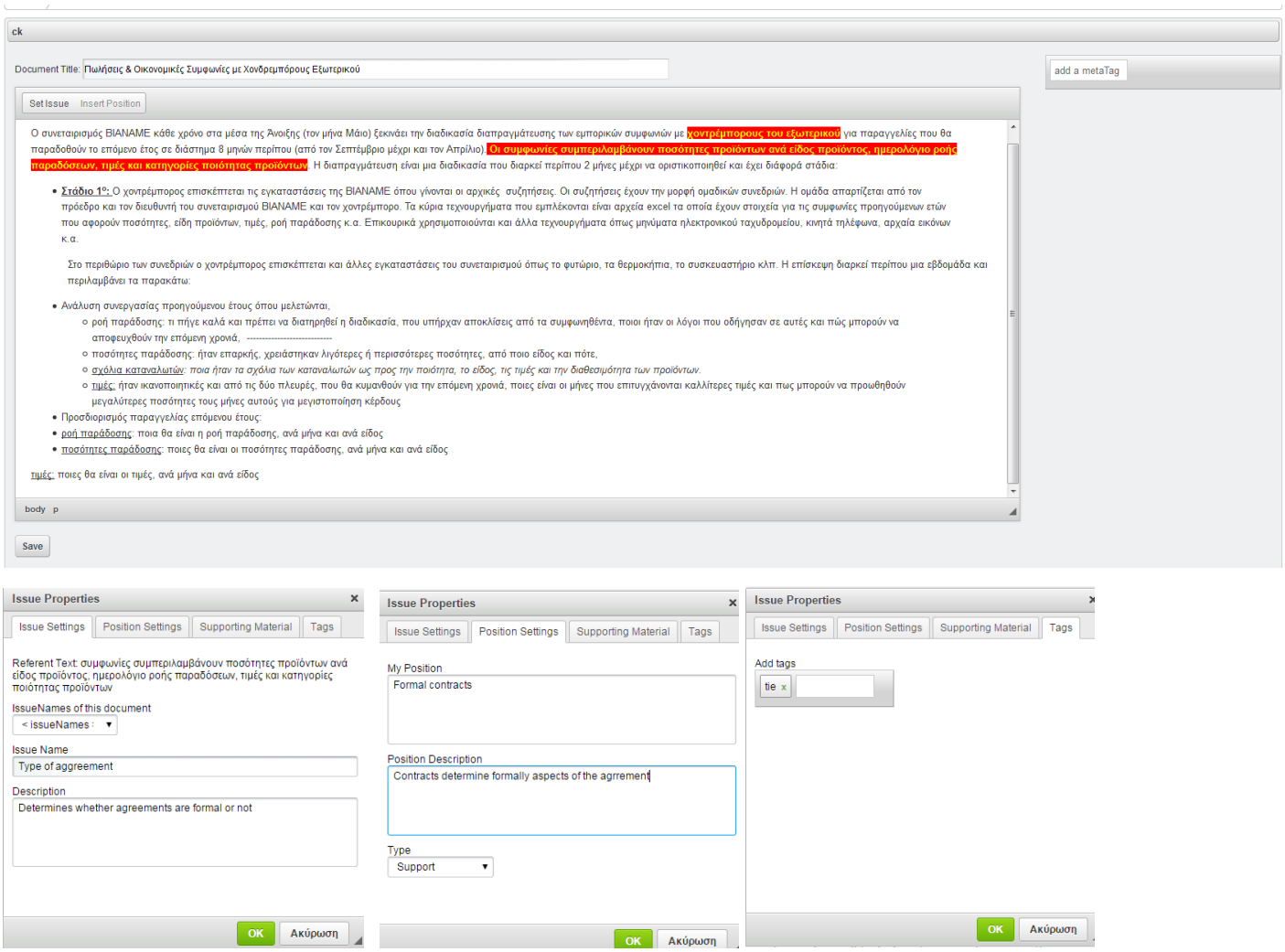
Once this is finalized achieved, the researcher starts to read the interview in order to pinpoint issues, state position and finally results in coding. Issues can be declared by selecting a phrase and pressing the “Set Issue” button in the editor. This results in highlighting the phrase with red indicating that it is an issue. An example is shown in Figure 6.3 where the phrase “Χοντρέμποροι του εξωτερικού” (“wholesalers of abroad”) has been declared as an issue to be populated. Figure 6.4 (left) depicts the issue settings and Figure 6.4 (right) outlines the position settings.

Figure 6.4: Issue settings (left), position settings (right)



Furthermore, he marks the phrase "Οι συμφωνίες συμπεριλαμβάνουν ποσότητες προϊόντων ανά..." (The negotiations include quantities of products per...) as another issue Figure 6.5 top figure. He filled in the issue settings Figure 6.5 (down left) and his position on the issue Figure 6.5 (down right) as well as a tag to issue (down right).

Figure 6.5: Mark issue (top), issue settings (down left), add position (down center) add tag(down right)



In the following he marks the word “χονδρέμποροι” (wholesalers) that has same issue properties with another existing issue. Thus as it is shown in Figure 6.6 the author select the desirable issue name and automatically both issue settings and position settings are completed. Furthermore, he marks the phrase “Η ομάδα απαρτίζεται…” (The group consists of...) as another issue Figure 6.7 up. He filled in the issue settings Figure 6.7 (down left) and his position on the issue Figure 6.7 (down right) as well as a tag to issue (down right).

Figure 6.6: Author adds another issue choosing a preexisting issue name (top) issue settings (down left) position settings (down right)

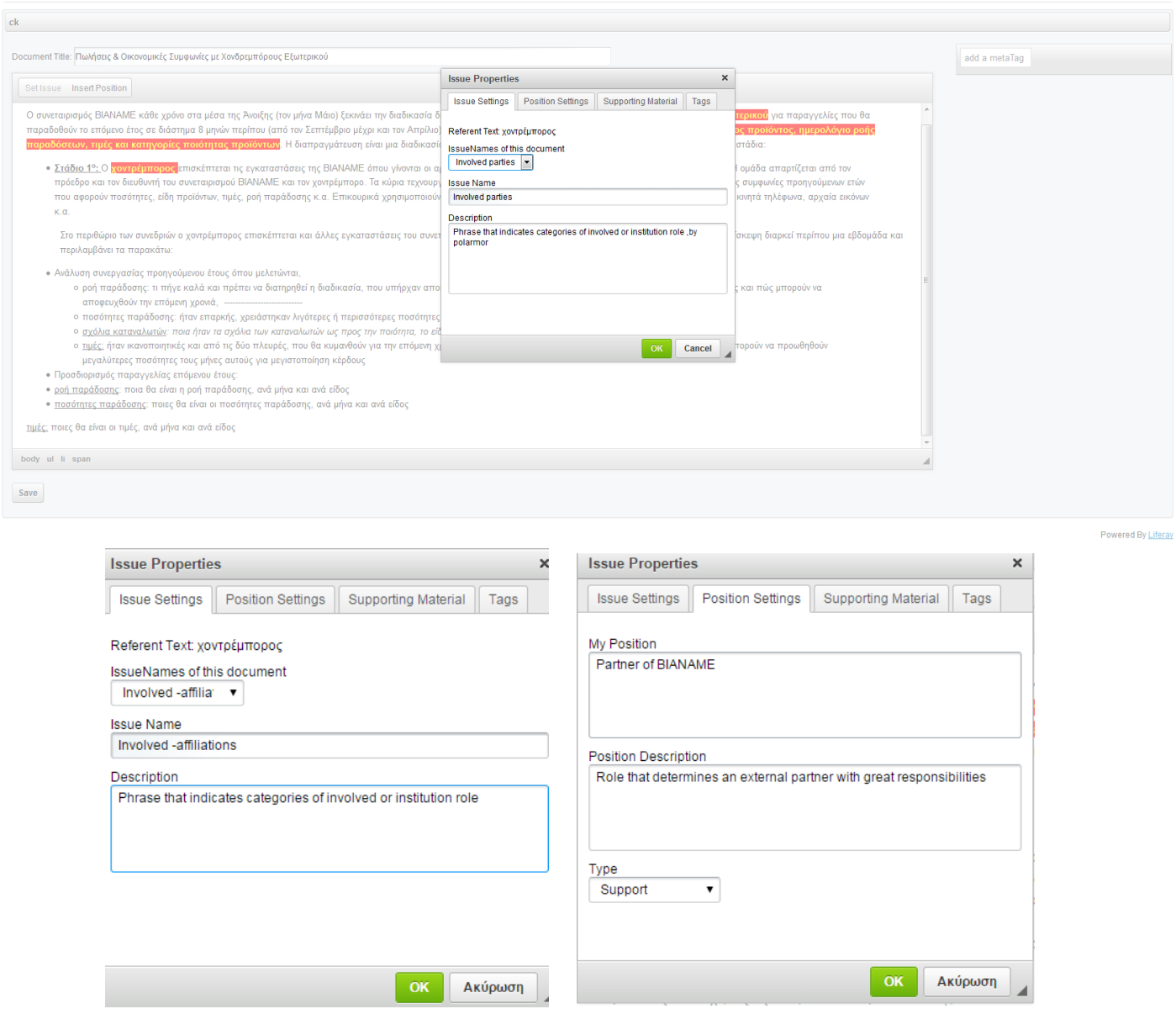
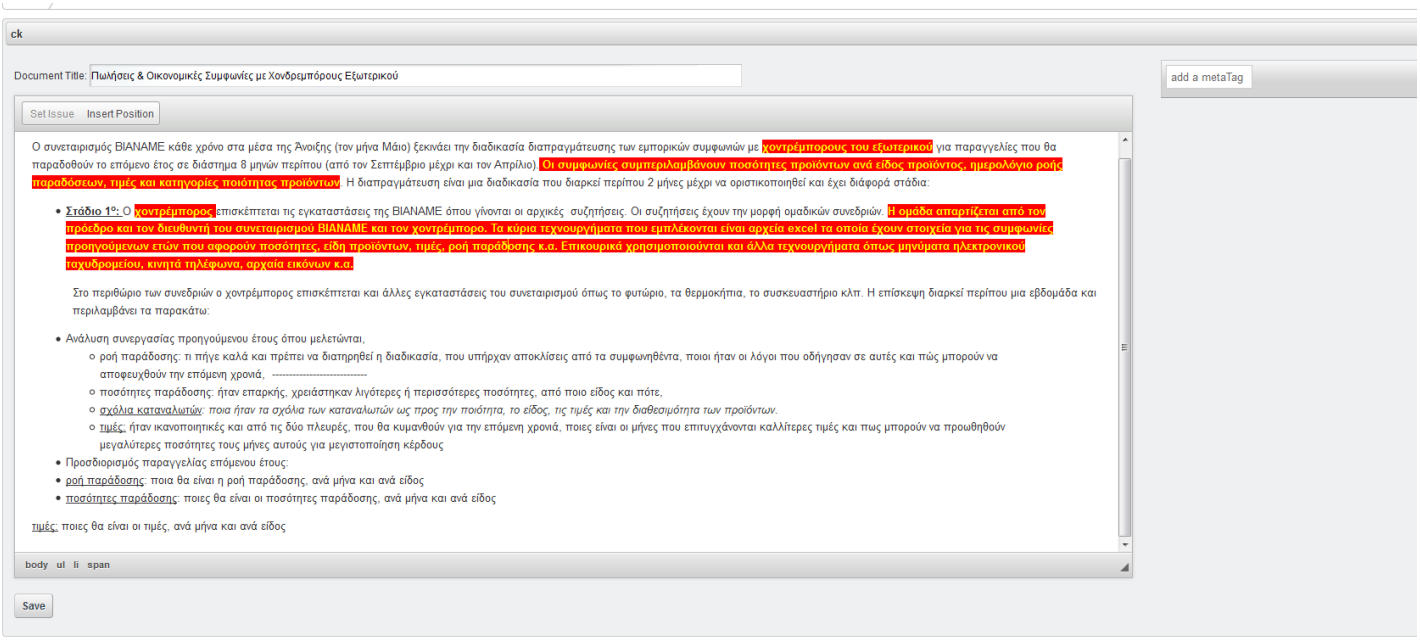
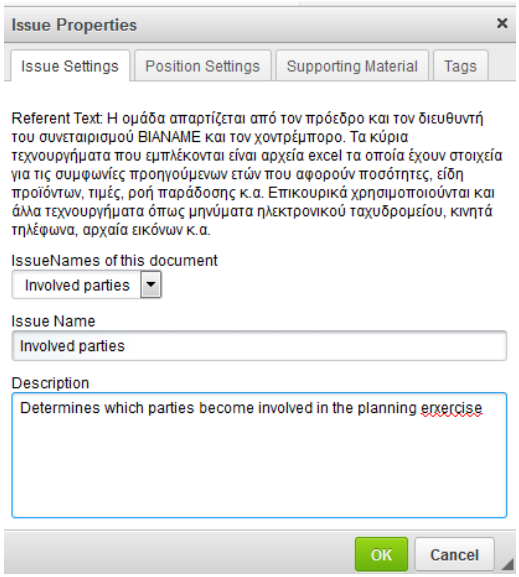
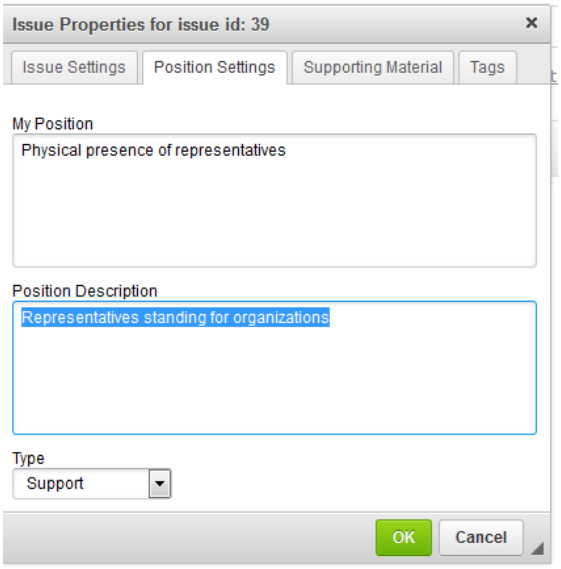


Figure 6.7: Author sets another issue (top), issue settings (down left) position (down right).







In the same way researcher pinpoints some issues posing his positions. Figure 6.8 depicts the interview with all the issues pinpointed by the researcher. In the following author defines the theory came of the analysis by adding metaTags or codes Figure 6.8. The next Figure 6.9 shows the theory completed.

Then, he wants to validate his issues with other users, experts of qualitative data analysis, thus he invites Figure 6.10 (left) these users by sending them an email with the link of the document. By clicking on the link Figure 6.10 (right) the proposed document opens and invited users (participants) can contribute to it (Figure 6.11).

Figure 6.8: The document of author

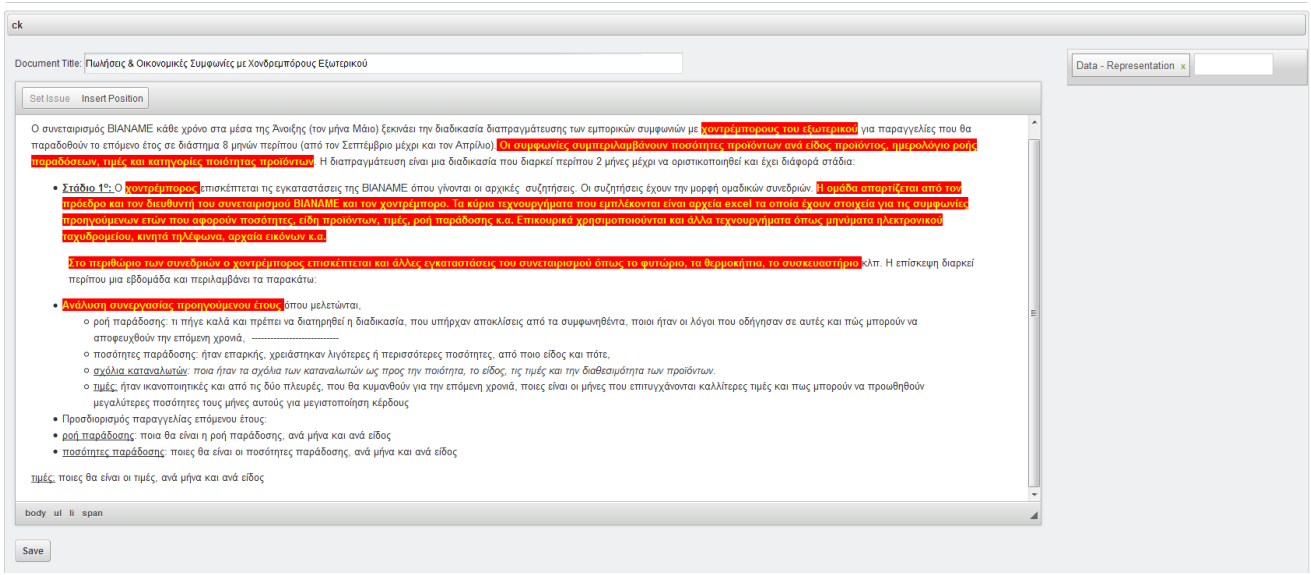


Figure 6.9: Authors adds metatags - the theory completed

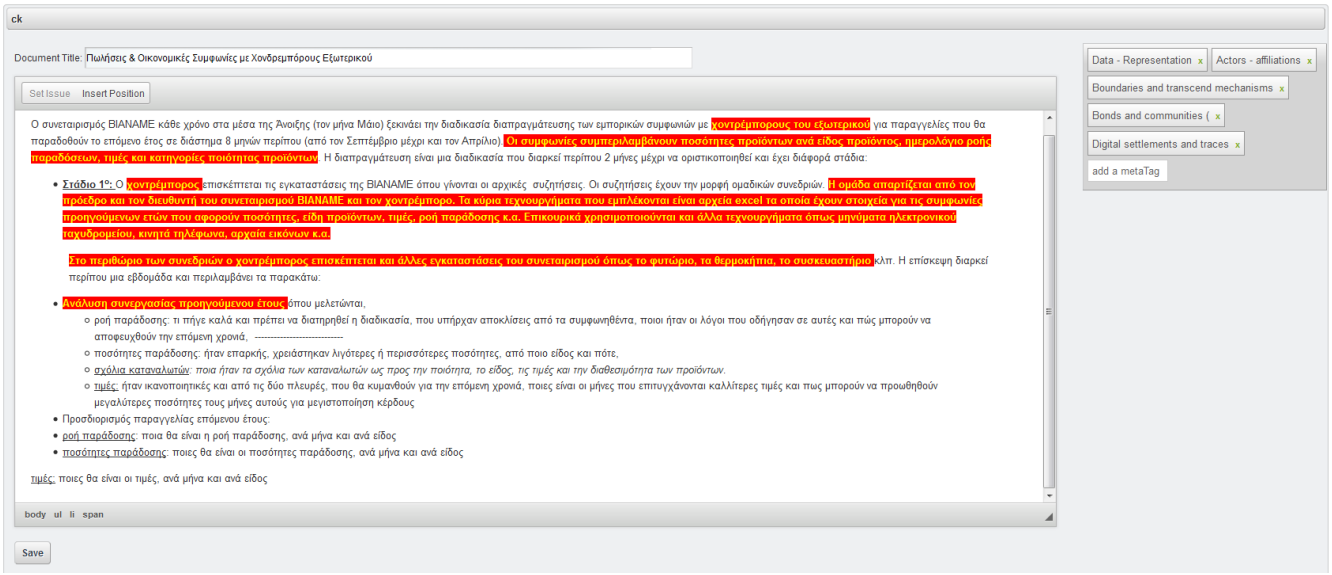


Figure 6.10: Sent invitation to contributors (left) the mail received by invited (right)

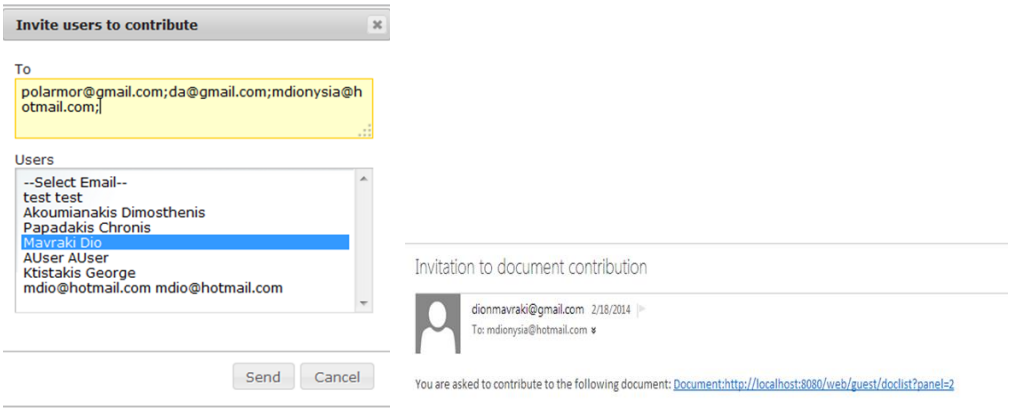


Figure 6.11: Word cloud of issues of all documents

Either author dionysia or invited polarmor and da can sign in their environment. Firstly, the author 'dionysia' after the document save and the invitation goes to portlet 2 in Figure 6.12. The author starts to add tags to issues Figure 6.13. More specifically, author adds the tag (role) to "χοντρεμποροι του εξωτερικού" and to "χονδρέμποροι", the tags "affiliation" and "roles" on issue "Η ομάδα απαρτίζεται από τον πρόεδρο και τον διευθυντή του συνεταιρισμού BIANAME και τον χοντρέμπορο. Τα κύρια τεχνουργήματα που εμπλέκονται είναι αρχεία..". The author fills the tags in all issues.

Figure 6.12: Document List: Author environment document

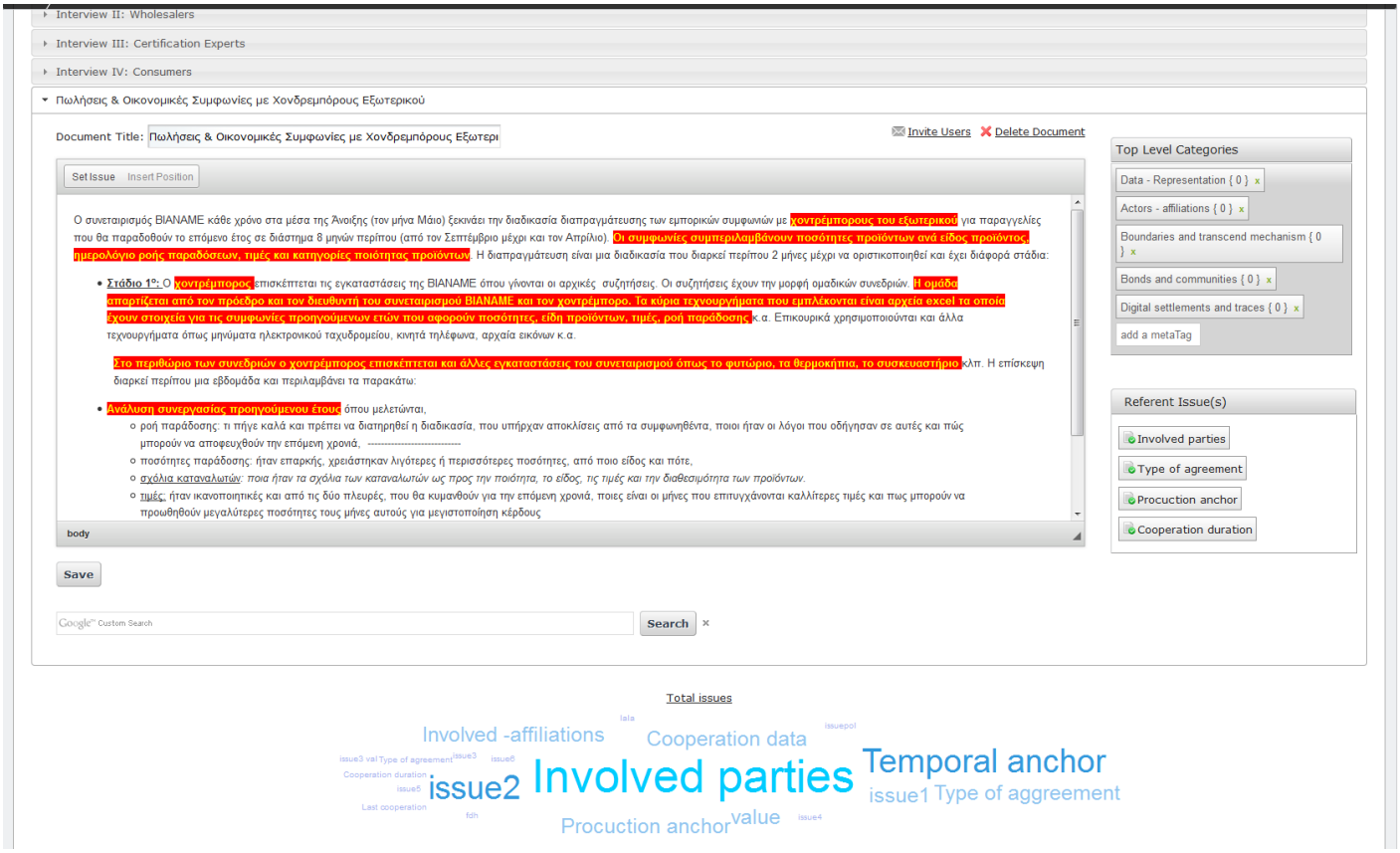
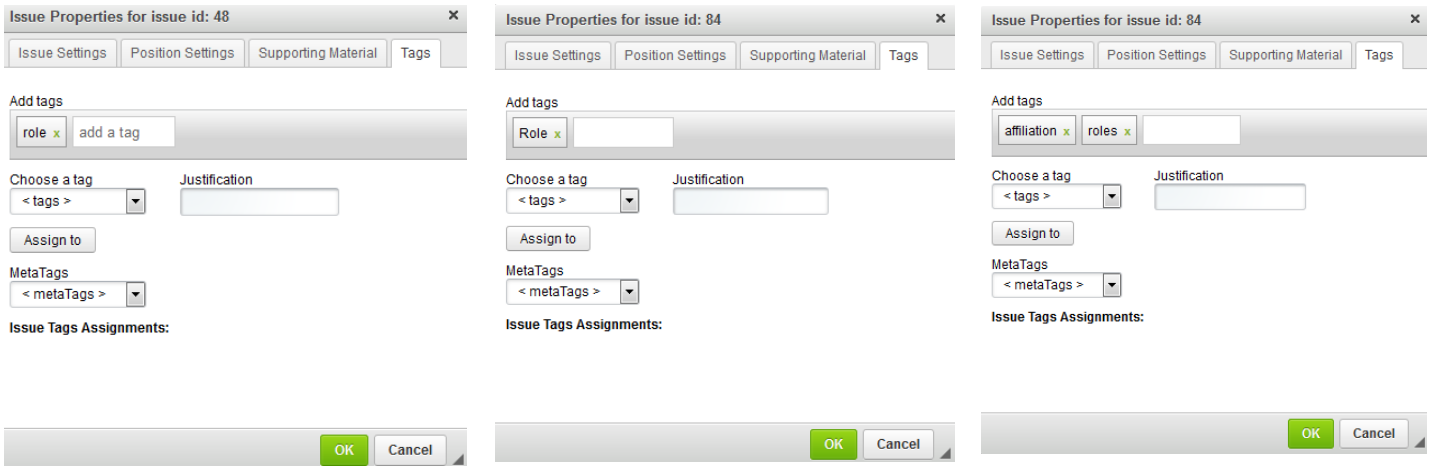


Figure 6.13: Add tags to issues



Then the author starts exploring the document using issues (Figure 6.14, Figure 6.15). Then, the user starts to assign tags to metatags. Figure 6.16 depicts these assignments. For instance, she assigns the first tag (affiliation) of issue "Η ομάδα απαρτίζεται από τον πρόεδρο και τον διευθυντή του συνεταιρισμού BIANAME και τον χοντρέμπορο..." to Data-representation metatag. The results of assignments are in Figure 6.17.

Figure 6.14: Exploring the document using tags and metatags. Selecting an issue filters them in document

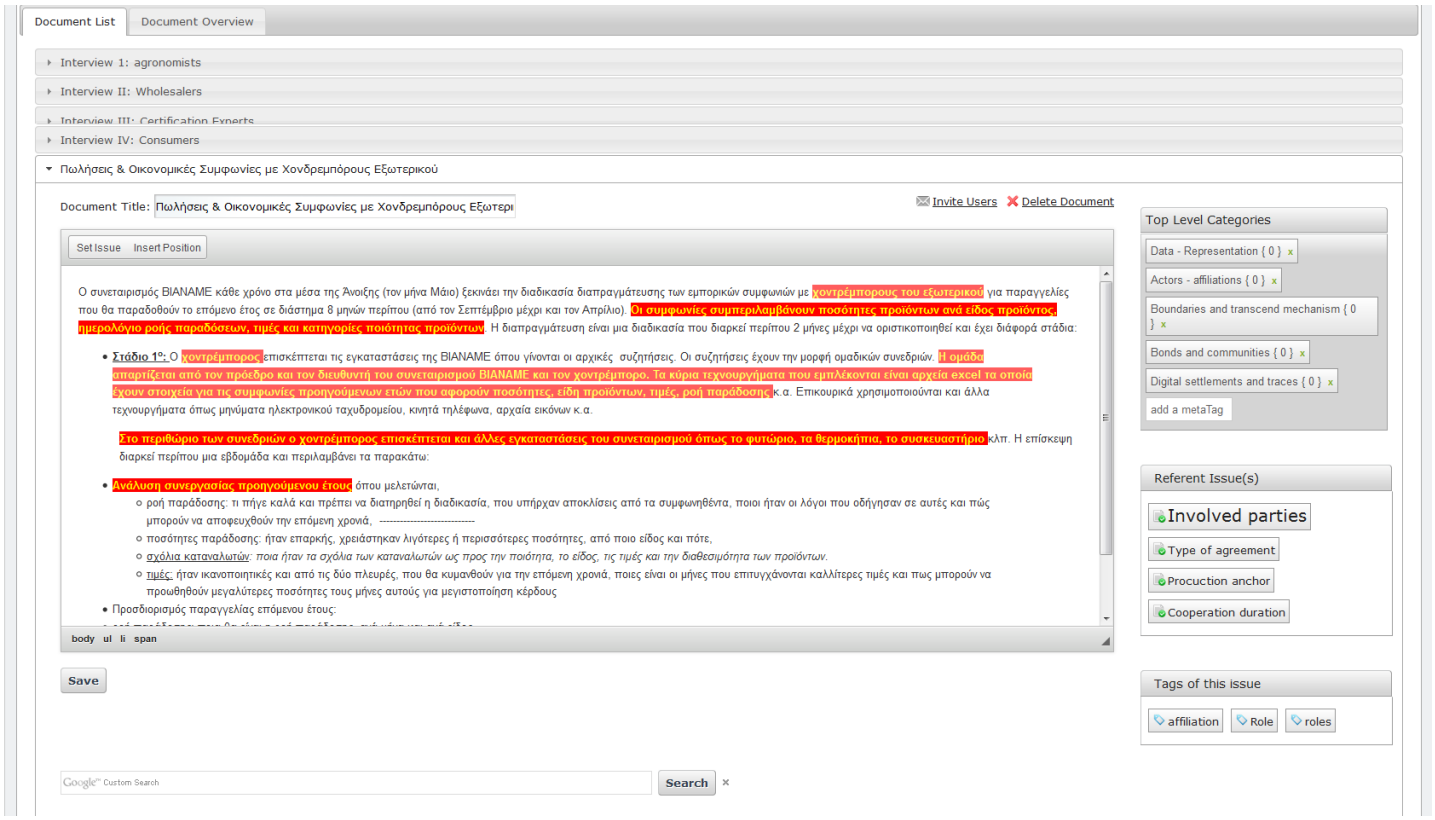


Figure 6.15: Exploring the document using tags and metatags. Selecting an issue filters them in document

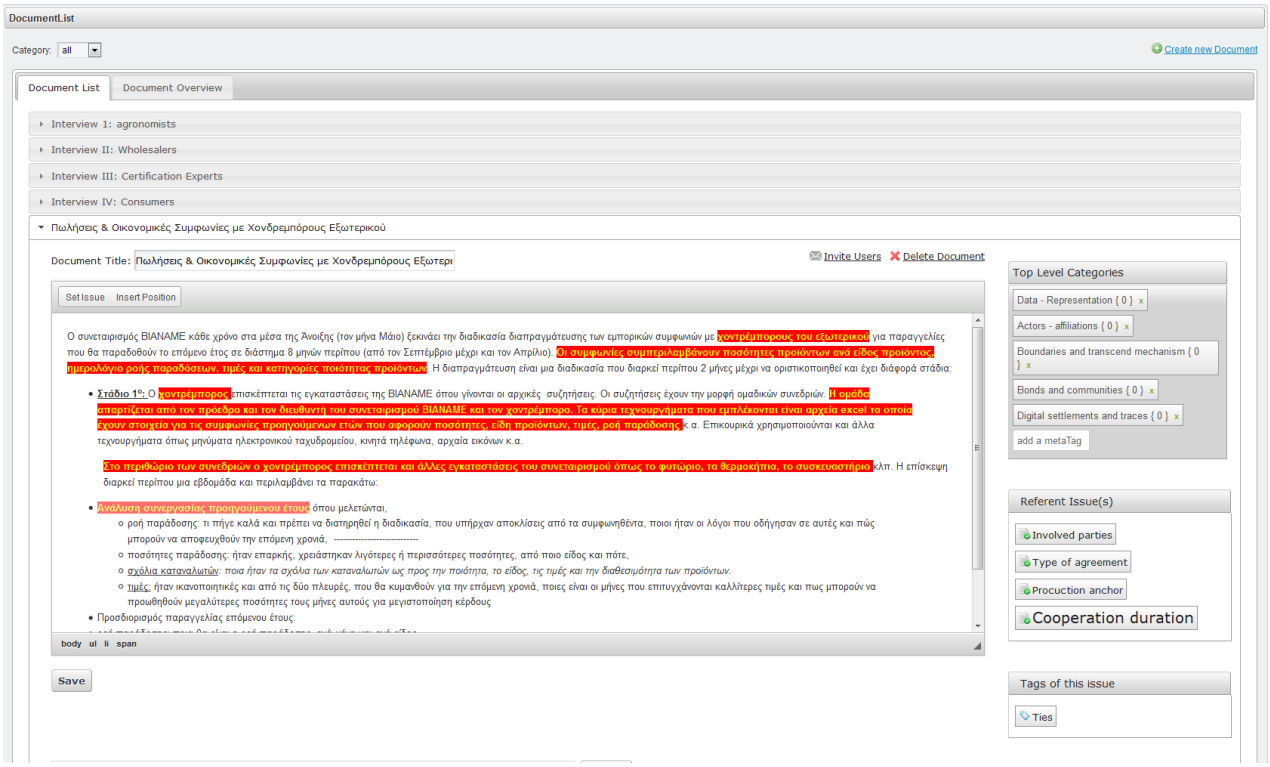


Figure 6.16: Tags Assignments to metaTags

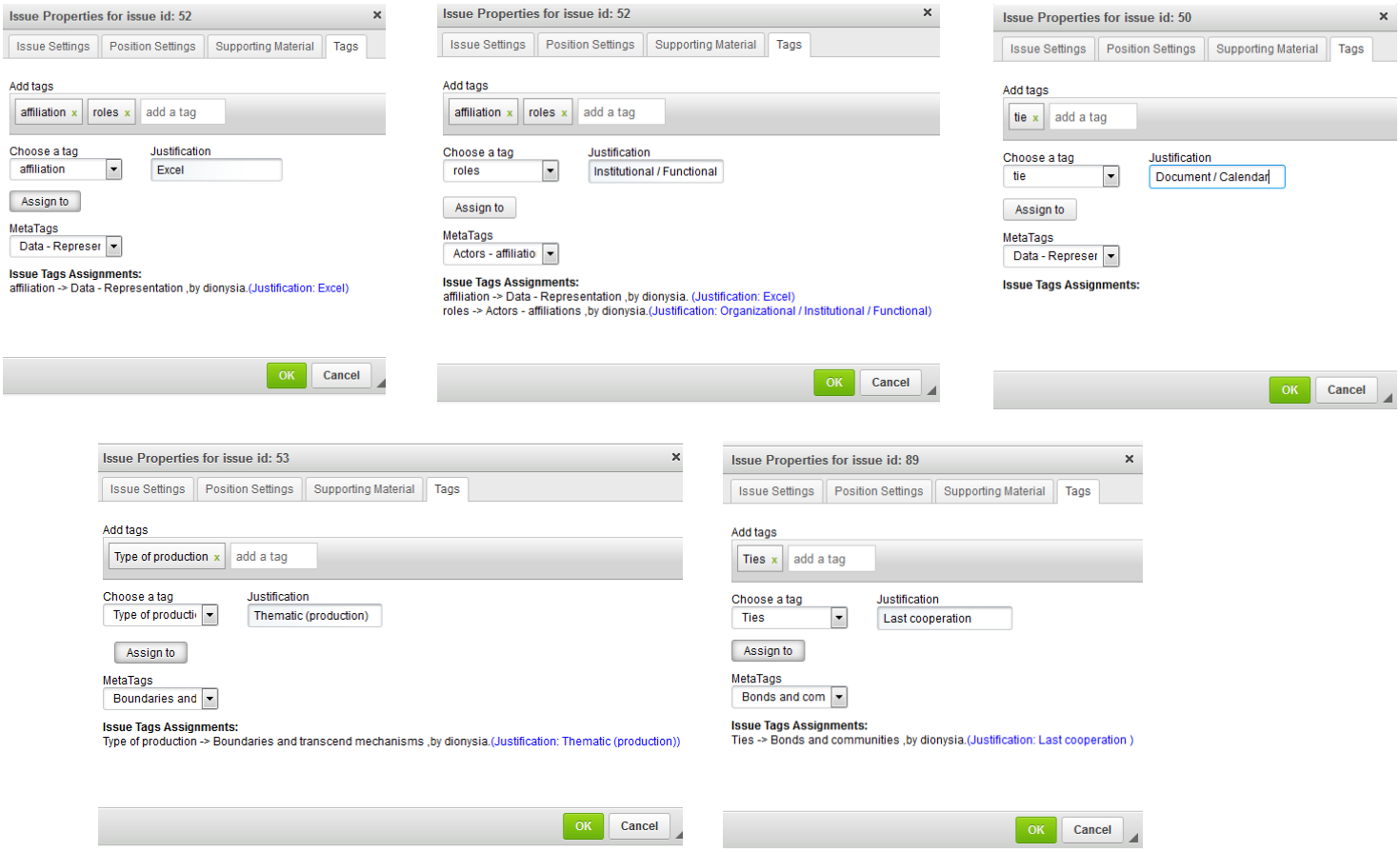
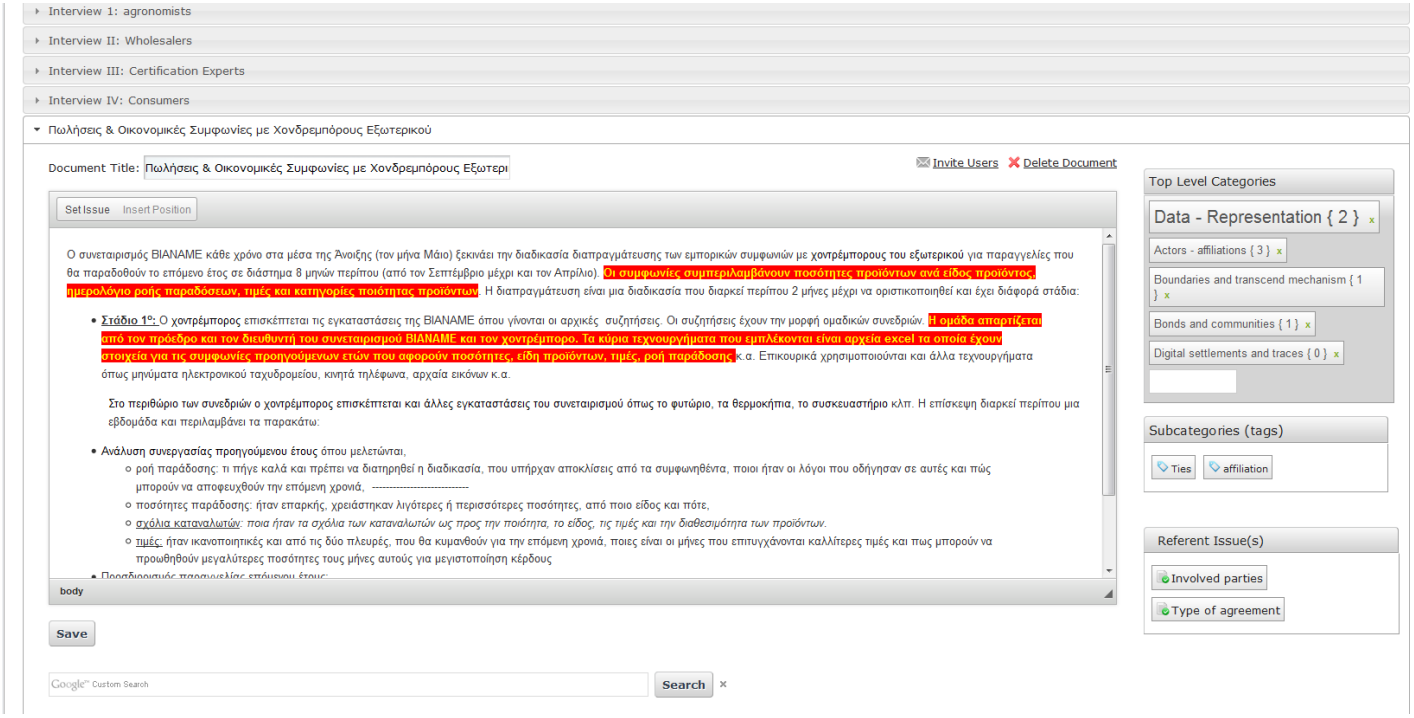
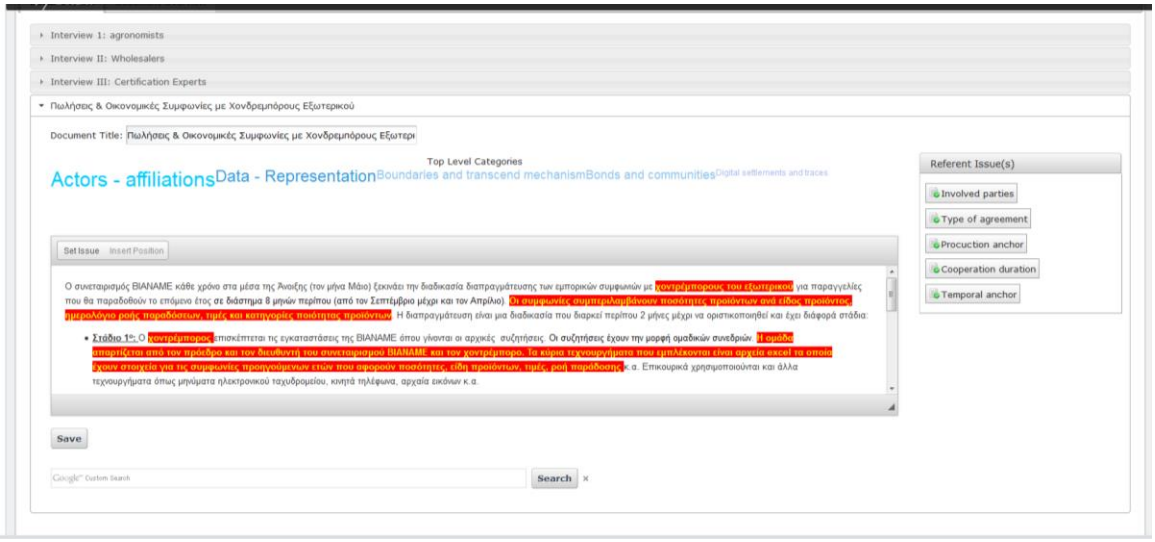


Figure 6.17: Exploring the document using tags and metatags



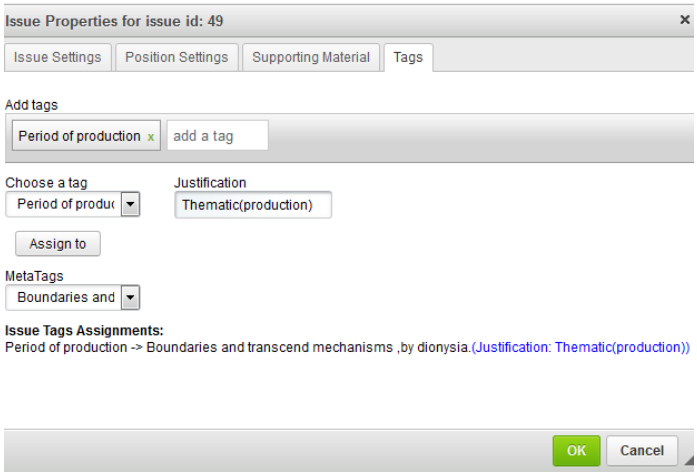
Accordingly, the invited signed in to the portlet in order to start his contribution. User 'polarmor' can see the theory established by the author, the issues have set as well the positions of author. Figure 6.18 depicts the environment of user 'polarmor'. On the top level of current document, invited user can see a word cloud with the top level categories have been defined for the document (that is the metatags or theory). On the right side of the document (Figure 6.18), the wisdom of the document is concentrated.

Figure 6.18: Invited environment



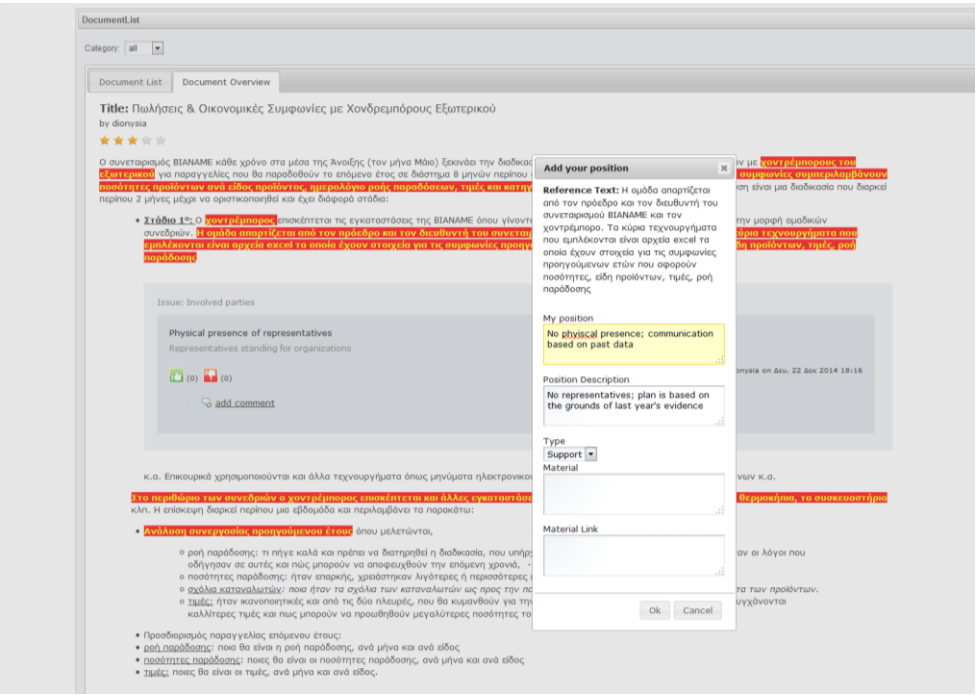
'Polarmor' starts to assigns tags of issues to metatags (see Figure 6.19). Specifically, he assigns the tag "Period of production" to metatag 'Boundaries and transcend mechanisms'.

Figure 6.19: Tag assignment to a metatag



In 'Overview mode' he adds his position to issues that author has previously has defined. For instance, in Figure 6.20 the user adds his position on issue 'Η ομάδα απαρτίζεται...' that author 'dionysia' has previously defined and a comment on author's position (see Figure 6.21).

Figure 6.20: Invited user adds a position



In the following, the user adds his issues. For instance in Figure 6.22 up the user has already sets two issues and he adds his third. He sets the issue that refers to text "Η επίσκεψη διαρκεί μια βδομάδα…" and in Figure 6.22 down his fills in the settings and his position. Next he assigns tags to metatags (Figure 6.23). To be more specific, he assigns the tag 'ties' to metatag 'Bonds and communities'. Another example is the assignment of issue 'affiliation' to 'Digital settlements' with the justification of 'email'. Another assignment is that of tag 'Role' to metaTag 'Actors -affiliations'. He continues to assigns tags to metatags

Figure 6.21: Invited user comments on a position

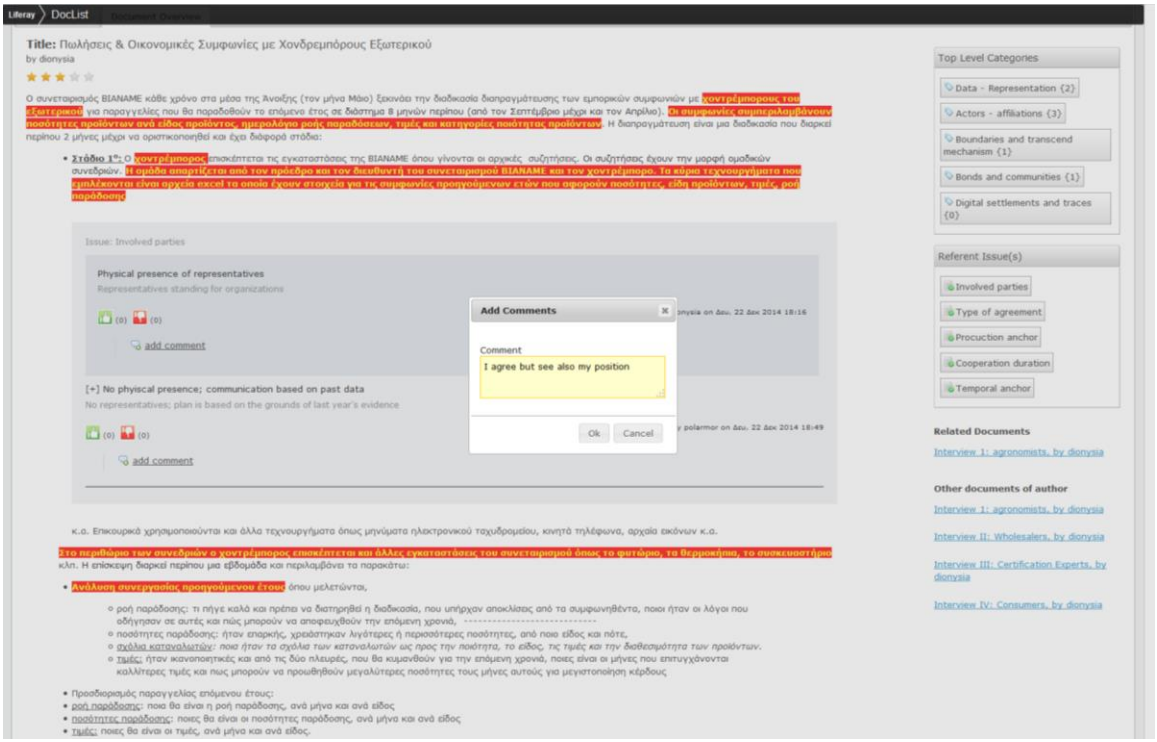
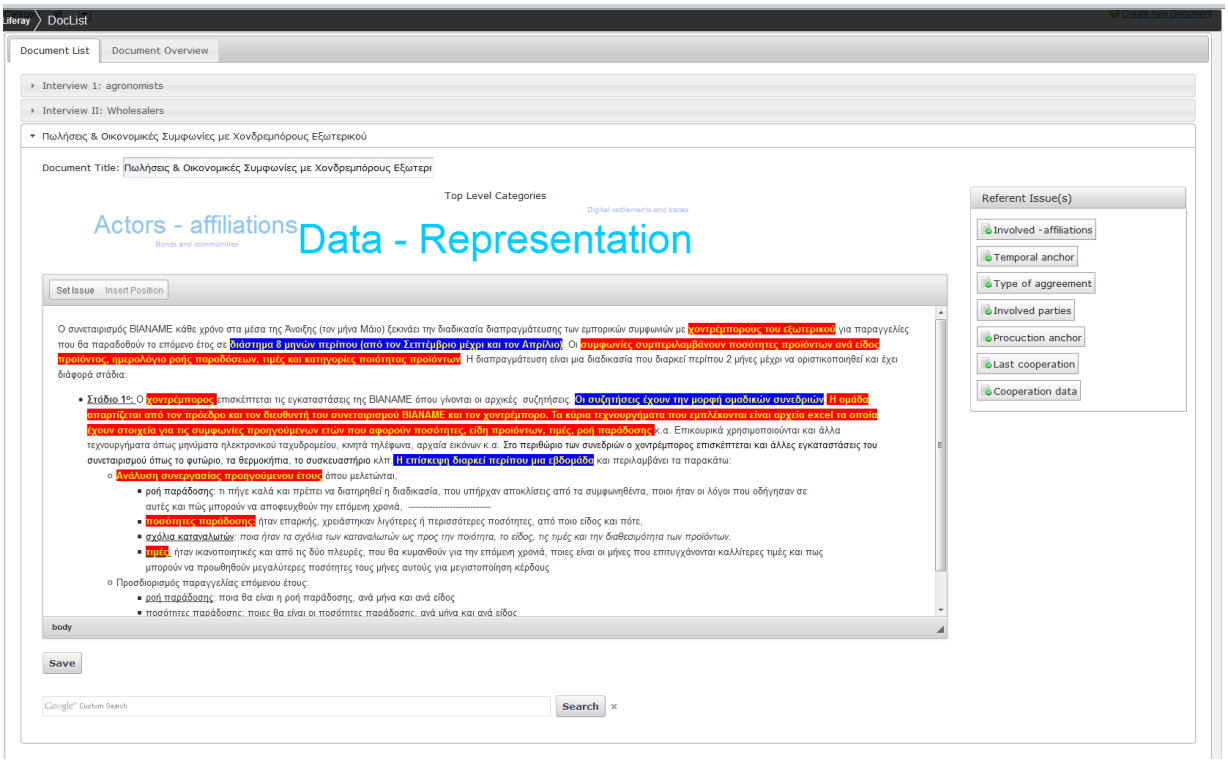


Figure 6.22: User adds a issue (up) issue setting (down left) positions (down middle) tags (down right)



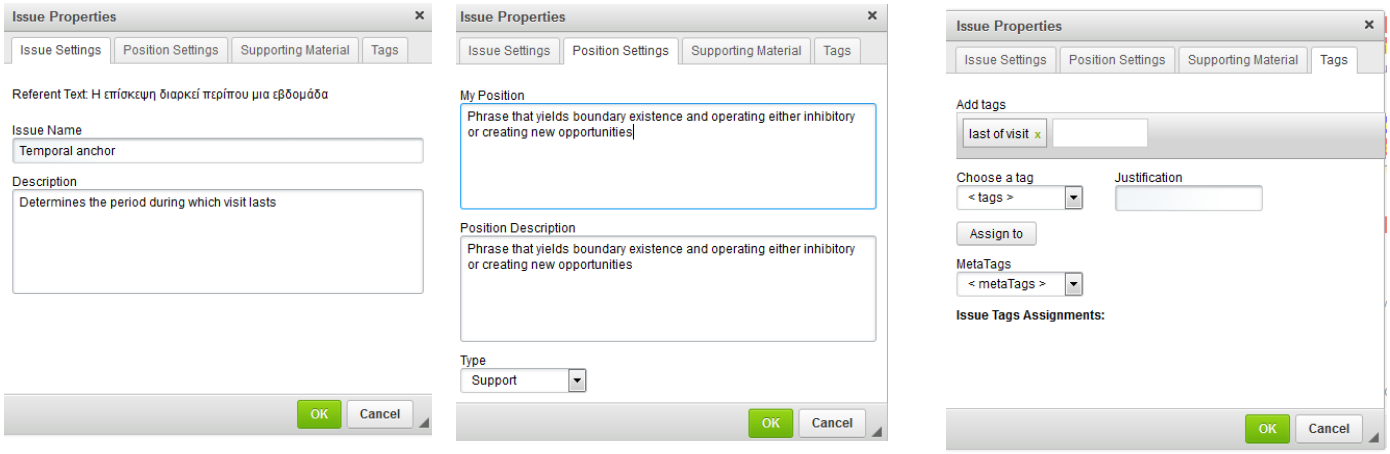
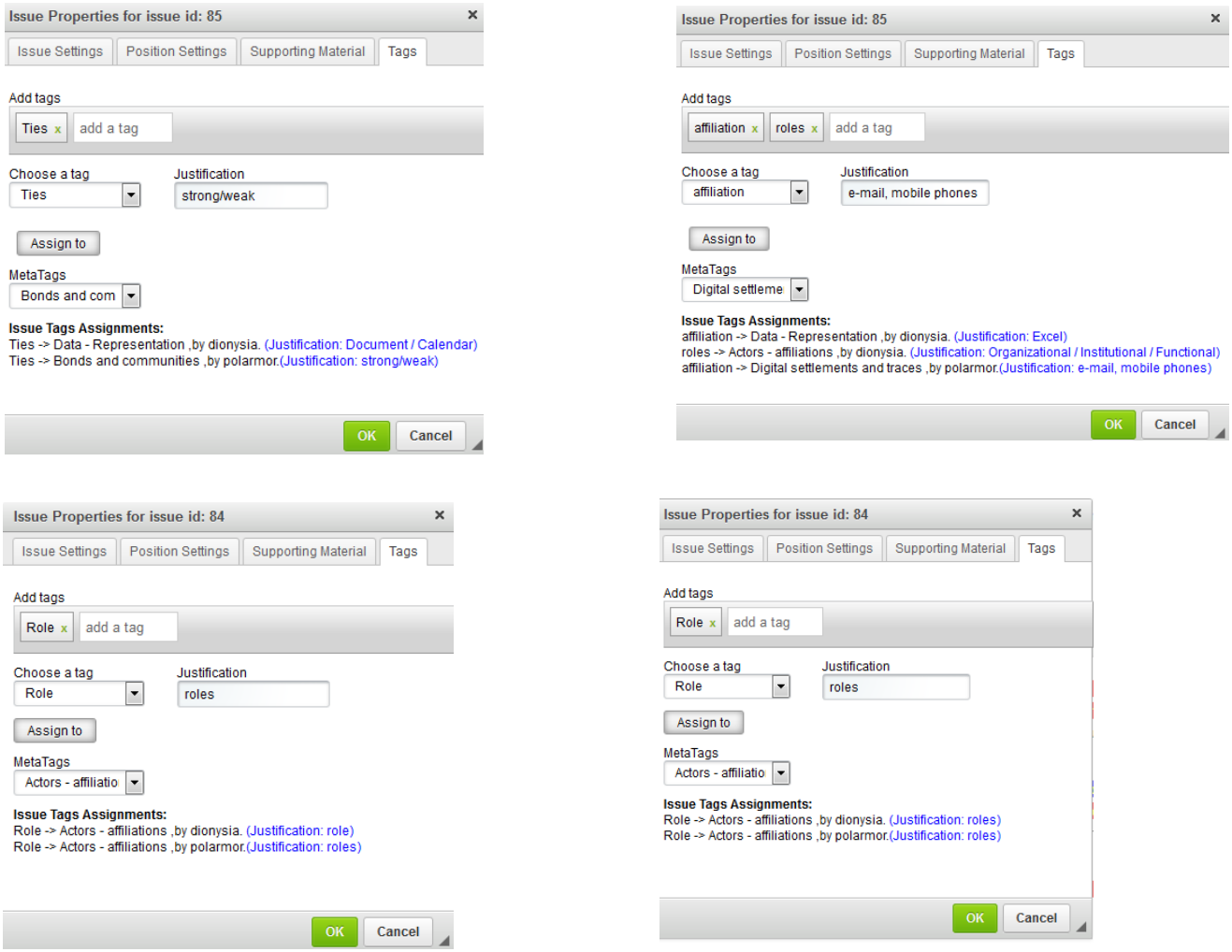
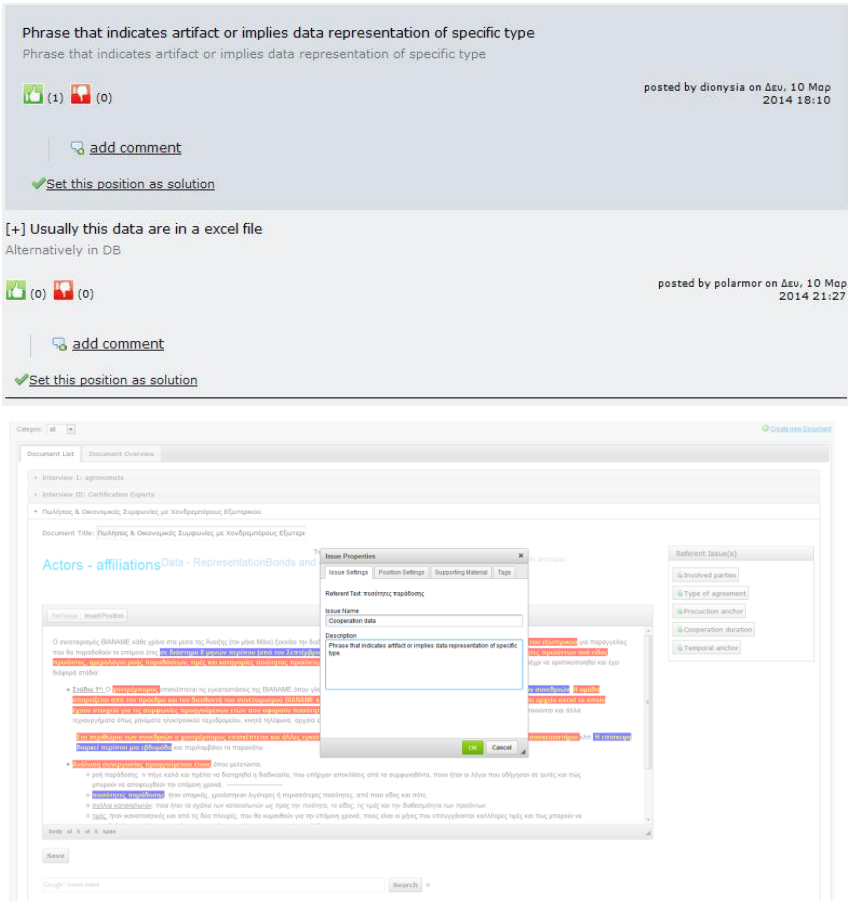


Figure 6.23: Invited assigns tags to metatags



In the following a third user ‘da’ signs in order to accept the invitation and contribute to the document. He votes positively a position of author in Figure 6.24 left and then assigns a tag to metagag Figure 6.24 right. He also pinpoints also an issue in the excerpt ‘ποσότητες παράδοσης’ as a cooperation data (issue name) Figure 6.24 down. User ‘da’ continues the exploring of the document by adding positions to existing issues, pinpointing new issues or assigning tags to metatags.

Figure 6.24: User votes a position (up left), assign a tag (up right), and adds a position (down)



Finally, author signs in order to get the results. That is, ‘dionysia’ checks which metatags have been used namely assigned to tags by clicking on each metatags. For instance in Figure 6.25 the user has selected the metatag ‘Boundaries and transcend mechanism’ and this shows the subcategories (tags) that has assigned to this metatag. Moreover, the issues that refer to this metatag are filtered. Namely, this action filters the document to highlight all referents assigned to this issue, including the tags.

The user also checks the statistics namely he gets data that concerns (Figure 6.26) which user contributes more, adds more issues etc. Then, the user solves the issues by selecting positions (Figure 6.27 up). When all issues are solved the document is considered as close, namely anyone can contribute (Figure 6.27 down).

Figure 6.25: Author select metatags thus filtering issues

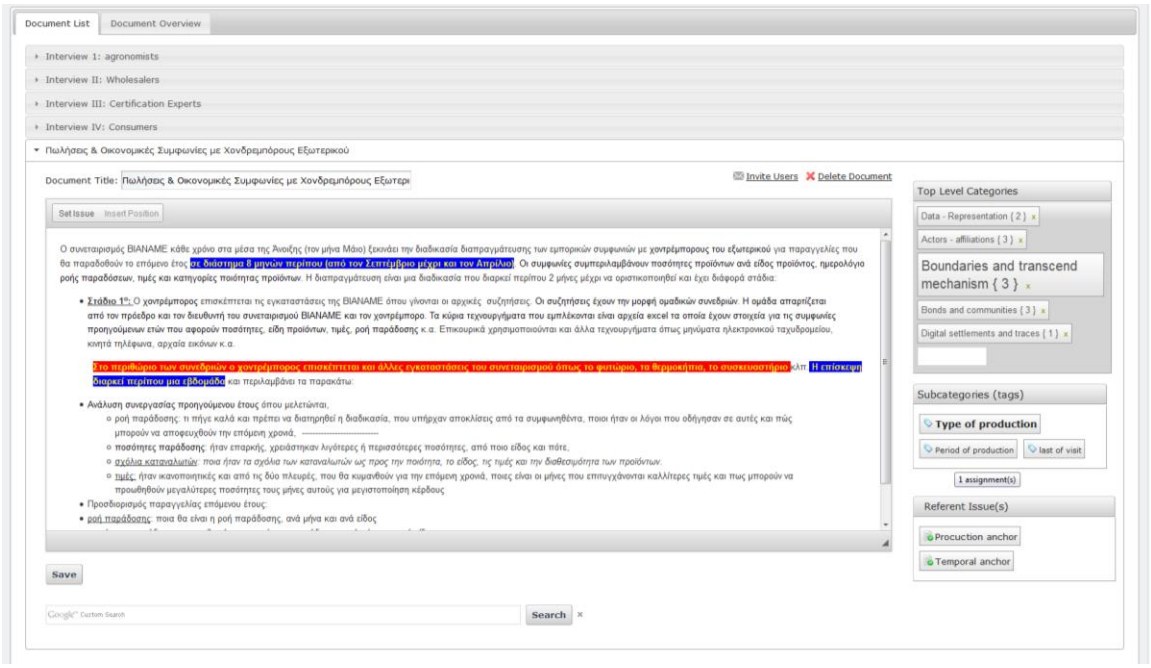


Figure 6.26: Statistics

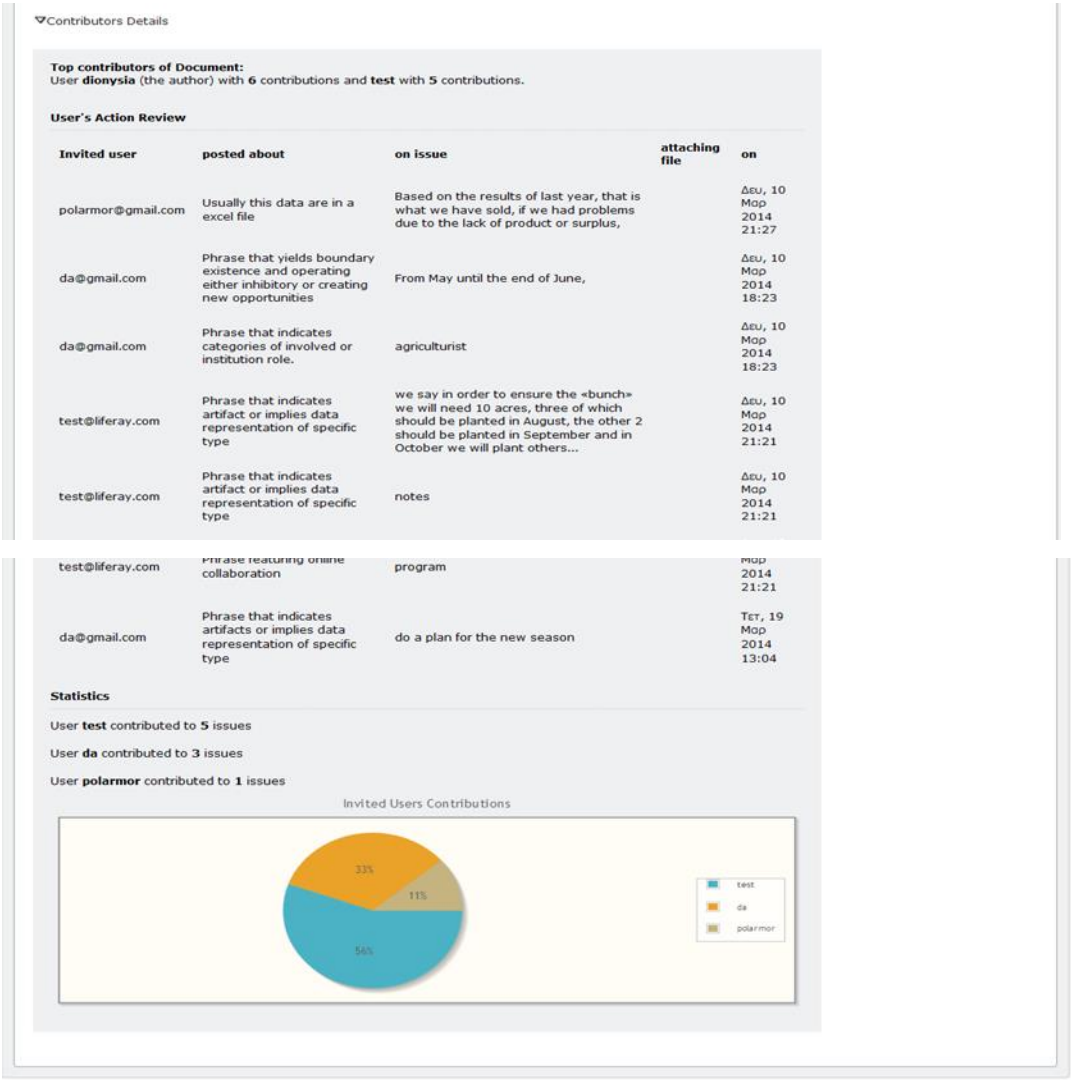
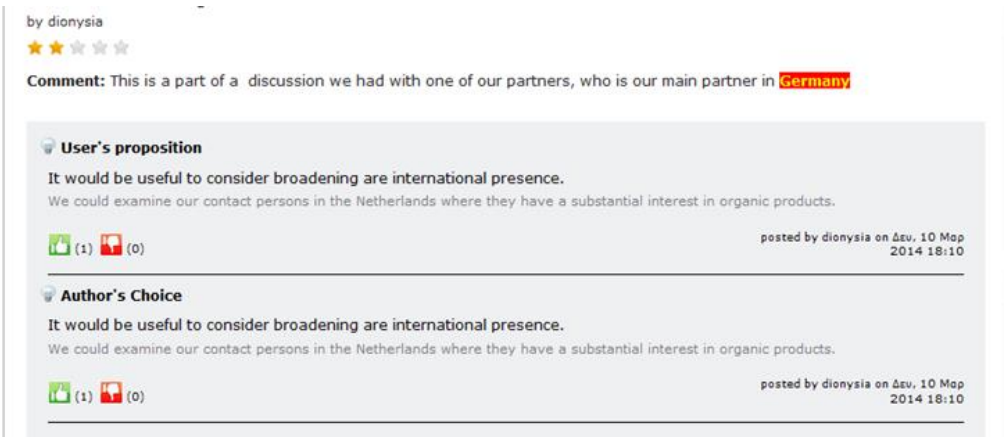


Figure 6.27: Set a position as solution (up) Close document (down)



Chapter 7 - Summary, contributions and future work

Summary

The thesis focuses on the management of Conversational Knowledge (CK) that is embedded in informal dialoguing patterns of collaborating peers. Due to its nature, CK is usually contained in linguistic patterns such as narratives, storytelling and word-of-mouth where peers can raise issues and engage in argumentation. Nonetheless, the advent of Web 2.0 makes certain provisions which enhance the media types in which tacit knowledge may proliferate. For instance, 'like' buttons, voting and rating widgets as well as tagging mechanism are just as useful in expressing intentions, preferences and codes. Thus, online discourse may be seen as mix of conversational patterns that collectively constitute the knowledge to be shared, negotiated and crystalized.

In this thesis, we have presented the concept using a case study and described the components of a system which is intended to facilitate Conversational Knowledge Management in the course of small group activities. One useful feature of the system is that it supports an incremental dialoguing pattern for negotiating contents and reaching collective consensus. Such 'collectivity' is made explicit and can be explored by dedicated provisions for issue tracking, tagging, assessing related documents, etc.

The system has been tested in one prominent application area related to qualitative data analysis. Using empirical data from this case study, we identify conversational patterns and assess intrinsic properties of their prominent media types. This helps anchor these patterns as 'Dialogue for Action', thus informing the design of portlets (in the Liferay portal) fostering creation of new knowledge through collaborative engagements amongst peers. It turns out that the system was favorably received and found useful. The case of qualitative data analysis brought to the surface intrinsic properties of tacit knowledge management and computer-mediated discourse as well as it can potentially create new knowledge. Specifically, our system can support equally well situations where codes are being developed from scratch as well as the case where established codes are to be validated by independent coders.

Replying to research questions

In light of the results presented thus far, we will now briefly discuss the research questions set in Chapter 1.

Question 1: Which are the features of an effective CKM system?

Our experience indicates that choosing an effective CKM tool is not a simple task. Although there is a variety of CKM solutions which constitutes a rich design space, each solutions has its own characteristics with drawbacks and advantages. In the absence of widely accepted benchmarks to qualify 'best-practice' solutions, it appears that the synergistic use of different technological genres may offer substantial benefits for organizations, groups and individuals. Needless to mention that (a) for different contexts of use and knowledge engineering applications, different criteria may be more or less conductive to success; and (b) limitations and

shortcomings in one technology genre could be easily overcome or by-passed by synergistic use of another technology.

Consequently, when weighting features and combining components, special attention should be given to fostering a more critical thinking and evidence-based reasoning and grounding, by representations which highlight notions, ideas and conceptual relationships between contributions. Systems which can provide sufficient support in this context are those implementing an argumentation process. Frequently, these systems may also benefit from loose integration with web 2.0 and social tools like tagging systems to enhance social participation and accessibility. In addition, an effective CKM tool should support an incremental dialoguing pattern for negotiating contents and reaching collective consensus. Such a component should facilitate peer communication and collaboration in the course of discussing, setting issues, argumenting on these issues by taking positions, making claims and adding propositions. Additionally, a mechanism for asking and answering questions should be available and easy to use. Meta-tagging can also provide a useful instrument for anchoring threads in a conversation or consolidating on line discourse. Through meta-tags peers may externalize cognitive biases that cannot be easily expressed through dialogue as well as group the data items to improve information and knowledge management. Finally, the ability to solve an issue and tracking peers actions is also necessary.

Question 2: What are the requirements of an interactive system that supports collaborative tasks?

The requirements of a modern interactive system supporting collaborative dialoguing tasks concern primarily: a) the digital representation of the users involved and b) the digital representations of the collective object. With respect to representing users, it turns out that building an appropriate profile through some sort of registration is necessary but not sufficient condition to ensure smooth collaboration. In addition, mechanisms such as social scenting and social translucence may offer substantial benefits in understanding who is taking part in conversations, who is leading a discussion and who is following, who has rights to decide on open issues or offer specific types of contributions as opposed to simply commenting. Frequently, these aspects are embedded in the system and may not be easily altered to suit specific requirements. Turning to the digital representations of the collective object of work, our results indicate that by allowing peers to manipulate a structured document in ways that anchor its parts in terms of issues and then tracking dialoguing threads surrounding these issues (i.e., propositions, comments, tags, etc.) results in rich structures from which several benefits can be drawn. For instance, conversations become retooled into a collection of structured markers such as issues, comments, propositions, etc. As a result, a single conversation or a repository consolidating multiple conversations can be explored and searched using such markers to extract further wisdom and added value. Another benefit stems from the fact that conversations are augmented with supplementary evidence and meta-data to depict individual or collective insights. Thus, in the presence of rich data sets one could envision the use of advanced visualizations providing summative accounts of certain parts of a conversation or multiple conversations featuring prominent issues such as codes, meta-tags or issues of interest.

Question 3: Can CKM systems provide a baseline for virtual work in the course of small group activities and how can this be facilitated through designing appropriate dialectical tools?

The present work has been primarily concerned with small group activities. Clearly such small group endeavors offer a useful baseline for assessing not only the value of CK management but also its practical implications for non-trivial virtual work. It turns out that conversational knowledge management constitutes a practice in itself which is viable when conceived as invoking operations with and in digital representations. Operations with digital representations anchor the case where users obtain and maintain virtual referents (i.e., accounts and profiles) which stand for the users and allow them to co-engage with others. On the other hand, operations on digital representations such as structured documents and the linguistic markers that surround them (i.e., issues, positions, votes, comments, etc.) coin regimes of virtual work where users (who are virtually present and acting with their digital counterparts) manipulate digital artifacts in certain ways to contribute to a shared agenda. Consequently, CKM as presented in this thesis entails virtual work by blending representations that stand or completely substitute for physical referents (i.e., users, objects of work or processes).

Contributions

In conclusion, the main contributions of the present research are two-fold. Firstly, our work frames computer-mediated conversational discourse as a mix of peer dialogue exchanges (i.e., questions and answers, comments and structured argumentation), social constructs (i.e., invitations and role taking) and certain linguistic patterns for externalizing intentions (i.e., rating, voting and tagging). Through this lens, online discourse becomes an enacted social accomplishment of peer groups capable of appropriating certain technologies. Secondly, we have developed a working prototype to illustrate the application of this concept in a concrete case study where conversational knowledge management dominates peer group exchanges. Our key objective in building the working prototype has been to provide a proof of concept rather than to compile a fully functional application. It turns out that in a case study which is highly knowledge-intensive, the tool consolidates and makes explicit aspects of informal and tacit knowledge which otherwise would have been omitted and hard to trace. Instead, using our application a range of these details has been brought to the surface and can be explored by the peer group.

Limitations and future work

Every piece of research is based on certain assumptions that frequently limit the applicability and/or generalizability of the findings. At the same time such assumptions or limitations form the baseline for future work. In the presented research, there are two limitations that need to be briefly commented on. The first relates to the data samples on which this work has been based, while the second is concerned with usability issues of our working prototype. Both these limitations can fuel future research at theoretical and engineering levels.

The data samples we have used to base our case study reflect a few interview transcripts which were translated and encoded as digital documents. Although such transcripts depict purely textual materials, we have attempted to enhance their interactive manifestation using images of real world objects as revealed by on-site visits. Nevertheless, qualitative data come in many more formats and modalities. For instance, cultural norms and values, video transcripts and questionnaires are just a few instruments which can provide additional empirical insights to a social phenomenon and the context in which it occurs. Although, our reference case did not invoke analysis of such data, we consider important that future work should aim to cross-test the propositions of this thesis against larger and richer empirical data sets.

Turning to the development efforts undertaken in this thesis, it is important to notice that our objective was to create a proof of concept prototype to demonstrate the synergistic use of different conversational patterns. In this vein, we have illustrated how structured argumentation can be complemented with voting and rating schemes, commenting, indexing and tagging. These mechanisms have been supported by re-engineering two basic portlets of the Liferay enterprise portal. Arguably, there are several improvements that could make this prototype more intuitive and flexible. For instance, the tagging mechanism could be improved to provide structured hierarchies indicating sub-tags under a tag and tag ownership. Additionally, the statistical data extracted and presented could be coupled with more explorative visualizations that bring to the surface commonalities and differences across documents of the same or different owners. Finally, one can also envision improvements in the issue handling mechanism so as to facilitate issue-based search in large document collections outside the corpus of documents implemented in the system.

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Appendix A- Transcript of interview of interviewee # 4

Comment: This is a part of a discussion we had with one of our partners, who is our main partner in Germany, the partner who takes the biggest part.

Q: This partner is not a retailer, he does not sell directly, he is a wholesaler.

He is a super wholesaler; he sells to other wholesalers who sell to shops and schools. Based on the results of last year, that is what we have sold, if we had problems due to the lack of product or surplus, we can do a plan for the new season.

Q: And you do this by telephone?

No. We meet each other and together we do this stuff. It takes us two days.

Q: Do you keep records about what you do?

Yes. I have counted last year's quantities per month. For example, last January we sold 10 tons of cucumber. He told me since it was difficult to sell that entire amount we had to reduce the price. For instance, he tells me instead of 10 tones to have only 8, or the opposite. Or to tell me that we sold 6 tons in a month. Or for example to advise me that it would be better if I had 15 tons.

Q: So there is a negotiation.

Yes. There is.

Q: Well, what do you get from the meeting? Do you get a file with notes, for example that say I will need five more in May?

Not only can I write down whatever I want but also, we can both conclude and propose how many tons we may need for a month. This is the first step. Then he leaves. From May until the end of June, I ask the agriculturist and Philip that if German wants these products and these quantities how many acres should be planted and when. Then we conclude all together. For example, we say in order to ensure the «bunch» we will need 10 acres, three of which should be planted in August, the other 2 should be planted in September and in October we will plant others...

Q: Yeah, yeah, okay...

Yes, in order to have this flow.

Q: Thus, both agronomist and Philip have been informed about what to ask from the producers.
Right.

Q: These are said orally and agronomists as well as producers keep notes.
Yes. We write down some notes about this subject. System also supports this operation. For example, we write down 15 acres of cucumber.

Q: Nice. I would like to see how this is recorded in the system.
Yes

Q: To capture the system and see it. Nice.
After I have finished all this... I make all codes and I know what... what I need, for example, I know I need a hundred acres (?), and so on. Then, I meet the producers. We meet first our producers, namely those who give us the 100 % of their product and we tell them: Guys we want these, the one who has let's say 5 acres says okay for me put two acres of cucumber, one acre of August brunch, one acre of December tomatoes. I start writing down all this info (I will show you) let's say I want ten it comes... you say I will put two; I say I will put another one acre. Thus I need some more to complete them.

Q: You tell me that it is a record of tenders offers, namely the producers.
Yes, in order to join us in the program.

Q: Exactly.
I want to know what each one will do and after we have taken the okay I start. When our producers finish the result is not always what we want. For example, sometimes I want ten acres and I have twelve acres to plant thus I inform that I may have problem with these two extra acres. On the other hand, it may be possible to have less acres, thus I have to look for producers who are willing to plant a specific product in a specific season. After I have finished I inform the agriculturist about the result, what we wanted but eventually this is the result because some times...

Q: You cannot wait.
Exactly, I cannot wait and sometimes for example I want 10 acres but we plant 12 acres because it is 2 I say no, I will plant this quantity and I will take the risk. Or the opposite I want 10 acres of a product and took only 7.

Q: Is there a priority? For example, you have found the amount of ten, let's say tomatoes, if someone else also plant, and will first 10 have a priority over the last? That is to say, you will not sell the product of the last?

I give priority to producers who bring the 100% of the product. That is to say, I have 3 acres.

Q: So you give priority to those you tell them what to plant. Actually you tell them what to plant in some extent.

No, I suggest them and they also express their opinion. I will talk with the producer who brings us the 100% of his quantity. For instance, if you have 4 acres but you give us only the two, while you sell the other two acres somewhere else, I will give priority to another producer who gives all his product.

Q: You write down this priority because you know them or is there a kind of record proposing you to prefer a producer from another.

This is our agreement, you know. I cannot based on one producer, there are some producers who also cooperate with other merchants and it is possible to prefer another retailer for some reasons (he may buy more expensive), and I will explain why I do this. Because when we finish this record (what and how many acres one have planted how many acres have grown up to whom I put the acres they wanted, in which codes we had lack) we discuss with the agriculturist about each acre when it will have grown up (for example, Kokarakis has planted red pepper in a 800 feet field, in another note I have written down when he planted etc. Finally, we conclude that it will start after 42 weeks to produce these quantities.

Q: Is this what you expect?

Yes, from this one I expect these from the other one I expect these per week. For example, this one who has planted later he will start also later and so on. Then, I sum them up per week. -I have a lot of this to do.

Q: I need one.

Well, after that, I will sum up all the types, pepper cucumber , etc , then I count a total situation (I will show you this which I send to our partner in Germany) and based on what we wanted, the acres we found and we will plant, we will have such a result , there is the first, because it may happen to need more but not to find, or to find what you like but to have planted an acre more and if you can find a way to sell these amounts.

Q: In order to wait the extra quantity.

Yes exactly. If he cannot, he inform me . If we have a large deficiency he must be informed, namely I sum up the whole season. Then we begin to seed, plant, and check and watch waiting for everyone to bring.

Q: Well I have seen these in Nick harvest program.

Yes

Q: I have seen in the system of Athena that counts the outputs per field, right? So you write down the output per field of previous years.

Yes, of course. The new season I use the outputs, which Athena has recorded the previous years, and discuss them with agriculturist. Thus, this will enhance the quality of our stuff.

Q: Yes.

Of course, here, we face the problem with the weather, as your father said you before. Because of the change in weather conditions the crop differs from year to year. This is something the system cannot support. Well, every week, I give a report to Germany, that is I sent a general, overall anticipation and every week I send also a report (I will show it to you – what I will send, where I will put it). And a third thing we do is that we try to check every 2 weeks , I say for example , I say here , in field with peppers , we are in week 48 now, I say 50,51,52 week from 48 I try to see how the fields are and it they are normal we will get these quantities. If you have a field suffering from an illness or for instance, due to the good weather the plants will flourish. I try to warn German If I have an ill garden that I will supply him with less quantity than that I told him on the fiftieth or fifty-first weeks.

Q: In the meantime you can find some producers who did not agree at first.

In this case what I do: if I have a defect then we are lucky because I will bring him immediately. Since I have already a loss. However, if I am normal I inform him that for example, I have told him for a ton but eventually I can send him half a ton above and what does he think about? He thinks and responses accordingly, either he agrees or he insists to sell. In this case, I inform the producer...

Q: Thus the price is not pre agreed?

No never...

Q: Do you define and agree about the price that week, right?

Maybe yes, since they have been working four years, we think the things last year. However this depends on supply and demand of market.

Q: Okay.

We agree about the amounts

Q: I see, okay.

So until the end of the season and then

Q: And we start again.

This was generally what we do to be able to...

Q: The whole planning, good, thank you!

Second text - Narrative Description: Πωλήσεις & Οικονομικές Συμφωνίες με Χονδρεμπόρους Εξωτερικού

Every year in mid-spring (in May), the cooperative organization BIANAME starts the negotiations about trade agreements with super wholesalers of abroad for orders to be delivered next year in about eight months (from September to April). The agreements include quantities per product type, delivery flow calendar, prices and product quality categories. Negotiation is a process that takes about two months to be finalized and has several stages:

Stage 1: The super wholesaler visits the facilities of BIANAME where initial discussions are made. Discussions look like team sessions. The team is comprised of the president and the director of the BIANAME and super wholesaler. The main artifacts involved are excel files that have data on the agreements of previous years regarding quantities, types of products, prices, delivery flow etc. Adjuvants are used and other articles like emails, mobile phones, ancient images etc. On the sidelines of the sessions super wholesaler visits and other facilities of the cooperative as the nursery, greenhouses, the packaging etc. The visit lasts about a week and includes the following:

- Analysis of last year cooperation,
    - delivery flow: what went well and must maintain the procedure, whether there were deviations from agreements, what were the reasons that led to them and how they can be avoided next year,
    - supply volumes: whether they were sufficient, required fewer or more quantities from what kind and when,
    - Consumer reviews: the consumer' comments about quality, type, price and availability.
    - prices: were the prices at good level from both sides, which will range for next year, which months did the organization achieve better prices and how to promote greater quantities of these months to maximize profit
- Determination of next year order:
    - delivery flow: what will be the flow delivery, per month and per type
    - Delivery quantities: What is the delivery quantities, per month and per type

- Prices: what will be the price, per month and per type?

Stage 2: In this stage an initial plan to order product types, quantities, and delivery flow rates is determined which will be finalized later (40 days later)) and more specifically when the next use case "Production Planning agreements basis with wholesalers" will have been completed. The reason for this is because the quantities, types of products and the delivery flow are intrinsically linked to the cultivation and production planning.

At this point, the first stages of the economic negotiations, which represent approximately 80% of the cooperative's turnover, with wholesalers abroad, are completed. The next steps are completed absence of wholesalers and include the production design based on the agreements of stage 2 with wholesalers.

Appendix B - Transcript of Interview of interviewee # 4 and narrative text: illustrative coding and conversational patterns (Phase A)

Transcript of Interview of interviewee # 4

Affiliation /user role

Boundaries

Comment: This is a part of a discussion we had with one of our partners, who is our main partner in Germany,

Affiliation /user role

Affiliation /user role

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He is a super wholesaler; he sells to other wholesalers who sell to shops and schools. Based on the results of last year, that is what w... If we had problems due to the lack of product or surplus, we can do a plan for the new season.

Affiliation

Q: And you do this by telephone?

Technology genre

No. We meet each other and together we do this stuff. It takes us two days.

Q: Do... keep records about what you do?

Boundaries

Yes. I... counted last ye...s quantities per month. For example, last January we sold 10 tons of cucumber. He ... was difficult ...ell that entire amount we had to reduce the price. For instance, he tells me ...ones to have only ... the opposite. Or to tell me that we sold 6 tons in a month. Or for example ...at it would be bette... ad 15 tons.

Data representation-artifact

E: So there is a negotiation.

Yes. There is .

Data representation-artifact

Data representation - artifact

Q: Well, what do you get from the meeting? Do you get a file with notes, for example that say I will need five more in May?

Affiliation /user roles

Boundaries

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Data representation-artifact

Q: Yeah, yeah, okay...

Yes, in order to have this flow.

Q: Thus, both agronomist and Philip have been informed about what to ask from the producers.

Right.

Q: These are said orally and agronomists as well as producers keep notes.

Yes. We write down some notes about this subject. System also supports this operation. For example, we write down 15 acres of cucumber.

Q: Nice. I would like to see how this is recorded in the system.

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Q: To capture the system and see it. Nice.

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Affiliation /user role

Affiliation /user role

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Q: Exactly.

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Q: You cannot wait.

Exactly, I cannot wait and sometimes for example I want 10 acres but we plant 12 acres because it is 2 I say no, I will plant this quantity and I will take the risk. Or the opposite I want 10 acres of a product and took only 7.

Q: Is there a priority? For example, you have found the amount of ten, lets say tomatoes, if someone else also plant, and will first 10 have a priority over the last? That is to say, you will not sell the product of the last?

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Q: So [illegible]rity to those you tell them what to plant. Actually you tell them what to plant in some exten[illegible]

Affiliation /user role

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Q: You write down this priority because you know them or is there a kind of record proposing you to prefer a producer from another.

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Yes, of course. The new season I use the outputs, which Athena has recorded the previous years, and discuss them with agriculturist. Thus, this will enhance the quality of our stuff.

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Of course, here, we face the problem with the weather, as your father said you before. Because of the change in weather conditions the crop differs from year to year. This is something the system cannot support. Well, every week, I give a report to Germany, that is I sent a general, overall anticipation and every week I send also a report (I will show it to you – what I will send, where I will put it). And a third thing we do is that we try to check every 2 weeks , I say for example , I say here , in field with peppers , we are in week 48 now, I say 50,51,52 week from 48 I try to see how the fields are and it they are normal we will get these quantities. If you have a field suffering from an illness or for instance, due to the good weather the plants will flourish. I try to warn German If I have an ill garden that I will supply him with less quantity than that I told him on the fiftieth or fifty-first weeks.

Affiliation /user role

Data representation- artifact

Affiliation /user role

Data representation - artifact

Affiliation /user role

Data representation- artifact

Affiliation /user role

Data representation- artifact

Technology genre

Technology genre

Q: In the meantime you can find some producers who did not agree at first.

In this case what I do: if I have a defect then we are lucky because I will bring him immediately. Since I have already a loss. However, if I am normal I inform him that for example, I have told him for a ton but eventually I can send him half a ton above and what does he think about? He thinks and responses accordingly, either he agrees or he insists to sell. In this case, I inform the producer...

Q: Thus the price is not pre agreed?

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Maybe yes, since they have been working four years, we think the things last year. However this depends on supply and demand of market.

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Q: Okay.

We agree about the amounts

Q: I see, okay.

So until the end of the season and then

Q: And we start again.

This was generally what we do to be able to..

Q: The whole planning, good, thank you!

Narrative text: Sales & Financial agreements with wholesalers abroad

Ο συνεταιρισμός BIANAME κάθε χρόνο στα μέσα της Άνοιξης (τον μήνα Μάιο) ξεκινάει την διαδικασία διαπραγμάτευσης των εμπορικών συμφωνιών με χοντρέμπορους του εξωτερικού για παραγγελίες που θα παραδοθούν το επόμενο έτος σε διάστημα 8 μηνών περίπου (από τον Σεπτέμβριο μέχρι και τον Απρίλιο). Οι συμφωνίες συμπεριλαμβάνουν ποσότητες προϊόντων ανά είδος προϊόντος, ημερολόγιο ροής παραδόσεων, τιμές και κατηγορίες ποιότητας προϊόντων. Η διαπραγμάτευση είναι μια διαδικασία που διαρκεί περίπου 2 μήνες μέχρι να οριστικοποιηθεί και έχει διάφορά στάδια:

- **Στάδιο 1ο:** Ο χοντρέμπορος επισκέπτεται τις εγκαταστάσεις της BIANAME όπου γίνονται οι αρχικές συζητήσεις. Οι συζητήσεις έχουν την μορφή ομαδικών συνεδριών, Η ομάδα απαρτίζεται από τον πρόεδρο και τον διευθυντή του συνεταιρισμού BIANAME και τον χοντρέμπορο. Τα κύρια τεχνουργήματα που εμπλέκονται είναι αρχεία excel τα οποία έχουν στοιχεία για τις συμφωνίες προηγούμενων ετών που αφορούν ποσότητες, είδη προϊόντων, τιμές, ροή παράδοσης κ.α. Επικουρικά χρησιμοποιούνται και άλλα τεχνουργήματα όπως μηνύματα ηλεκτρονικού ταχυδρομείου, κινητά τηλέφωνα, αρχαία εικόνων κ.α. Στο περιθώριο των συνεδριών ο χοντρέμπορος επισκέπτεται και άλλες εγκαταστάσεις του συνεταιρισμού όπως το φυτώριο, τα θερμοκήπια, το συσκευαστήριο κλπ. Η επίσκεψη διαρκεί περίπου μια εβδομάδα και περιλαμβάνει τα παρακάτω:
    - Ανάλυση συνεργασίας προηγούμενου έτους όπου μελετώνται,

        - ροή παράδοσης: τι πήγε καλά και πρέπει να διατηρηθεί η διαδικασία, που υπήρχαν αποκλίσεις από τα συμφωνηθέντα, ποιοι ήταν οι λόγοι που οδήγησαν σε αυτές και πώς μπορούν να αποφευχθούν την επόμενη χρονιά, ----------
        - ποσότητες παράδοσης: ήταν επαρκής, χρειάστηκαν λιγότερες ή περισσότερες ποσότητες, από ποιο είδος και πότε,
        - σχόλια καταναλωτών: *ποια ήταν τα σχόλια των καταναλωτών ως προς την ποιότητα, το είδος, τις τιμές και την διαθεσιμότητα των προϊόντων.*
        - τιμές: ήταν ικανοποιητικές και από τις δύο πλευρές, που θα κυμανθούν για την επόμενη χρονιά, ποιες είναι οι μήνες που επιτυγχάνονται καλλίτερες τιμές και πως μπορούν να προωθηθούν μεγαλύτερες ποσότητες τους μήνες αυτούς για μεγιστοποίηση κέρδους
    - Προσδιορισμός παραγγελίας επόμενου έτους:
        - ροή παράδοσης: ποια θα είναι η ροή παράδοσης, ανά μήνα και ανά είδος
        - ποσότητες παράδοσης: ποιες θα είναι οι ποσότητες παράδοσης, ανά μήνα και ανά είδος
        - τιμές: ποιες θα είναι οι τιμές, ανά μήνα και ανά είδος.
- **Στάδιο 2ο:** Προσδιορίζεται ένα αρχικό πλάνο παραγγελίας σε είδη προϊόντων, ποσότητες, ροή παράδοσης και τιμές το οποίο θα οριστικοποιηθεί αργότερα (περίπου 40 μέρες αργότερα))και όταν θα έχει ολοκληρωθεί και η επόμενη περίπτωση χρήσης «Σχεδιασμός Παραγωγής βάση συμφωνιών με τους χονδρεμπόρους». Ο λόγος που γίνεται αυτό είναι γιατί οι ποσότητες, τα είδη προϊόντων και η ροή παράδοσης είναι άρρηκτα συνδεδεμένα με τον σχεδιασμό καλλιέργειας και παραγωγής.

Σε αυτό το σημείο ολοκληρώνονται τα πρώτα στάδια των διεργασιών των οικονομικών συμφωνιών με τους χονδρεμπόρους του εξωτερικού οι οποίες αντιπροσωπεύουν το 80% περίπου του κύκλου εργασιών του συνεταιρισμού. Τα επόμενα στάδια ολοκληρώνονται απουσία των χονδρεμπόρων και περιλαμβάνουν τον σχεδιασμό παραγωγής βάση των συμφωνιών του σταδίου 2 με τους χονδρεμπόρους.

Codification

Data and representation– user roles affiliations - Boundaries and overrun mechanisms – Ties (bonds) and communities – Digital villages /settlements and traces

Appendix C- Transcript of Interview of interviewee # 4: illustrative coding and conversational patterns (Phase B)

Transcript of Interview of interviewee # 4

Comment: This is a part of a discussion we had with one of our partners, who is our main partner in Germany, the partner who takes the biggest part.

E: This partner is not a retailer, he does not sell directly, he is a wholes

He is a super wholesaler; he sells to other wholesalers who sell to shops and schools. Based on the results of last year, that is what we have sold, if we had problems due to the lack of product or surplus, we can do a plan for the new season.

Q: And you do this by telephone?

No. We meet each other and together we do this stuff. It takes us two days.

keep records about what you do?

ave counted last year s quantities per month. For example, last January we sold 10 tons of cucumber. He told me since it was difficult to sell that entire amount we had to reduce the price. For instance, he tells me instead of 10 tones to have only 8, or the opposite. Or to tell me that we sold 6 tons in a month. C

e that it would b if I had 15 tons.

E: So there is a negotiation.

Yes. There is .

Q: Well, what do you get from the meeting? Do you get a file with notes, for exam need five more in May?

Not only can I write down wh but also, we can both conclude and propose how many tons we may need for a month. This is the f aves. From May until the end of Ju turist and Philip that if German wants these products and these quantities how many acres should be planted and when. Then we conclude all together. For example, we say in order to ensure the «bunch» we will need 10 acres, three of which should be planted in August, the other 2 should be planted in September and in October we will plant others...

Q: Yeah, yeah, okay...

Yes, in order to have this flow.

Q: Thus, both agronomist and Philip have been informed about what to ask from the producers.

Right.

Q: These are said orally and agronomists as well as producers keep notes.

Responsibilities or different roles

Responsibilities or different roles

Issue schedule

Issue price

Collaborative work

Get people involved

Quotes of quantities

proposition

proposition

negotiation

Issue quantity

Cross turn quote

Proposition/ take a decision

Question / answer

take a decision

claim

proposition

claim

Get people to involved

Yes. We write down some notes about this subject. System also supports this operation. For example, we write down 15 acres of cucumber.

Q: Nice. I would like to see how this is recorded in the system.

Yes

Q: To capture the system and see it. Nice.

After I have finished all this... I make all codes and I know what... what I need, for example, I know I need a hundred acres (?), and so on. Then, I meet the producers. We meet first our producers, namely those who give us the 100 % of their product and we tell them: Guys we want these, the one who has lets s... for me put two acres of cucumber, one acre of August brunch, one acre of December tomatoe... down all this info (I will show you) lets say I want ten it comes... you say I will put two; I say... one acre. Thus I need some more to complete them.

Q: You tell me that it is a record of tende... producers.

Yes, in order to join us in the program.

I want to kno... what each one will do and after we have taken the okay I start. When our producers finish the result is not always what we want. For example, sometimes I want ten acres and I have twelve acres to plant thus I inform that I may have problem with these two extra acres. On the other hand, it may be possible to have ... thus I have to look for producers who are willing to plant a specific product in a specific season.

After I have finished I inform the agriculturist about the result, what we wanted but eventually this is the result because some times...

Q: You cannot wait.

Exactly, I cannot wait and sometimes for example I want 10 acres but we plant 12 acres because it is 2 I say no, I will plant this quantity and I will take the risk. Or the opposite I want 10 acres of a product and took only 7.

Q: Is there a priority? For example, you have found the amount of ten, lets say tomatoes, if someone else also plant, and will first 10 have a priority over the last? That is to say, you will not sell ... last?

I give priority to producers who bring the 100% of the product. That is to say...

Q: So you give priority to those you tell them what to plant. Actually you tell them what ... extent.

No, I suggest them and they also express their opinion. I will talk with the producer who brings ... For instance, if you have 4 acres but you give us only the two, while you sell the other two acres ... I will give priority to another producer who gives all his product.

Q: You write down this priority because you know them or is there a kind of record pr... prefer a producer from another.

Get producers involved

Give priority to some producers

Producers accept the invitation

Agreement

Disagreement

Issues

Information about the result

Preference to some producers

Conversation

Price Issue

Preference to some producers

This is our agreement, you know. I cannot based on one producer, there are some producers who also cooperate with other merchants and it is possible to prefer another retailer for some reasons (he may buy more expensive), and I will explain why I do this. Because when we finish this record (what and how many acres one have planted how many acres have grown up to whom I put the acres they wanted, in which codes we had lack) we discuss with the agriculturist about each acre when it will have grown up (for example, Kokarakis has planted re field, in another note I have written down when he planted etc. Finally, we conclude th 42 weeks to produce these quantities.

Attributes of acres

Q: Is this what you expect?

Yes, from this one I expect these from the other one I expect these per week. For example, this one who has planted later he will start also later and so on. Then, I sum them up per week. -I have a lot of this to do.

Q: I need one.

Well, after that, I will sum up all the types, pepper cucumber , etc , then I count a total situation (I will show you this which I send to our partner in Germany) and based on what we wanted, the acres we found and we will plant, we will have such a result , there is the first, because it may happen to need more but not to find, or to find what you like but to have planted an acre more and if you can find a way to sell these amounts.

Q: In order to wait the extra quantity.

Yes exactly. If he cannot, he inform me . If we have a large deficiency he must be informed, namely I sum up the whole season. Then we begin to seed, plant, and check and watch waiting for one to bring.

Issue quantity deficiency

Q: Well I have seen these in Nick harvest program.

Yes

Q: I have seen in the system of Athena that counts the outputs per field, right? So the output per field of previous years.

Discussion

Yes, of course. The new season I use the outputs, which Athena has recorded the previous years, and discuss them with agriculturist. Thus, this will enhance the quality of our stuff.

Claim

Issue weather

Of cours here, we face the problem with the weather, as your father said you before. Because of the change in weather conditions the crop differs from year to year. This is something the system cannot support. Well, every week, I give a report to Germany, that is I sent a general, overall anticipation and every week I send also a report (I will show it to you – what I will send, where I will put it). And a third thing we do is that we try to check every 2 weeks , I say for example , I say here , in field with peppers , we are in week 48 now, I say 50,51,52 week from 48 I try to see how the fields are and it they are normal we will get these quantities. If you have a field suffering from an illness or for instance, due to the good weather the pl nts will flourish. I try to warn German If I have an ill garden that I will supply him with less quantity than th I told him on the fiftieth or fifty-first w

Issue system

narration

Q: In the meantime you can find some producers who did not agree at first.

In this case what I do: if I have a defect then we are lucky because I will bring him immediately. Since I have already a loss. However, if I am normal I inform him that for example, I have told him for a ton but eventually I can send him half a ton above and what does he think about? He thinks and responses accordingly, either he agrees or he insists to sell. In this case, I inform the producer...

Q: Thus the price is not pre agreed?

No never...

Q: Do you define and agree about the price that week, right?

Maybe yes, since they have been working four years, we think the things last year. However this depends on supply and demand of market.

Q: Okay.

We agree about the amounts

Q: I see, okay.

So until the end of the season and then

Q: And we start again.

This was generally what we do to be able to ...

Q: The whole planning, good, thank you!

Temporal boundaries

Sales & Financial agreements with wholesalers abroad

Negotiations

Every year in mid-spring (in May), the cooperative organization BIANAME starts the negotiations about trade agreements with super wholesalers of abroad for orders to be ... eight months (from September to April). The agreements include quantities per product type, delivery flow calendar, prices and product quality categories. Negotiation is a process that takes about two months to be finalized and has several stages:

Different Roles

Temporal boundaries: Durations

Different roles:

- Stage 1: The super wholesaler visits the facilities of BIANAME where initial discussions are made. Discussions look like team sessions. The team is comprised of the president and the director of the BIANAME and super wholesaler. The main artifacts involved are excel files that have data on the agreements of previous years regarding quantities, types of products, prices, delivery flow etc. Adjuvants are used and other artifacts like emails, mobiles, images etc. On the sidelines of the sessions super wholesaler visits and other facilities of the cooperative as the nursery, greenhouses, the packaging etc. The visit lasts about a week and includes the following:

Artifacts

Temporal boundaries: Durations

o Analysis of last year cooperation,

- delivery flow: what went well and must maintain the procedure, whether there were deviations from agreements, what were the reasons that led to them and how they can be avoided next year,
- supply volumes: whether they were sufficient, required fewer or more quantities from what kind and when,
- consumer reviews: the consumer' comments about quality, type, price and availability.
- prices: were the prices at good level from both sides, which will range for next year, which months did the organization achieve better prices and how to promote greater quantities of these months to maximize profit

o Determination of next year order:

- delivery flow: what will be the flow delivery, per month and per type
- Delivery quantities: What is the delivery quantities, per month and per type
- prices: what will be the price, per month and per type.

Set issues

• **Step 2:** In this stage an initial plan to order product types, quantities, and delivery flow rates is determined which will be finalized later (40 days later) and more specifically when the next use case "Production Planning agreements basis with wholesalers" will have been completed. The reason for this is because the quantities, types of products and the delivery flow are intrinsically linked to the cultivation and production planning. At this point, the first stages of the economic negotiations, which represent approximately 80% of the cooperative's turnover, with wholesalers abroad, are completed. The next steps are completed absence of wholesalers and include the production design based on the agreements of stage 2 with wholesalers.

Temporal boundaries: Durations