



OPAALS PROJECT

Contract n° IST-034824

WP10: Sustainable Research Community Building in the Open Knowledge Space

**Del10.9 - Self-reflection of community
building, communication and collaboration
processes in the NoE**



Project funded by the European
Community under the "Information Society
Technology" Programme

Contract Number: IST-034824

Project Acronym: OPAALS

Deliverable N°: 10.9

Due date: Month 36

Delivery Date: 24th June 2009

Short Description:

This deliverable presents results from a self-reflective trend study (comprised of a survey trend study and a content analysis) and contributions to the community that were conducted under the umbrella of T10.9 “Applied fieldwork-methodologies” and in WP6.

It offers an “empirical” view on the emergence of the OPAALS community, its communication and collaboration processes, the differences between several subgroups, and their development from the beginning to the end of phase 2 of the project.

The second focus of the deliverable is to arrive at a set of recommendations for sustainable community building and self-governance that are based on the research results.

Authors: Marco Bräuer, Ingmar Steinicke, Frauke Zeller

Partners contributed: -

Made available to: Public

Versioning

Version	Date	Name, organization
V1	06.05.2009	Marco Bräuer, Ingmar Steinicke & Frauke Zeller (UniKassel)
V2	14.05.2009	Marco Bräuer, Ingmar Steinicke & Frauke Zeller (UniKassel)
V3	26.05.2009	Marco Bräuer, Ingmar Steinicke & Frauke Zeller (UniKassel)
V4	02.06.2009	Marco Bräuer, Ingmar Steinicke & Frauke Zeller (UniKassel)
V5	19.06.2009	Marco Bräuer, Ingmar Steinicke & Frauke Zeller (UniKassel)

Quality check

Internal Reviewers: Mehita Iqani (LSE), Francesco Botto (CN)

Dependencies:

Achievements*	<ul style="list-style-type: none"> • Development of a research design enabling to study a geographically dispersed research community • Implementation of a trend survey study and a content analysis (OPAALS as object of self-reflective research) • Initiation of further research projects in order to strengthen OPAALS research (with WP6 and WP10) • Dissemination of research results to the community in order to foster self-reflection • Development of recommendations for the further development of the OPAALS community • Methodological support for the specific requirements gathering and user-test of the OKS (Sironta & Guigoh)
Work Packages	<p>Phase 2 Contributions:</p> <ul style="list-style-type: none"> • WP 3: Provision of data drawn from the survey trend study • WP 6: Joint analysis of the associations from the survey study. • WP 9: Data analysis concerning the multi-disciplinary character of the community and the establishment of a group identity. Those data were used in D9.7. • WP 10: Collaboration with the T10.11 research team in order to conduct social network analysis on the emergence of inter-institutional collaboration networks. • ICT (Integration and Coordination Team): OKS Specific requirements gathering and user-test • All Work Packages: Provision of data drawn from the survey trend study <p>Contributions for Phase 3:</p> <ul style="list-style-type: none"> • WP 6: Content analysis codebook and mailing list-archive serve as one basis for further research on the evolution of an OPAALS-specific language • WP 10: Methodological experiences are the basis for OKS usability research • Whole community: Recommendations for sustainable community building
Partners	All partners and researchers due to the self-reflection character of the task; more specifically the ICT (Integration and Coordination Team)
Domains	Social science domain in terms of theory, methodology, and data analysis
Targets	All domains; The main target are OPAALS researchers and all researchers involved in virtual research teams
Publications*	Bräuer, M., Crone, A., Dürrenberg, C., & Zeller, F. (2008). Governance in the OPAALS community. In O. Nykänen, J. Huhtamäki, J. Salonen, S. Pohjolainen & K. Silius (Eds.), <i>Proceedings of the 2nd International OPAALS Conference on</i>

	<p><i>Digital Ecosystems: OPAALS 2008</i> (pp. 28-36). Tampere: Hypermedia laboratory at the Tampere University of Technology.</p> <p>Bräuer, M., Crone, A., Dürrenberg, C., Lapteva, O., & Zeller, F. (2008). Appropriateness of communication and collaboration tools in an international virtual research community. In O. Nykänen, J. Huhtamäki, J. Salonen, S. Pohjolainen & K. Silius (Eds.), <i>Proceedings of the 2nd International OPAALS Conference on Digital Ecosystems: OPAALS 2008</i> (pp. 22-27). Tampere: Hypermedia laboratory at the Tampere University of Technology.</p> <p>Bräuer, M., Steinicke, I. & Zeller, F. <i>Virtual research teams – theorising on cultures, scientific domains, and the choice of digital media technologies</i>. Abstract submitted to: Digital Media Technologies Revisited: Theorising social relations. Berlin, Nov. 20-21, 2009.</p>
PhD Students*	<p>Marco Bräuer, media and communication science</p> <p>Hagen Peukert, linguistics</p> <p>Oxana Lapteva, linguistics</p> <p>Ingmar Steinicke, computer and communication science</p>
Outstanding features*	<ul style="list-style-type: none"> • Concrete recommendations for sustainable online community building based on empirical data • Additional empirical evidence for domain and cultural differences in working practice
Disciplinary domains of authors*	<p>Marco Bräuer (German Diplom, equivalent to MA in Media and Communication Studies), PhD student</p> <p>Ingmar Steinicke (BSc in Media & Information Technology and MA in Communication Research), PhD student</p> <p>Frauke Zeller (Social Sciences, Linguistics)</p>

The information marked with an asterisk () is provided in order to address Recommendation n. 4 from the Year 2 review report*



This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License. To view a copy of this license, visit : <http://creativecommons.org/licenses/by-nc-sa/3.0/> or send a letter to Creative Commons, 543 Howard Street, 5th Floor, San Francisco, California, 94105, USA.

EXECUTIVE SUMMARY

The OPAALS community represents a “Mode 2”¹ knowledge community: Knowledge in OPAALS is produced in the context of application (contributing to the emerging field of Digital Ecosystems by establishing within it a sustainable research community). Furthermore, knowledge in OPAALS cuts across disciplinary borders and the whole community is composed of members with a huge variety of skills, professions, and scientific domains. Indeed, OPAALS is trying to go beyond common disciplinary boundaries so as to give rise to a new domain. This demanding vision calls for an extremely reflective way of knowledge production.

This deliverable presents results from a self-reflective study (comprising of a survey trend study and a content analysis of the OPAALS-all mailing list) and contributions to the community that were conducted under the umbrella of T10.9 “Applied fieldwork-methodologies”. It offers an empirically based view on the emergence of the OPAALS community, its communication and collaboration processes, the differences between several subgroups, and the development from the beginning to the end of phase 2 of the project. The second focus of the deliverable is to arrive at a set of recommendations for sustainable community building and self-governance that are based on the research results.

The analysis of the survey trend study and the email-list revealed several differences with regard to media choice, perception of governance issues and indicators for a sustainable community building between several subgroups in the OPAALS community.

As our analysis showed there are some issues which need to be coped with so as to ensure a sustainable community building. Other indicators (e.g. English language usage, interaction density in general, emerging of a shared understanding regarding particular concepts) already move towards the desired direction.

As main recommendations we suggest to provide

- A well elaborated communication etiquette and
- an overview of available email lists to improve the collaboration processes.
- The governance could be improved through more efforts to develop a shared role understanding.
- OPAALS should consider to develop a concrete community enlargement strategy for research partners and SMEs, and
- develop policies that concern the joining and leaving of the community, the access to resources, and the usage of the OKS to ensure sustainable community.

The recommendations that could be drawn from the data analysis will be disseminated to the whole community in order to initiate a discussion process on the further development of OPAALS.

¹ A definition of Mode2 knowledge production is provided in chapter 1 (Introduction).

INDEX

1	INTRODUCTION	1
1.1	AIM OF THE DELIVERABLE	2
1.2	STRUCTURE OF THE DELIVERABLE	2
2	THEORETICAL BACKGROUND.....	3
2.1	THEORETICAL PERSPECTIVES ON OPAALS AS A KNOWLEDGE PRODUCING COMMUNITY	4
2.2	INDEPENDENT VARIABLES.....	5
2.2.1	Age.....	5
2.2.2	Sex	5
2.2.3	Domain background	6
2.2.4	Cultural impact.....	6
2.3	DEPENDENT VARIABLES	7
2.3.1	Governance in dispersed projects	8
2.3.2	Media choice	8
2.3.3	Community building	11
2.4	AGENDA FOR COORDINATION AND SELF-REFLECTIVE RESEARCH	12
2.4.1	Some notes on Action Research and Self-Reflection.....	12
2.4.2	A Framework for Coordination: Network Action Research	14
3	RESEARCH QUESTIONS AND METHODOLOGY.....	16
3.1	TREND STUDY	16
3.2	MAILING LIST ANALYSIS.....	18
4	RESULTS AND OUTCOME.....	20
4.1	RESULTS FROM THE OPAALS TREND STUDY	20
4.1.1	Sample and Descriptives	20
4.1.2	National cultures in OPAALS.....	21
4.1.3	Topics of Work in OPAALS	24
4.1.4	Information Sources and Sources for Scientific Exchange.....	26
4.1.5	Appropriateness of collaboration tools for the work in OPAALS	28
4.1.6	Professional and informal interaction.....	36
4.1.7	Number and intensity of contacts	42
4.1.8	Decision making	47
4.1.9	Role understanding.....	49
4.1.10	Associations.....	50
4.1.11	Language Usage.....	52
4.2	DYNAMICS AND DIRECTIONS OF THE OPAALS-ALL LIST – A CONTENT ANALYSIS.....	54
4.2.1	Sender Characteristics	54
4.2.2	Message Characteristics.....	55
4.2.3	Summary and notes from observations	58
4.3	COORDINATION ACTIVITIES	59
4.3.1	Dissemination of information to the OPAALS community	59
4.3.2	Initiation of a Social Network Analysis Working Group and a Data-Mining Working Group.....	60
4.3.3	Participation in the P2P & Social Networks Chats.....	60
4.3.4	Design of a Wiki Template for Introducing Research Projects	60
4.3.5	Data input and exchange with other Tasks/WorkPackages.....	61
4.3.6	Specific Requirements Gathering and testing of the OKS	61
5	DISCUSSION AND RECOMMENDATIONS.....	64
5.1	COLLABORATION.....	64
5.2	GOVERNANCE.....	66
5.3	COMMUNITY BUILDING	67
5.4	APPLIED FIELDWORK METHODOLOGIES – LESSONS LEARNED FROM T10.9.....	68
5.5	FUTURE PROSPECTS	68
6	REFERENCES	70

INDEX OF FIGURES

Figure 1	Independent and dependent variables of analysis.....	5
Figure 2	Wave 2: Self perception of professional/informal interaction (grouped by IDV)	41
Figure 3	Wave 3: Self perception of professional/informal interaction (grouped by IDV)	41
Figure 4	Wave 4: Self perception of professional/informal interaction (grouped by IDV)	41
Figure 5	Informal interaction with your task group members.....	42
Figure 6	Informal interaction with the OPAALS members of your institution.....	42
Figure 7	Professional interaction with the members of the entire OPAALS community (IDV).....	42
Figure 8	Professional interaction with the members of the entire OPAALS community (MAS)	42
Figure 9	Number of contacts for professional interaction (grouped by domain)	46
Figure 10	Mean intensity of contacts for professional interaction (grouped by sex)	46
Figure 11	Histogram for number of contacts for professional communication.....	47
Figure 12	Development of perception of decision making process in OPAALS (low MAS).....	48
Figure 13	Development of perception of decision making process in OPAALS (high MAS)	48
Figure 14	Evolution of the five most mentioned association clusters for the term <i>collaboration</i>	51
Figure 15	Evolution of the five most mentioned association clusters for the term <i>OKS</i>	52
Figure 16	Evolution of the five most mentioned association clusters for the term <i>community</i>	52
Figure 17	Relevance of email topics in the all-list.....	56
Figure 18	Overview of threads in the OPAALS-all mailing list.....	58
Figure 19	Overview of coordination and collaboration activities of T10.9	59

INDEX OF TABLES

Table 1	Message Equivocality/Media Richness Matching Framework for Communication Effectiveness .	10
Table 2	Dimensions of analysis	16
Table 3	The four waves of the trend study	17
Table 4	Overview of the waves of the survey.....	20
Table 5	Descriptive data of the survey waves	21
Table 6	Grouping for Power Distance Index (PDI)	22
Table 7	Grouping for Individualism Index (IDV)	22
Table 8	Grouping for Masculinity Index (MAS).....	23
Table 9	Grouping for Masculinity Index, controlled for percentage of women (MAS2)	23
Table 10	Grouping for Uncertainty Avoidance Index (UAI).....	23
Table 11	Management of the work package task(s)	24
Table 12	Getting to know and staying in touch with collaborators	25
Table 13	Work on work package tasks and/or deliverables.....	25
Table 14	Creating and discussing new ideas with collaborators.....	25
Table 15	Dissemination of information to the OPAALS community.....	26
Table 16	Information Sources	27
Table 17	Sources for scientific exchange	28
Table 18	Appropriateness of tools in OPAALS (ranked, wave 1).....	29
Table 19	Appropriateness of tools for work outside OPAALS (ranked, wave 1).....	30
Table 20	Appropriateness of collaboration tools for the management of work package tasks	31
Table 21	Getting to know and staying in touch with collaborators	32
Table 22	Work on work package tasks and/or deliverables.....	33
Table 23	Appropriateness of creating and discussing new ideas with collaborators	34
Table 24	Appropriateness of dissemination of information to the community.....	35
Table 25	Professional interaction with members of the task group	37
Table 26	Professional interaction with members of the same institution	38
Table 27	Professional interaction with members of the entire OPAALS community	38
Table 28	Informal interaction with members of the task group	39
Table 29	Informal interaction with OPAALS members of the same institution	39
Table 30	Informal interaction with members of the entire OPAALS community	40
Table 31	Scale for rating intensity of professional interaction with OPAALS partners	43
Table 32	Number of contacts with 'less frequent' interaction	44
Table 33	Number of contacts for professional interaction.....	45
Table 34	Mean intensity index of contacts for professional interaction	46
Table 35	Decision making	48
Table 36	Role Understanding	50
Table 37	Relevance of English language compared to native language in wave 4.....	53
Table 38	Development of language usage	53
Table 39	Intercoder reliability coefficients.....	54
Table 40	List of threads in the OPAALS all-mailing list	57
Table 41	Relation of participants rating "Version control" in respect to their experience.....	62

1 INTRODUCTION

The traditional mode of knowledge production organised according to disciplinary boundaries is fundamentally changing (see Gibbons et al., 1994). For more than 15 years, a new mode of knowledge production coined as “Mode 2” has been emerging. Not only the character of knowledge production, but also knowledge validation and dissemination are transforming. The OPAALS-NoE can be seen to represent a Mode 2 knowledge community as knowledge in OPAALS is produced in the context of application (contributing to the emerging field of Digital Ecosystems by establishing within it a sustainable research community). Furthermore, knowledge in OPAALS cuts across disciplinary borders and the whole community is composed of members with a huge variety of skills, professions, and scientific domains. Along with these characteristics, OPAALS prefers flatter hierarchies (in contrast to the classical division into departments and research institutions), and transient organisational structures. Thus, researchers with very different disciplinary backgrounds collaborate on joint tasks. Indeed, OPAALS is trying to go beyond common disciplinary boundaries so as to give rise to a new domain (DoW, p. 33). This demanding vision calls for an extremely reflective mode of knowledge production. The importance of reflectivity is highlighted in the projects’ DoW:

“To support the formation of a sustainable research community as well as a smooth merging of its methodologies with the innovation dynamics of SME networks, therefore, the OPAALS project itself can serve as a very good object of its own research.” (DoW, p. 34)

Deliverable 6.1 refined this definition of reflectivity:

“Reflection is an active process through which we curiously witness our own experience and take a closer look at it and explore it in depth. The key issue of the reflective process is the observation of one's own actions, experiences, ideas, knowledge and to examine them through a critical lens. The ability to explore and be sceptical to some extent opens to the community members the new dimension of research and knowledge production. In this context, we also introduce the notion of reflectivity as an application of the OPAALS research questions to the community itself. From this perspective, we have the ability to see people in two different situations, as developers (designers and/or researchers) and as users (and / or object of research). This allow us to gain the results and to learn through experience.” (D6.1, p. 36)

We strongly support the idea that the success of OPAALS depends – besides its academic rigour and its focus on applicability – to a significant degree on its ability to establish sustainable channels of reflectivity. Reflectivity can be regarded as a responsibility of any community member and as a specific task for the whole project.

The multi-institutional, geographically dispersed, multi-domain, multi-professional and multi-cultural composition of the community have led to a challenging situation. All those factors influence community building, communication, and collaboration processes. Self-reflection on the level of every-day tasks is an important way to address these challenges, as it is this kind of awareness that is needed for the negotiations in relation to cooperation. In addition, there is another important aspect concerning self-reflection at a meta-level: If a community aspires to merging domains and to developing a new domain, self-reflection about epistemological assumptions is getting very important. Whereas the latter was already tackled in task 10.6

"Epistemological basis for OPAALS' interdisciplinary research"² and also in D6.1 and D12.1 (pp. 55-73), the former issue represents the major content of this deliverable.

1.1 Aim of the deliverable

This deliverable presents results from a self-reflective study and contributions to the community that were conducted under the umbrella of task 10.9 "Applied fieldwork-methodologies".

"Applied" means that we do not only review methodologies for the research on knowledge communities. One of the major responsibilities of the task was to conduct research on OPAALS. Hence, one aim of the deliverable is to present an empirically based description of the emergence of the OPAALS community, its communication and collaboration processes, the differences between several subgroups and the development from the beginning to the end of phase 2 of the project. The second focus of the task was to support research activities of other tasks and to provide some points of orientation. From those two foci, the deliverable aims at presenting a comprehensive set of recommendations for the community to improve its collaboration effectiveness, and sustainability of the NoE. Those recommendations are also published for the community at the special wiki page where they can be discussed.

1.2 Structure of the deliverable

The deliverable starts with a short summary of research on knowledge communities and the context of OPAALS. The theoretical chapter 2 is intended to introduce our view on the research on OPAALS: In chapter 2.2 we present a set of crucial independent variables. We argue that those variables are important to keep in mind when dealing with the building of a community as they represent the key explanatory factors for possible differences in community building, collaboration and communication processes in different groups. Chapter 2.3 introduces the important dependent variables, those dimensions which are at the focus of our analysis: media choice, community building, and governance. As the research team did not look at the OPAALS community "from outside" and the researchers are indeed part of OPAALS, chapter 2.4 addresses the issue of how research and practice, action and reflection can be combined and how the research efforts of our task are actually informing practices within OPAALS. After having provided the theoretical ground and framework for our analysis, chapter 3 introduces our guiding research questions and introduces the methodology we applied for our research. Chapter 4 is completely dedicated to present our major research analysis' results as well as a report of the coordination and dissemination activities done in task 10.9. The deliverable ends with a comprehensive discussion of our research results and the development of concrete recommendations for the further development of OPAALS with respect to a sustainable community.

² Two milestone reports are the result of task 10.6: Crone & Bräuer (2007) and Crone & Bräuer (2008). Task 10.6 can be seen to have laid the epistemological foundations as well as the basis in terms of philosophy of science for the work on task 10.9 and this deliverable.

2 THEORETICAL BACKGROUND

Researchers and theorists of computer-mediated communication (CMC) usually claim that computer-mediated communication has significant effects on social relations. Some authors (Kollock & Smith, 1996; Stegbauer & Rausch, 2006) claim that such technology-mediated and new forms of social interaction would evoke wider participation and traditional status would not play a significant role (when compared to face-to-face communication). As a result, hierarchies would decrease and would become flatter and more egalitarian. More inclusive and participatory communication and collaboration patterns would emerge, and hence more democratic organisations. In the field of science, typical motivations to use CMC would be the exchange of information and the building of new contacts. Furthermore hierarchical centre-periphery relations would diminish. As a consequence, a "socially distributed knowledge production system" (Gibbons, 1994) is said to be emerging. However, critical voices warn of a techno-optimistic attitude and rather suggest that social relations would remain in even more challenging forms (Kollock & Smith, 1996). Besides, there is empirical evidence that Mode 2 knowledge production faces challenges and even dangers. Stegbauer & Rausch (2006) claim that there is still too little research in that field in order to provide a more substantiated picture.

It is beyond the scope and the aim of this deliverable to introduce all theoretical approaches relevant to the study of online-collaboration. However, we would like to consider within their larger context those areas of research within which this deliverable and the work on task 10.9 is located. It is for this reason that we both address some of the major concepts and make explicit relations where OPAALS has already dealt with those issues.

When it comes to deal with the technology-induced changes in the science field, the notions of "e-science", "cyberscience", and "collaboratories" are of help (for a short introduction see OPAALS D10.5). In addition, the field of the "open-source" communities was studied as the open source movement can be regarded as a socially distributed knowledge production system (see OPAALS Deliverables D8.1, D8.2, and D8.3). Those deliverables provide important knowledge about the context of the OPAALS NoE. The work conducted in this task (10.9) and hence this deliverable is strongly based on the comprehensive report on the discourse organisation in epistemic cultures (D6.1). D6.1 allowed us to develop the research design and by means of the proposed socio-linguistic framework provided us with dimensions of analysis that were reframed in this task. Furthermore, when it comes to analyse differences between epistemic cultures, D6.1 serves as an appropriate basis. This deliverable also explicitly builds on the discussion concerning knowledge communities of D10.5.

At a more theoretical level, M10.7 and M10.11 informed our research with the discussion of epistemological issues important to establish interdisciplinary research. At a more pragmatic level, since multi-institutional and multi-disciplinary research need to connect with the wider research communities, dissemination can be regarded as a main effort. In turn a group identity and a corporate branding can stimulate the research in a locally dispersed community (D9.7 and D9.9).

In this chapter we will provide some theoretical perspectives on the nature of OPAALS, on the basis of which we will then deduce the independent and dependent variables that structured our empirical analysis of the development of OPAALS and its inherent differences.

2.1 Theoretical perspectives on OPAALS as a knowledge producing community

Before analysing an object of interest, it is necessary to get an understanding of the general nature of the object. This understanding will embed the object within a specific context and will also frame its relevance beyond the object itself. As OPAALS is per definition a group of people who collaborate to generate knowledge about digital ecosystems we will start from this point in order to get some theoretical perspectives on our research object:

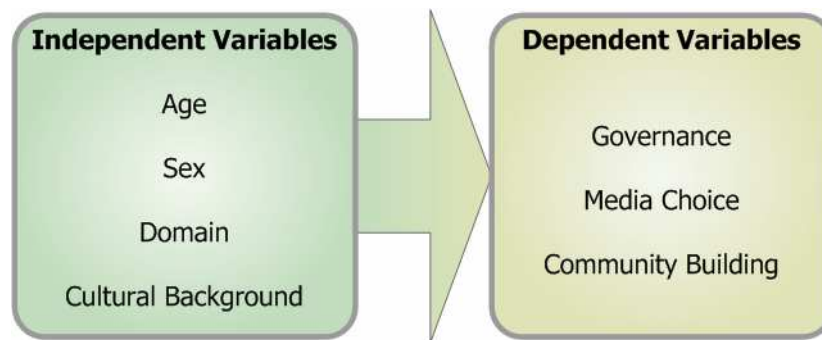
OPAALS can firstly be regarded as a **virtual team**. A virtual team can be characterised by three features: (1) geographical dispersion, (2) the general use of CMC is more widespread than face-to-face communication, and (3) team members are working on interdependent tasks on the basis of joint aims (Schiller & Mandviwalla, 2007, p. 13). This approach is sensible when it comes to emphasise and study the critical role of ICT for the projects' success. However, there is still no substantial theoretical progress on the study of virtual teams, which makes the choice of appropriate theories for developing research questions and hypotheses quite hard (Schiller & Mandviwalla, 2007).

OPAALS can also be seen to represent a **community of practice** (CoP). According to Wenger, communities of practice are groups whose members engage in sharing and learning on the basis of a shared domain of interest. Communities of practice have a shared repertoire of resources, experiences, stories, and tools, all of which establish a shared practice. This practice is developed through activities such as problem solving, information sharing, discussing recent developments, the documentation of projects, visits, and the mapping of knowledge and identification of gaps (Wenger, n.d., 2f.). What is particularly significant for the case of OPAALS, is the fact that CoPs are open for anyone who shares a concern or a passion for a specific topic, i.e. researchers and practitioners. This makes sense especially when it comes to reflect the integration of SMEs in OPAALS (see also OPAALS D6.1, p. 38f. and D10.5, p. 18f.).

A more general theoretical perspective offers to regard OPAALS as **complex-adaptive system**. Mehita Iqani and Francesco Botto (2009) regard the OPAALS' agents as researchers and research institutions. Those agents are "multiple and semi-autonomous, working independently on elements of research tasks" (p. 11). With a striking similarity to the CoP concept, agents must act with commonly agreed-upon rules, which constitute the environment within which agents act" (p.11). The outcomes of OPAALS and its complex adaptive system may be surprising. Research results cannot be pre-determined. The research process can be characterised by non-linearity and unpredictability. However, the level of surprise has its limitations in their task to evolve towards fitness and goals. All those processes are self-organising and autopoietic (see D 12.1 for a more comprehensive account on CAS and its applicability for OPAALS).

So far about the theoretical conceptualisations of OPAALS, in the next two subchapters we will introduce important dimensions for the empirical study of OPAALS as an object of research. This analytical framework is guided by theories of media choice, of epistemic cultures, and of differences in national cultures. In the following section we will provide a short summary on how individual, domain-based, and cultural variables may influence working practices and as well as the major dimensions for analysis.

Figure 1 Independent and dependent variables of analysis



2.2 Independent Variables

Considering that people are at the heart of OPAALS, their characteristics exert significant influence on the development of the NoE. During the next few pages we want to discuss the aspects we assume to be of high relevance as their variance in OPAALS is expected to be higher. These aspects are the independent variables, which guided our analysis of the NoE.

2.2.1 Age

Empirical studies have often revealed the existence of a so-called digital divide which points to the fact that elderly people are less familiar with digital media and as a result less likely to be users of digital media than younger people. Although all OPAALS members need to be users of digital media and hence need to be familiar with digital media to a certain extent, age diversity still could lead to different perceptions and usage profiles of digital media and communication. Since the number of OPAALS members beyond 40 is relatively small, a sufficient comparison of different age groups won't be possible.

2.2.2 Sex

Statistical analyses suggest that gender disparities in the number of internet users have disappeared in the United States (Ono & Zavodny, 2007, 2003) and have diminished considerably e.g. in Germany (Van Eimeren & Frees, 2008). Even though gender disparities among internet users have disappeared in some countries, we assume that men are still more likely to use the internet than women in many other countries. Moreover, and more important in our case, even if there are no differences in the number of users, there can be differences in the way the internet is used. Hargittai and Hinnant (2008) discuss these differences under the term "second-level digital divide" which is caused by differences in computer literacy and online fluency. The results of their study showed that "women [of the sample of 18- to 26-year-old American adults] are less likely to claim knowledge about online terminology and features, and those who use the Web infrequently also report lower levels of know-how about it" (Hargittai & Hinnant, 2008, p. 617). Although these differences can also be caused by higher modesty of women's skills, it might simply indicate lower skills. In fact we do not expect our female partners to have lower skills because they have the same educational background. However, the analysis of differences caused by sex makes sense because it is possible that men have different working styles and therefore different approaches towards CMC than women. This is not to say that those differences are in any way offending to one group. However, if our research reveals any differences, they would

need to be addressed by governance procedures. This is the reason why we would argue that differences may be important to analyse.

2.2.3 Domain background

What is most likely to constitute as the core influence in OPAALS NoE is the professional background: the OPAALS members work in different domains which may lead to different work practices. Domains can be regarded to represent own forms of knowledge production and knowledge utilisation. Individuals are integrated in those traditions and become part of them, which means that they adopt typical communication and collaboration styles (see D6.1, pp. 32-39).

Previous analyses of the appropriateness of collaboration tools within OPAALS already showed that there are significant differences concerning the appropriateness of phone/internet phone between social scientists and computer scientists regarding certain tasks (Bräuer et al., 2008, p. 4). It is now the question whether this variable reveals also differences in other contexts.

2.2.4 Cultural impact

When members come from four continents in order to create an international research network, cultural diversity can have considerable effects upon media choice, community building, communication, and collaboration. Cultural differences may influence the perceived needs of discussing ideas, disseminating information as well as other tasks.

Analysing cultural imprints and their influence on values, behaviours, institutions and organisations is mainly based on Hofstede's momentous IBM study from 1981 and its revision from 2001. Using Hofstede's dimensions for the analysis of OPAALS is useful in three aspects: 1. All participants of Hofstede's study were employees of IBM. Both, the OPAALS NoE and IBM are organisations wherein people joined basically for professional reasons and in order to share a common goal. So the context of both objects of research is similar: organisational and work-related. 2. Countries of Hofstede's survey coincide quite well with the countries where OPAALS' members come from. Thus most national cultures of OPAALS members can be described with regard to Hofstede's results and can be included in our analysis. 3. In an experiment conducted by Hichang & Jae-Shin (2008), the researchers also used the IBM survey as a reference for their cultural analysis. Using Hofstede in our analysis will make it possible to compare their findings with ours.

In the following the five indices adduced by Hofstede for describing several aspects of national cultures will be introduced:

The first index is called Power Distance Index (PDI) and expresses the social handling of human inequality especially with regard to hierarchy. As OPAALS is a network with a relatively flat hierarchy and fostered interaction between all members through all hierarchy levels the PDI might explain differences in interaction behaviour caused by differences in the PDI from the cultural background of the interacting members.

The second index – Uncertainty Avoidance Index (UAI) – describes the handling of the uncertainty of future which can lead to concrete measures, traditions, rules, and rituals to escape from ambiguity. It is "the extent to which the members of a culture feel threatened by uncertain or unknown situations" (Hofstede, 2001, p. 161). In case the rules within OPAALS are perceived as vague this could conflict with the members' needs of clear rules when they come from a culture with high UAI.

Although there are not too many studies investigating the interdependencies of communication and cultural background, one study conducted by Hichang & Jae-Shin (2008) showed that the task of information seeking is accomplished differently depending on people's cultural conditioning. The authors used the differences in individualism (IDV, Hofstede's third index) between US and Singapore to explain their findings. In the experiment they conducted students from two national cultures were split into three groups: two Singaporean and one US-American group. The students' task was to write a review about a new technology and to afterwards comment upon reviews by other participants. While American students also commented upon reviews by Singaporean students, none of those commented upon items written by American students. These differences³ indicate that individuals from collectivistic societies (low IDV) "are less inclined to seek out information from someone outside of their social boundaries" (Hichang & Jae-Shin, 2008, p. 564). People from collectivist cultures define themselves more about the in-group they belong to. Usually the smallest unit of self-consciousness is the family in collectivist cultures and the individual in individualist cultures. In a collectivist society trust is mainly established through the belonging of the same in-group. For collaboration this leads to the fact that "in the collectivist society *the personal relationship prevails over the task and over the company* and should be established first; in the individualist society, in contrast, *the task and the company are supposed to prevail over any personal relationships*." (Hofstede, 2001, p. 239).

Masculinity (MAS), Hofstede's fourth index, considers the so called masculine (ego enhancement) and feminine (relationship enhancement) work goals. Moreover "masculinity stands for a society in which social gender roles are clearly distinct [...]. Femininity stands for a society in which social gender roles overlap [...]." (Hofstede, 2001, p. 297). An individual can be either masculine or feminine, but when it comes to the level of analysis concerning the country, a culture can be seen as being either predominantly masculine or feminine. This means that there are more people with masculine values like being assertive, tough, and focused on material success or more people with feminine values like being modest, tender, and concerned with the quality of life (Hofstede, 2001).

A fifth dimension – Long- versus short-term orientation (LTO) – based on a survey conducted by Chinese researchers, was added to Hofstede's framework when it became obvious that the first study was conducted under a "cultural bias in researcher's mind" (Hofstede, 2001, p. 351). The Chinese study discovered a new dimension which does not correlate with the other dimensions. It tends towards Confucian philosophy and describes the focus on virtues oriented towards past and present (low LTO) or on future benefits (high LTO).

For our community and work, each cultural dimension could have impacts on people's behaviour as the variance of the indices within OPAALS is quite high.

2.3 Dependent variables

The aforementioned factors may influence the collaboration, communication, and community building processes in OPAALS. This is the reason why the governance of all processes within OPAALS should not be considered as a static variable to be defined by the legal, financial and political constraints. On the contrary, it is important that all governance measures

³ These findings also point to the fact that more research is needed to investigate the cultural impacts on CMC. Many theories about CMC were culturally biased in that they were only based upon studies conducted in North America and Western Europe.

respect differences and trends to evolve a successful adaptive self-governance of collaboration, communication and community building. Because of the high dispersion of OPAALS' members, most collaboration between members from different organisations will be mediated, which is why we want to focus on media choice for initiating collaboration processes. Communication in turn is the core process of all organisations; it is inherent in all collaborative processes which includes community building measures as well.

2.3.1 Governance in dispersed projects

As shown in D12.2 the field of governance research covers a wide range from political science to economics and information technology (Darking, 2008). As the majority of the NoE's members are from different universities, the governance of OPAALS is one of the core issues. In principle, governance means the establishment of relationships between different social groups and the decision making processes by which responsibilities are established (Darking, 2007, p. 80). Hence, governance can be regarded to represent a core dimension of a community or a network. The challenge is to manage the required high level of independence of scientific work in contrast to the expected structure and plan fulfilment imposed by external stakeholders like governments or companies who provide the necessary monetary support (Bräuer et al., 2008b).

With governance both sensitivity and stringency are needed. The sensitivity of governance is meant to provide the necessary freedom without resulting in trouble, ineffective redundancies, or distractions. The sustaining and effective freedom can only be achieved when being able to detect upcoming problems as soon as possible and to induce measures respecting institutional, cultural, professional and individual differences within the community. The stringency of governance emerges within concrete work packages based on a four-year plan. This schedule frames the scientific autonomy and steers it to specific results which constrain the scientific freedom. To fulfil this ambivalent governance task, it is very important to be aware of existing and potential differences between several NoE subgroups. Otherwise several problems might occur which counteract a successful governance. Cummings & Kiesler (2007, p. 7) summarize these problems as follows:

"[...] projects with investigators at different universities are likely to have more difficulty fostering a collegial social environment, building common ground, maintaining awareness of what others are doing, attending to the project, and making rapid adjustments to surprises. [...] Advances in communication and computer technology represent opportunities to collaborate in new ways, but for purposes of coordination, technology is an imperfect substitute for collocation. In studies of business and research projects with dispersed members, researchers have discovered project delays, misunderstandings, institutional rivalries, free riding, distractions from local institutional priorities, inconsistent procedures across institutions, and failures to share information."

The governance in OPAALS not only determines financial and structural conditions, but it also affects media choice and community building processes.

2.3.2 Media choice

Media choice in organisational settings plays a crucial role for the success of the organisation. However, media choice tends not to be consciously reflected and often the appropriate choice of communication channels is taken for granted. The questions why people use specific applications fitting their needs is studied by communication researchers.

However, before introducing those important concepts, we would like to explain why it is important to study media choice in OPAALS.

OPAALS is trying to achieve an "interdisciplinary" dialogue. The research on epistemic cultures reveals that there are quite different communication patterns in different scientific domains. In the case of OPAALS, such different habits give rise to a challenging situation. An appropriate choice of media is essential, even though ideas on what media are appropriate may considerably differ. Since this situation may cause subtle tensions and misunderstandings (see also Bräuer et al., 2008), the latter needs to be addressed by the self-governance of the project.

Most communication in OPAALS inevitably takes place in a computer-mediated communication setting, which is why a major focus of this deliverable is on CMC. Survey data can be used in order to develop self-governance strategies of how to handle the balance of CMC-communication and F2F-communication. Furthermore, research on media choice can also inform the development and adoption-processes of the OKS.

In order to be able to do research on those issues, theories are needed that explain why people choose specific media in order to perform specific tasks.

The main idea of media choice theories lies in the assumption that effective media choice means choosing a medium that is compatible with the task that needs to be done (Bouwman, van den Hooff, van de Wijngaert & van Dijk, 2005, p. 96). There are two basic theories that help to explain the relationships between the characteristics of a medium and the corresponding communication activities. **Social presence theory** assumes that a medium creates a kind of social presence of the partners involved in the communication act by its ability to convey verbal and nonverbal cues. Such cues are usually perceived to be important for interpersonal communication. Media vary in the degree they are able to evoke the perceived proximity of the communication partner. This social presence is conveyed by non-verbal signals, proximity, and physical appearance (Short, Williams & Christie, 1976). A higher degree of social presence enhances the social aspect of communication. As a consequence, face-to-face communication always seems to provide the best communication. However, there are many situations in which we would intuitively accept that writing an email, for example, fits the needs of a specific communicative situation. It is therefore not surprising that social presence theories are not well supported empirically (Bouwman, van den Hooff, van de Wijngaert & van Dijk, 2005, p. 96). Taking this point of criticism into account, **media richness theory** postulates that different communicative requirements call for different media choices. Organisational participants are trying to reduce ambiguity by means of their media selection (Schmitz & Fulk, 1991, p. 488). Daft & Lengel (1984) differentiate between two different information requirements: (1) Uncertainty is the result of a lack of information that creates the need for more information. (2) Equivocality refers to the absence of clear definitions, i.e. the existence of diverse and even conflicting interpretations of an organisational situation (Trevino, Daft & Lengel, 1990, p. 74; Bouwman & van de Wijngaert, 2002, p. 332). This ambiguity can be reduced by selecting a rich medium, i.e. a medium that has the capability of (a) facilitating feedback, (b) communicating multiple cues, (c) presenting individually tailored messages, and which implies (d) the use of natural language (Schmitz & Fulk, 1991, p. 488). In situations with a high level of equivocality (e. g. in a job interview), rich media have the highest ability to facilitate communication. According to Trevino, Daft & Lengel (1990) it is possible to rank media according to what degree they are able to convey equivocal information. Face-to-face communication is considered to be the richest medium, followed by telephone, email, letters,

notes and memos, bulletins, and reports. However, a rich medium is not always the best choice for every task. Table 1 relates message characteristics and media richness. If, for example, a rich medium is chosen to communicate an unequivocal message, a communicative failure might occur. The receivers of the message might be confused. For an equivocal situation, rich media work best. They allow to provide immediate feedback, multiple cues, a personal focus, and the use of a natural language.

Table 1 Message Equivocality/Media Richness Matching Framework for Communication Effectiveness (Trevino, Daft & Lengel, 1990, p. 81)

		MESSAGE	
		Unequivocal	Equivocal
MEDIA RICHNESS	Rich	Communicative Failure Rich media's excess cues cause confusion and surplus meaning	Effective Communication Rich media match equivocal message
	Lean	Effective Communication Media low in richness match unequivocal message	Communicative Failure Lean media used for equivocal messages provide too few cues to capture message complexity

Both the social presence model and the media richness model are theories of rational choice: people use a particular communication channel which they expect to be most appropriate for the intended purpose. However, those concepts seem to rest on so far unrealistic assumptions about organisational behaviour. In that they (can be characterised to) reveal a rationalist bias and to display technological determinism (Fulk, Schmitz & Steinfield, 1990, p. 117). Fulk, Schmitz & Steinfield (1990, 1991) therefore introduced a **social influence model of media use** taking into account that media perceptions are "in part subjective and socially constructed" (Fulk, Schmitz & Steinfield, 1990, p. 121). The authors do not deny that media perceptions are determined by objective features of those media. However, media characteristics are also determined to a "substantial degree by the attitudes, statements, and behaviours of coworkers" (ibid.). Two processes are responsible for this social influence: Firstly, there are statements of co-workers about the medium's characteristics, the task features, and their choice making. Secondly, there is vicarious learning taking place (p. 123). Thus, according to the social influence model there are different suppositions concerning the rationality of media use: Rationality is subjective and socially influenced through information provided by others (p. 123). As a result, media choice is the result of a process that occurs over time. This process of making sense is directly influenced by group norms. Especially the use of media will most probably be embedded within norms of a particular social group. There are several important factors at play in the use of media which have not yet been introduced in organisational contexts, i.e. individual factors (e.g. different cognitive styles), facilitating factors (e.g. accessibility of a medium), and direct constraints (e.g. geography and time). Fulk, Schmitz and Steinfield make clear that - if one should consider all the relevant factors of influence, the model of social influence would get too complex. We can

draw the conclusion that media choice in organisational settings is far from trivial. Media choice is a process that comprises four key aspects: the character of the task, the character of the medium, the subjective and socially constructed perceptions of the media at hand as well as a set of situational factors. It is in a process of matching those four factors that a specific medium is chosen. In the case of OPAALS we argue that the study of media choice is important in order to arrive at recommendations for further self-governance procedures. Especially observing the process of media choice over the time and possible differences in the perceived appropriateness of media between different domains are of interest.

2.3.3 Community building

As OPAALS can be regarded as a community, it is one of the aims to ensure a sustainable community building so that all partners can work together, share knowledge and expertise, and support the emerging of digital ecosystems beyond the end of the financial support by the EC. The crucial question of how the sustainable community building can be achieved is strongly coupled with the question of how the cues within the various communities grow. Although the success of a sustainable community building of OPAALS can only be stated after several years beyond the end of the last phase of OPAALS, it is important that basic dimensions of the community will increase in its extent. Otherwise the sustainability of the NoE does not appear in a favourable light.

In D10.5 (Bräuer, Dini, Dory, English, Iqani, & Zeller, 2007, pp. 22-26) seven dimensions of online communities are discussed: purpose, communication, trust and identity, reputation, boundaries, history, and expression. Purpose and boundaries within OPAALS can be regarded as fixed and therefore are not expected to change since its founding. The boundaries to become a member of OPAALS are defined through the formal requirements of a NoE which is supported by the European Commission. The purpose in turn is achieving the aims of the OPAALS NoE which are established in several workplans.

Regarding the dimensions which can change during the development of a community, we can assume that a person's reputation will change through communication in the sense that communication is necessary to establish a reputation. If somebody does not know the reputation of a particular person, it will be very likely that these persons also have no direct and maybe even no indirect communication. As every member of OPAALS has an identity, the trust given to another member through evaluating his or her identity will also influence their communication. If somebody has no trust in a member of the NoE it, is also very likely that this person will keep the communication to a minimum. So if communication with a particular member increases, it is a relatively reliable indicator for increased trust between these persons. Moreover, communication will establish reputations of the persons who take part in the communication act. Analysing the communication will in turn support the community awareness of its own history which will help to sustain an enduring community. Where density and intensity of communication can be measured with quantitative methods it is more appropriate to investigate the way of expression of the community by analysing respective statements of the community members with a qualitative approach. Expression points to the aspect of language. The communication between different domains calls for a uniform framework based on interdisciplinary ontologies. Those ontologies provide the community members with a common interpretation of key terms and concepts (see D6.1, pp. 18-30).

The density of communication can be analysed by means of a social network analysis and is basically counted through the number of contacts for each member. The intensity of

communication with regard to the strength of the social cues is more related to time and frequency of interaction. Both concepts are coupled with the notion of social capital which also reflects the success of community building. As Granovetter (1973) pointed out, it is important that an individual develops weak ties first to gain first integration into the community so as to avoid local cohesion and fragmentation of inner-circles. "Thus, increasing time spent with strong ties inhibits the expansion of social capital. In contrast, weakly tied pairs are more likely to possess disparate friendship circles, thereby providing opportunities for individuals to expand their networks and develop generalized trust. As a result, individuals more actively pursuing and maintaining weak ties typically possess greater levels of social capital than those limiting their interactions to strong ties" (Best & Krueger, 2006, p. 397). So an important aspect of successful community building is the growth of the individual networks within the community. However, regarding the OPAALS NoE considering the development of social capital we have to consider the different cultures. Considering the findings of Hofstede (2001) and Hichang and Jae-Shin (2008) we expect people from low IDV to develop stronger ties than people from high IDV.

2.4 Agenda for coordination and self-reflective research

The above paragraphs have dealt with the various fields of research dealing with the development of the OPAALS community, its communication and collaboration processes. Conducting research *on* OPAALS also means to conduct research *to the benefit of* OPAALS. A way to combine research and practice is the concept of action research. Action research is an approach that was introduced for OPAALS in D6.1 and was already applied in task 10.7 (see D10.5).

2.4.1 Some notes on Action Research and Self-Reflection

Initially, the idea was to develop a framework from which all activities conducted in task 10.9 could be deduced. In order to combine research and action, "network action research" was chosen as the appropriate theoretical and methodological framework. Action research is not a specific way of doing research. It can be regarded as an "umbrella paradigm" or a "meta-methodology" which allows the use of different research methods with specific guiding principles (Foth, 2006, p. 207). In the following these principles will be introduced.

Action research can be characterised as a participatory, democratic process that is aimed at bringing together action and reflection, theory and practice with the aim of finding practical solutions for individuals and communities (Reason & Bradbury, 2001, p. 1). One of the advantages of action research for OPAALS is that it brings together researchers and people working in practical fields within a collaborative process of knowledge construction. In fact, almost every person working for OPAALS is a practitioner and a researcher at the same moment. The traditional separation of action and reflection does not fit the situation in Mode 2 knowledge communities. The most important elements of an action research approach are:

- Action research is a collaborative process between researchers and people in the situation that is being researched
- Action research is a process of critical inquiry
- Action research has a focus on social practice
- Action research is a deliberate process of reflective learning

- Action research employs a clear identification of the actions and the research objectives, and
- Action research is a circular iterative process

Research conducted within such a framework differs from mere hypothesis-testing research in that it is meant to change the very situation it is located in. Making interventions into the research field is usually not part of the classical research process. Action research carries out interventions in natural organisational settings populated by the people whom the action researcher is studying and whom the research intends to benefit directly and immediately (Lee, 2007, p. 44).

In principle, the process of action research can be summarised as follows: a researcher enters a real-world problem situation. She takes in the situation and reflects upon her theoretical frameworks and the methods she applies. This leads (a) to findings, and (b) to new research themes (Checkland & Holwell, 2007, p. 9). In the case of our research we may conclude that the research team is composed of members of the OPAALS community. The team uses specific theoretical frameworks and methods in order to study OPAALS. Those results are directly communicated to the members of the community. This mode of research does not allow to draw general conclusions. However, in the case of OPAALS this approach is capable of generating some main ideas and basic results for OPAALS and comparable research projects. Checkland & Holwell (2007) pay attention to the fact that:

Achieving credibility, consensus does not make a “truth claim” as strong as that derived from replicability of results independent of time, place, and researcher. Action researchers must pay careful attention to the claim of validity relevant to their research into phenomena not “homogenous through time” (p. 11).

The aim of AR should, according to Checkland & Holwell (2007), enact a process based on a “declared-in-advance methodology” (encompassing a particular framework of ideas) (p.13). The authors emphasise this point as it is important to make interested “outsiders” and laypeople understand the research process. Hence, the epistemological presuppositions of the research process will need to be set out. What matters is not truth, but plausibility. In order to make the results plausible, the claims of the research have to be well-founded (p. 15). This is exactly what the theoretical and the methodological section of this deliverable tries to achieve by making explicit our research topics as well as the theoretical basis and empirical dimensions with regard to the social criteria. We also regard it as necessary to explicitly elaborate on the choice of the methodological orientation applied in the work on T10.9 and the issue of ‘observation from the inside’ versus ‘observation from the outside’.

Methodological Orientation

Usually self-reflective research is associated with qualitative social research methods, e.g. participant observation and ethnographic approach that had further been developed to virtual ethnography in order to study groups in computer-mediated environments. This makes sense for several reasons as descriptions of social reality in groups are expressed in the language of the group itself and are not pre-structured by concepts of the researcher. However, those methods have also clear limitations: As long as for example the OKS is not used as common communication platform, virtual ethnography and participant observation have quite a limited scope and can only provide a partial picture, i.e. only events that are visible for the researcher can be observed and studied. One aim of this deliverable is to present an empirically based description on the emergence of the OPAALS community, its communication and collaboration processes, the differences between several subgroups and

the development from the beginning to the end of phase 2 of the project. Applying only qualitative methods cannot sufficiently cope with this aim of research. In order to be able to map changes occurring over time and taking the whole community into consideration, the decision for a trend-survey study is sensible out of the following reasons:

- (1) It is possible (at least on a theoretical scale) to collect data from all community members, especially regarding their individual perceptions;
- (2) the development of trends can be detected, and
- (3) as a survey affects all OPAALS researchers, by answering the questionnaire it may initiate a reflective process as to their day-to-day work in the project.

Surveys may of course produce biased results as the example of socially desirable answering behaviour shows. As alternative second method we have decided to conduct a content analysis in order to map the communicative development in OPAALS with a nonreactive method. Both studies basically follow a "quantitative" approach that should ensure a higher level of inter-subjectivity. Furthermore, the methodological choice is a result of the theoretical orientation of this deliverable too. Our approach is based on assumptions that could be drawn from previous studies on national cultures, epistemic cultures, governance research, linguistic studies, and models of media choice.

Observation from the Inside

As the members of the survey team were also members of the community in the focus of research, the question arises whether observers from 'outside', i.e. who are not members of the community, could provide a more "independent" view on the processes observed. However, inside researchers have better insights into the dynamics of the community and can develop and change their analysis tools with respect to recent developments within the community.

The fact that the researchers in charge were members of the community should increase trust in the integrity of the observers and reduce the feeling of being observed from the outside. In order to ensure trust by the other community members, we presented the aims of our research at various OPAALS meetings (see chapter 4.3.1). Moreover it is one aim of the OPAALS NoE to address itself as object of research which means to animate the members to reflect upon their role and the development of the community. The research of T10.9 provides a perfect opportunity in this respect.

2.4.2 A Framework for Coordination: Network Action Research

For the specific case of OPAALS, **network action research** as proposed by Foth (2006) can be used well for combining our research efforts with the second, "practical" focus, outlined in T10.9.

The primary objective of network action research is to map the existing (formal and informal) networks that operate within the community and initiate small participatory action research projects within each of them. The task of the action researcher is then to link the various sub-networks of inquiry so as to form a larger community of practice (Foth, 2006). Foth notes that:

The action researcher's task is to monitor the communicative ecology of the community and provide additional meta-networking nodes that act as an interface between different stakeholders to allow the free flow of information and experience exchange (p. 213).

Instead of relying solely on formal structures such as focus groups, steering committees and workshops, a network action researcher seeks to also map, maintain and harness informal social networks and thus fulfils the role of a community or neighbourhood worker who not only connects the community with researchers and sponsors but also networks the networks in an effort to develop the infrastructure necessary for sustainability and ongoing learning networks (p. 216).

From these statements, the dual character of our approach becomes clear: Practice is inspired by research and research is inspired by practice. Our research follows the circular mode of action research from diagnosis to evaluation and reflection. The deliverable presents the results of ongoing research. These aspects can be summarised as follows:

- **Monitoring** of the communicative ecology of the community via empirical research
- **Coordination** - Provision of networking nodes, initiating free flow of information and experience design
- **Reflection** - Development of recommendations, including self-reflection of the task itself

The monitoring was mainly supported by concrete empirical social research. Furthermore, as the researchers involved in the team are also community members, we were observing the community and the results of the observations serve as important factors for the interpretation of the data we collected. Those observations have the character of a participant observation. The research team met on a regular basis in order to establish its own channel of self-reflection.

Another important aspect that needs to be considered are the researchers who represent the main stakeholders in the OPAALS community. Scientists and researchers usually demand a high level of independence for their work and react very critical towards attempts to directly influence their work. When considering that OPAALS is a democratic, participatory research community, and when bearing in mind the principles of network action research, it becomes clear that coordination cannot mean any more than the provision of new modes for networking, the initiation of a free flow of information and the provision of data that can enable self-reflection in different working teams.

Reflection is located in the section of this deliverable where we discuss the results of our research and arrive at actual recommendations (chapter 5).

3 RESEARCH QUESTIONS AND METHODOLOGY

The last chapter has introduced the theoretical framework that has guided our empirical research efforts. On the basis of those theoretical reflections we have drawn two major research questions:

- 1.) How do collaboration, perception of governance, and community building change over time?
- 2.) Are there any differences in collaboration, perception of governance, or community building with regard to sex, domain, and national cultures?

The underlying hypotheses for these questions are that there will be a development over time and that there could be differences between sex, domain, and national cultures. By answering these questions, recommendations for improving community building, governance, and collaboration processes can be drawn from empirical evidence.

Therefore the three basic categories were grouped according to several dimensions for the sake of quantitative and qualitative analysis (s. Table 2).

Table 2 Dimensions of analysis

	Trend Study	Mailing list Analysis
Collaboration (Media Choice)	<ul style="list-style-type: none"> - Appropriateness of collaboration tools - Choice of information sources - Choice of sources for scientific exchange - Work topics 	<ul style="list-style-type: none"> - Topics discussed
Governance	<ul style="list-style-type: none"> - Decision making style - Role understanding 	<ul style="list-style-type: none"> - Purpose of emails - Frequency of email traffic - Characteristics of senders
Community Building	<ul style="list-style-type: none"> - Number of contacts - Intensity of interaction - Professional and informal interaction - Associations - English language usage 	<ul style="list-style-type: none"> - Frequency of email traffic - Characteristics of senders

By conducting a trend study it was possible to detect changes occurring over a certain period of time and between several sub-groups within OPAALS. Moreover it was possible to potentially include all OPAALS members which would not have been possible through focus group analysis, observations of work, or any content analysis. However, the trend study was complemented with the analysis of the OPAALS all-email-list, where aspects of content analysis were included as well.

3.1 Trend Study

The core method to investigate differences and developments in community dynamics was an online survey trend study which was conducted in four waves where the questionnaires could be accessed through online survey platform. In each step all the OPAALS researchers were invited via email to participate in the online survey. In this email they received a personal link so that they could access the survey only through this URL. Thus it was ensured that every person could answer the questionnaire only once, regardless of how

often and from which computer the URL was accessed. However, it was also possible to interrupt the survey and continue answering later. Before the end of each survey period a general reminder was sent. In waves 1 and 2 personal reminders were sent in addition. These reminders were intended to increase the response rate so that as many partners as possible would be included in the total sample. In wave 4 the questionnaire got a special time slot during the General Meeting in January 2009.

Table 3 The four waves of the trend study

	Start of survey	End of survey
Wave 1	2006-12-13	2007-03-31
Wave 2	2007-11-22	2007-12-17
Wave 3	2009-07-13	2009-08-04
Wave 4	2009-01-12	2009-02-15

Each survey consisted of several blocks of questions which were based on the dimensions mentioned above:

Governance

- How do members of OPAALS perceive the process of decision making?
Ideally, all members have the same perception of the decision making style which would indicate a consistent governance through all work packages and partners. From our perspective, the underlying decision making style in OPAALS is based on democratic principles, where an authoritative decision needs to be taken only in exceptional cases.
- How do individuals understand their role within OPAALS?
A successful governance should give each member a profound understanding of the individual role within the NoE. Only if somebody understands the purpose and relevance of his or her work it can be expected that the work will be of the best quality. This question is also strongly related to community building issues.

Collaboration

- What are the most appropriate communication tools with regard to specific work topics?
As argued in the last chapter media choice is the initiator for most collaborative processes within OPAALS. So it is important to identify the media which are perceived to be the most appropriate for certain tasks.
- What sources are perceived as the most important ones for information and for scientific exchange?
Differences in perceiving the importance of information sources and sources for scientific exchange need to be considered in order to find useful strategies to facilitate multi-disciplinary collaboration and publication platforms.
- What work topics are the most relevant?
This question aims at investigating the relevance of several work topics which could interfere with other variables.

Community Building

- With how many partners do the members have contact?
The more contacts somebody has the better the chance to find somebody to collaborate with, to exchange ideas with, and to establish a shared understanding within the whole community.
- How intensive is the interaction with each partner?
The more intensive the interaction with a partner is, the more trust can emerge. And the more trust is built, the higher the chances are for developing a sustainable community.
- To what extent does professional interaction dominate over informal interaction?
As the purpose of OPAALS is of a professional nature, informal interaction seems to indicate that the community goes beyond this purpose and can develop ties which sustain the professional purpose.
- Is there a growing shared understanding of basic concepts of OPAALS?
A shared understanding of basic concepts indicates successful communication and supports the rise of mutual understanding and trust.
- Is there a change in English language usage of non native English speakers?
Because English is used as common language and thus connects all partners, an increase in the use of English language would indicate the desired growth in interaction density.

It is from the perceived governance, the actual collaboration processes as well as from the indicators of a sustainable community building that recommendations for new governance measures can be deduced. The latter need to be accomplished with regard to the differences revealed in OPAALS.

3.2 Mailing List Analysis

The content of communication is an important element of the communication process itself (Rössler, 2002, p. 291). While the survey trend study maps communication and collaboration processes, an analysis of the OPAALS-all mailing list shall shed light on the content and the dynamic in the respective list. Content analysis can be regarded as one of the major methods in media and communication studies. In order to assess the development of a community, the observation of its contents are of high importance. The OPAALS-all list can be regarded as the major project-internal public information and discussion space. The study shall shed light on the dynamics and levels of participation of this list.

According to a definition by Fröh (1998), content analysis is "[...] an empirical method for the systematically and inter-subjectively reproducible description of formal and content characteristics of messages" (p. 25).

Inter-subjectively reproducible results mean that the instrument developed by the researchers leads, when applied repeatedly, to the same results. In comparison with the method of survey, content analysis is a nonreactive and unobtrusive research technique (Rössler, 2002, p. 295).

OPAALS as a research community embraces democratic, participatory and inclusive communication and collaboration. From the dimensions of governance, collaboration, and community building the following research questions were derived:

- What is the ratio between active and passive participants of the mailing list?
- How interdisciplinary is the mailing list?
- What are the main content characteristics of the list?
- Do communication patterns get thicker over time?

The first step was to develop a codebook to answer the research questions. The codebook comprises three dimensions (based on Orlikowski & Yates, 1994). The first dimension covers the basic characteristics of the e-mail as they are represented in the header (date, subject line, from-field, to and cc fields). The second dimension regards the content of each email (primary and secondary purpose of the message, research vs. administration email, content forwarded, and attachments). The third dimension finally considers the characteristics of the sender (domain affiliation of the sender, function of the sender in the project). As a whole, the codebook consists of 28 variables. The codebook can be can be downloaded from the projects' wiki page⁴. Each email was separated into a single email-file (*.eml) with a unique numeric identifier in the file name. Thus, each email was coupled with its analysis data in the data set through its identifier in the file name.

The following chapter is intended to introduce the results of our research.

⁴ <http://wiki.opaals.org/Codebook>

4 RESULTS AND OUTCOME

This section presents our major findings from the OPAALS trend study and the content analysis of the OPAALS-all mailing list. Furthermore, the coordination activities that were conducted during phase 2 of the project are also introduced.

4.1 Results from the OPAALS trend study

4.1.1 Sample and Descriptives

The sample of each survey wave consisted of the researchers in OPAALS, varying from 72 in wave 1 up to 96 in wave 4 (Table 4). There were several challenges in the design and conduction of the study: At first, the different English language levels among community members necessitate a sensitive handling of this aspect in order to arrive at a questionnaire that can be appropriately understood by all respondents. Secondly the different cultural, disciplinary, professional (research, business, software development) backgrounds call for the usage of a common vocabulary (terms might be used quite differently in different cultures or scientific domains). Another issue is the fact that there are several forms of affiliations within the project, e.g. part-time researchers or sub-contractors. This is important when considering the field period: a too shortly calculated field period could have the consequence that a researcher miss to participate in the survey as her activities within the project are quite low or she is too busy to take the time filling in the questionnaire. Arriving at a sufficient completion rate was quite challenging (even though reminders were sent out and the survey was kept open for three weeks in waves 2, 3, and 4. Especially wave 3 in June/July 2008 was rather critical as only approximately 40 percent of the sample completed the questionnaires.

Table 4 Overview of the waves of the survey

	field period	sample	response rate (% of the population)	completed questionnaires (% of the population)
first wave (pilot study) ⁵	13.12.2006 - 31.03.2007	72	47 (65%)	36 (50%)
second wave	22.11.2007 - 17.12.2007	87	70 (80%)	56 (64%)
third wave	13.06.2008 - 04.07.2008	88	48 (55%)	35 (40%)
fourth wave	12.01.2009 - 25.01.2009	88	54 (61%)	49 (56%)

Table 5 summarises the main descriptive data from the survey waves concerning sex, age, domain, and language. The share of female researchers varies from 25% up to 40% of the respective samples. The majority of the researchers are between 20 and 40 years old. There are nearly as many social scientists as computer scientists in the sample. What is remarkable is the result that up to 30% of the researchers located themselves in several domains. Around 30% of the respondents speak English as their native language. The data indicate that over the course of the different waves there were no significant trends or changes in

⁵ The first wave was a pilot study conducted in task 6.1 as an application of the socio-linguistic framework. In task 10.9, the questionnaire was revised (see also M10.8, Crone & Bräuer, 2008). We decided to present results from the waves 2, 3, and 4 in this deliverable as those waves cover phase 2 of the project with the same partners. However, when useful, we integrated results from wave 1 to provide a broader picture. A result report from wave 1 is available on the projects' wiki.

the basic composition of the samples. In the following subchapters, a detailed view on the data will be presented.

Table 5 Descriptive data of the survey waves

		Wave 1 (N=36) %	Wave 2 (N=56) %	Wave 3 (N=35) %	Wave 4 (N=49) %
sex	male	75.0	69.6	60.0	71.4
	female	25.0	30.4	40.0	28.6
age	20-30	38.9	30.4	25.7	28.8
	31-40	41.7	41.1	42.9	42.3
	41-50	8.3	16.1	17.1	11.5
	51-60	11.1	7.1	8.6	7.7
	60+	.0	5.4	5.7	3.8
domain	computer science	36.1	51.9	31.4	35.4
	social science	31.1	29.6	4.0	33.3
	natural science	2.8	1.9	2.9	4.2
	different domains	30.0	16.6	26	27.1
language	English native language	36.1	32.1	28.6	30.0
	English not native language	63.9	67.9	71.4	70.0

4.1.2 National cultures in OPAALS

Since there was no direct record of the participant's cultural background in the questionnaires, the native language of each participant was considered as a strong indicator for the cultural background.

Therefore, it was assumed that Spanish speaking OPAALS members working in Spain were Spanish, and likewise German speaking members in Austria are Austrian. Moreover, it was assumed that all native English speakers working at British partner institutes were British and Irish when working in Ireland. English native speakers at partner institutes where English is no official language were not considered for the fact that it would not be clear whether they came from the UK, Ireland, the USA, Australia or some other place – the same procedure was applied to Spanish(-speaking) people outside Spain. Native speakers of other languages (e.g. Russian, Romanian, Hungarian) could not be considered for the reason that there were no cultural indices available for their cultures. So 11 different cultural backgrounds where cultural indices data were available (Hofstede 2001) could be included in the analysis.

Because the total number of participants for each culture was too small for a meaningful analysis each cultural index was divided into two groups by using the median of wave 4 to get sets of approximately the same size. Finally we chose one group of cultures with low values and one group with high values for each cultural index. Even though the size of the groups varies between the waves, the groups needed to remain constant for analysis. Because the LTO index did not directly derive from Hofstede's IBM study, some cultures of the IBM sample do not have a LTO index, which is why we skipped the analysis of this index with respect to a consistent sample through all indices.

For masculinity index (MAS) and for uncertainty avoidance index (UAI) a second grouping was considered on the basis of corrections proposed by Hofstede. The MAS2 index shows the "MAS scores after the percentage of women in the IBM sample [of Hofstede's study] was controlled for the scores that would have been obtained if all country samples included the

same percentage of female respondents" (Hofstede 2001: 285). The UAI2 index on the other hand scores the UAI when controlled for the average age of the respondents of each country. However, in our case the UAI2 groups are the same as the UAI groups.

Taken these groupings of national cultures (Table 6 - Table 10) it was possible to analyse the differences between these groups with regard to the research questions.

Table 6 Grouping for Power Distance Index (PDI)

	National cultures	PDI	N (Wave 2)	N (Wave 3)	N (Wave 4)
low PDI	Austrian (German)	11	4	3	3
	Irish (Irish, English)	28	7	5	6
	Finnish (Finnish)	33	4	1	2
	German (German)	35	3	4	4
	British (English)	35	7	5	6
	Dutch (Dutch)	38	1	1	2
high PDI	Italian (Italian)	50	9	5	5
	Spanish (Spanish)	57	4	1	5
	Greek (Greek)	60	4	2	2
	Brazilian (Portugese)	69	2	2	4
	Indian (Hindi, Bengali, Oriya)	77	3	2	5
N Ratio			26:22	19:13	23:21

Table 7 Grouping for Individualism Index (IDV)

	National cultures	IDV	N (Wave 2)	N (Wave 3)	N (Wave 4)
low IDV	Greek (Greek)	35	4	2	2
	Brazilian (Portugese)	38	2	2	4
	Indian (Hindi, Bengali, Oriya)	48	3	2	5
	Spanish (Spanish)	51	4	1	5
	Austrian (German)	55	4	3	3
	Finnish (Finnish)	63	4	1	2
high IDV	German (German)	67	3	4	4
	Irish (Irish, English)	70	7	5	6
	Italian (Italian)	76	9	5	5
	Dutch (Dutch)	80	1	1	2
	British (English)	89	7	5	6
N Ratio			21:27	11:20	21:23

Table 8 Grouping for Masculinity Index (MAS)

	National cultures	MAS	N (Wave 2)	N (Wave 3)	N (Wave 4)
low MAS	Dutch (Dutch)	14	1	1	2
	Finnish (Finnish)	26	4	1	2
	Spanish (Spanish)	42	4	1	5
	Brazilian (Portugese)	49	2	2	4
	Indian (Hindi, Bengali, Oriya)	56	3	2	5
	Greek (Greek)	57	4	2	2
high MAS	German (German)	66	3	4	4
	British (English)	66	7	5	6
	Irish (Irish, English)	68	7	5	6
	Italian (Italian)	70	9	5	5
	Austrian (German)	79	4	3	3
N Ratio			18:30	9:22	20:24

Table 9 Grouping for Masculinity Index, controlled for percentage of women (MAS2)

	National cultures	MAS2	N (Wave 2)	N (Wave 3)	N (Wave 4)
low MAS2	Spanish (Spanish)	35	4	1	5
	Brazilian (Portugese)	44	2	2	4
	Indian (Hindi, Bengali, Oriya)	47	3	2	5
	Finnish (Finnish)	51	4	1	2
	German (German)	59	3	4	4
	British (English)	66	7	5	6
high MAS2	Italian (Italian)	72	9	5	5
	Greek (Greek)	73	4	2	2
	Irish (Irish, English)	74	7	5	6
	Austrian (German)	75	4	3	3
	Dutch (Dutch)		1	1	2
N Ratio			16:31	10:20	20:22

Table 10 Grouping for Uncertainty Avoidance Index (UAI)

	National cultures	UAI	UAI2	N (Wave 2)	N (Wave 3)	N (Wave 4)
low UAI	British (English)	35	43	7	5	6
	Irish (Irish, English)	35	54	7	5	6
	Indian (Hindi, Bengali, Oriya)	40	48	3	2	5
	Dutch (Dutch)	53	45	1	1	2
	Finnish (Finnish)	59	54	4	1	2
	German (German)	65	53	3	4	4
high UAI	Austrian (German)	70	77	4	3	3
	Italian (Italian)	75	58	9	5	5
	Brazilian (Portugese)	76	74	2	2	4
	Spanish (Spanish)	86	89	4	1	5
	Greek (Greek)	112	98	4	2	2
N Ratio				25:23	18:13	25:19

4.1.3 Topics of Work in OPAALS

In research communities a variety of tasks need to be carried out. Consequently, five specific work topics were touched upon in the questionnaire:

- (1) Management of the work package tasks(s)
- (2) Getting to know and staying in touch with collaborators
- (3) Work on work package tasks and/or deliverables
- (4) Creating and discussing new ideas with collaborators
- (5) Dissemination of information to the OPAALS community

Those work topics are meant to cover the various aspects of the work in a project, ranging from management respectively governance (1, 3, and 5) aspects to creative and community building dimensions of work (2 and 4). In order to be able to get an exact answer from the respondents the following scale was chosen: daily – several times a week – several times a month – less frequent – didn't appear yet.

As far as the *management of the work package task(s)* is concerned, the majority of the respondents work on this topic several times a week and several times a month. Only a small number of respondents is not involved in managing work package tasks. However, all in all this work topic does not cover too much time of the work process. Furthermore, there seem to be no remarkable movements between the waves. Management of the work package task(s) represents a stable part of the work in OPAALS (Table 11).

Table 11 Management of the work package task(s)

	Wave 2 (%)	Wave 3 (%)	Wave 4 (%)
Daily	15	12	10
several times a week	33	33	38
several times a month	20	27	27
less frequent	20	24	12
didn't appear yet	11	3	13
Total	100 (N: 54)	100 (N: 33)	100 (N: 52)

The topic of *getting to know and staying in touch* with collaborators is important in order to measure the amount of individual community building efforts among the researchers. The vast majority engages in this topic at least several times a month. In waves 2 and 4 more than 40 percent of the respondents kept the contact to their collaborators at least several times a week. This is a remarkable result as it provides empirical ground for the importance of the community to be based on sustained and sustainable contacts. In the development over the waves there are no significant changes. The topic can be regarded as stable (Table 12).

Table 12 Getting to know and staying in touch with collaborators

	Wave 2 (%)	Wave 3 (%)	Wave 4 (%)
daily	9	11	10
several times a week	39	20	33
several times a month	41	57	49
less frequent	11	11	8
didn't appear yet	0	0	0
Total	100 (N: 56)	100 (N: 35)	100 (N: 51)

The work topic of *work on work package tasks and/or deliverables* represents what usually would be described as common work. A significant majority is working for OPAALS on a daily or at least several times a week basis. Only a small minority is less frequently than several times a month engaged in this actual work. When looking at the different waves we can observe a slight change from work on a daily basis to work on the basis of several times a month (Table 13).

Table 13 Work on work package tasks and/or deliverables

	Wave 2 (%)	Wave 3 (%)	Wave 4 (%)
daily	41	29	31
several times a week	32	49	46
several times a month	23	17	13
less frequent	4	6	10
didn't appear yet	0	0	0
Total	100 (N: 56)	100 (N: 35)	100 (N: 52)

Creating and discussing new ideas with collaborators is an essential work topic and task especially for knowledge communities. The results reveal that this task is done by a majority of the respondents at least several times a month. The distribution of the efforts within this task is also stable over the different survey waves (Table 14).

Table 14 Creating and discussing new ideas with collaborators

	Wave 2 (%)	Wave 3 (%)	Wave 4 (%)
daily	5	3	2
several times a week	25	17	29
several times a month	59	66	44
less frequent	11	14	25
didn't appear yet	0	0	0
Total	100 (N: 56)	100 (N: 35)	100 (N: 52)

The issue of *dissemination of information to the OPAALS community* gives a different impression. The majority of the respondents provide information to the whole community less frequently than several times a month. This result is stable over the different survey waves. However, the result is not very surprising as most work takes place in tasks and work packages (Table 15).

Table 15 Dissemination of information to the OPAALS community

	Wave 2 (%)	Wave 3 (%)	Wave 4 (%)
daily	2	3	2
several times a week	4	6	8
several times a month	30	35	31
less frequent	57	56	51
didn't appear yet	7	0	8
Total	100 (N: 56)	100 (N: 34)	100 (N: 51)

4.1.4 Information Sources and Sources for Scientific Exchange

Researchers as well as practitioners have access to a broad variety of sources of information. Each epistemic culture has its own information source preferences. In the survey we distinguished between information sources and sources for scientific exchange. The participants had to display the importance of a list of different sources on a scale ranging from 1 = very important to 4 = not important. In the following we present data from the second wave of the trend study.⁶

Table 16 shows the results of the mean scores of information sources with regard to the whole community, the group of computer scientists, and the group of social scientists. Meetings, interpersonal exchange, online journals and journals are perceived as the most important sources of information.

⁶ We did not consider this question for trend analysis as there should not be any changes with regard to information sources and sources for scientific exchange.

Table 16 Information Sources

Source	All participants		Computer Scientists		Social Science	
	Mean	SD	Mean	SD	Mean	SD
Journals	1.93	.98	2.11	.96	1.63	.81
Online journals	1.80	.86	2.04	.79	1.44	.52
Books (monographs)	1.95	.84	2.07	.77	1.81	.83
Edited books (anthologies)	2.15	.91	2.26	.81	1.88	.89
Online books	2.29	.87	2.29	.81	2.25	1.00
Open access online documents	1.61	.62	1.54	.58	1.69	.70
Conference papers	1.75	.84	1.50	.64	1.94	1.00
Working papers	2.13	.80	2.19	.79	2.07	.96
Reviews	2.27	.89	2.21	.83	2.33	1.11
Websites of researchers	2.52	.93	2.36	.91	2.75	.86
Online courses	3.22	.79	2.96	.74	3.60	.63
Reports	2.29	.82	2.25	.74	3.60	.63
Posters	3.31	.74	3.04	.79	3.53	.52
Academic mailing-lists	2.91	.87	2.64	.91	3.00	.66
Forum	2.93	.69	2.79	.63	3.13	.64
Interpersonal exchange	1.72	.85	1.81	.88	1.81	.98
Conferences	1.88	.81	1.86	.80	1.81	.75
Meetings	1.61	.68	1.68	.67	1.62	.79

If the means of the two groups of social scientists and computer scientists are compared, we can see that social scientists regard journals ($p < .1$) and online journals ($p < .05$) as more important than their colleagues from the computer science domain. On the contrary, conference papers ($p < .1$), online courses ($p < .01$), posters ($p < .05$), and forums ($p < .1$) are more important to the computer scientists than to the social scientists.

Information sources and sources for scientific exchange are different: Scientific exchange points to sources where discourse takes place and thus to sources which are chosen in order to publish results.

Conferences, meetings, interpersonal exchange, journals and open access documents are perceived to be the most important sources for scientific exchange. In addition, working papers and online journals were also considered to be important (Table 17).

Table 17 Sources for scientific exchange

Source	All participants		Computer Scientists		Social Scientists	
	Mean	SD	Mean	SD	Mean	SD
Journals	1.71	.90	1.89	.76	1.38	.62
Online journals	1.86	.90	2.07	.81	1.50	.63
Books (monographs)	2.09	.94	2.07	.81	1.75	1.00
Edited books (anthologies)	2.27	.95	2.25	.80	1.94	1.06
Online books	2.44	.92	2.32	.77	2.40	1.06
Open access online documents	1.75	.72	1.64	.62	1.69	.60
Conference papers	1.50	.69	1.39	.74	1.56	.63
Working papers	1.87	.73	1.96	.75	1.53	.64
Reviews	2.26	.86	2.30	.82	2.21	1.05
Websites of researchers	2.46	.95	2.25	.97	2.75	1.00
Online courses	3.19	.68	3.00	.67	3.36	.75
Reports	2.37	.78	2.48	.64	1.93	1.03
Posters	3.24	.70	3.04	.64	3.57	.85
Academic mailing-lists	2.61	.87	2.46	.79	2.62	1.03
Forum	2.81	.75	2.71	.54	2.93	1.07
Interpersonal exchange	1.75	.89	1.71	.76	1.93	1.16
Conferences	1.46	.57	1.50	.58	1.50	.63
Meetings	1.64	.75	1.68	.61	1.73	1.03

Social scientists regard journals as well as online journals as more important than the computer scientists in the sample ($p < .05$). Working papers and reports were also regarded as more important by the social scientists. Only posters were regarded as more important by the group of computer scientists than by the social scientists group.

4.1.5 Appropriateness of collaboration tools for the work in OPAALS

OPAALS has to rely on computer-mediated tools in the project's every-day life. Hence, the appropriateness of communication tools is important to monitor, in order to reflect and feed the community with results initiating self-reflection of communication processes within the community's sub-teams.

Results from the pilot study

In the pilot study participants were asked about the appropriateness of collaboration tools for their work in OPAALS and for their work outside OPAALS. For the work in OPAALS face-to-face interaction as well as email, followed by mailing-lists and the OPAALS wiki were rated as most appropriate (Table 18). The results seem to reflect the necessity of getting to know and jointly developing new ideas and discussing project ideas during this "constitutive" phase of the project. The results are analogous to those gathered on the perceived appropriateness of collaboration tools outside the work for OPAALS (Table 19).

Table 18 Appropriateness of tools in OPAALS (ranked, wave 1)

	N	Mean	SD
Face-to-face group meetings	36	4.47	.74
Face-to-face interaction	36	4.42	.91
Email	36	4.42	.77
Mailing lists	35	3.83	1.20
OPAALS Wiki (in OKS desktop)	36	3.72	1.06
Phone/Internet Phone	35	3.71	.96
Instant Messenger (AOL, icq, etc.)	35	3.43	1.29
Video/audio-conference (more than 2 participants)	35	3.34	.94
OPAALS Forum (in OKS desktop)	34	2.97	1.29
OPAALS chat program (in OKS desktop)	36	2.94	1.29

In order to find out whether the participants made differences between the perceived appropriateness concerning the work in OPAALS or outside OPAALS, a dependent t-test was conducted. Generally, there were no significant differences between the perceived appropriateness when comparing the work done within and outside OPAALS. However, participants rated the appropriateness of mailing lists for the work in OPAALS ($M=3.83$) significantly higher than for outside OPAALS ($M=3.29$, $p < .01$). This result is not surprising as the mailing list is one of the core information and communication means of the community. Especially during the initial phase this list was, besides the wiki, the main information platform, every community member is automatically subscribed to, receives messages, and is also able to disseminate information to the community. The low appropriateness rating of the OPAALS chat program seems to be a result of what Markus (1990) called the "critical mass" theory of interactive media: universal access - which means that every community member can reach every community member via a specific interactive medium - is regarded as decisive for the utility of an interactive medium, and hence its perceived appropriateness within the community. The fact that a specific collaboration tool is rated low in its appropriateness need not result from stable characteristics of the medium itself, but it might well be the consequence of a lack of "universal access".

In a next step we calculated independent t-tests between male and female OPAALS members and between social scientists and computer scientists (engineers).

Concerning the work in OPAALS females rated the appropriateness of face-to face interaction ($M= 4.89$) significantly higher than their male collaborators ($M=4.26$; $p=.07$). The same picture can be drawn for the appropriateness of face-to-face group meetings (female: $M=4.89$; male: $M=4.33$, $p=.06$).

Concerning the work in OPAALS the group of computer scientists and engineers rated the appropriateness of instant messenger ($M=3.85$) significantly higher in the statistics than their colleagues from the social science and business domain ($M=2.83$ $p=.047$). There were no other differences that are statistically significant concerning the domain background found in the pilot study.

Table 19 Appropriateness of tools for work outside OPAALS (ranked, wave 1)

	N	Mean	SD
Face-to-face interaction	36	4.61	.64
Face-to-face group meetings	36	4.39	.77
Email	36	4.39	.77
Phone/Internet Phone	35	3.69	1.05
Instant Messenger (AOL, icq, etc.)	35	3.54	1.40
Mailing lists	36	3.33	1.24
Video/audio-conference (more than 2 participants)	36	3.08	1.08

Results from Wave 2 to wave 4

Originally it was planned to study in the next waves of the survey actual communication and collaboration patterns mediated by the Open Knowledge Space (OKS), the collaborative platform of the community. As the launch of this software was delayed, the research team decided to enhance the questions of the appropriateness of tools for collaboration by enabling a comprehensive comparison of the perceived appropriateness for collaboration tools in relation to the topics of collaboration. With this approach it is possible not only to provide birds-eye results on the perceived appropriateness of tools for the work in OPAALS; but it is now also possible to give detailed information on the appropriateness of tools for very specific topics. The results presented here only elaborate on differences such as sex and domain background. Our analysis has provided no empirically founded differences in the rates of appropriateness between different cultures.

Appropriateness of managing work package tasks

As far as the topic of *managing work package tasks* is concerned, face-to-face interaction, group meetings and email are rated as most appropriate. In waves 2 and 4 email was ranked first. This result is consistent with the more “administrative” topic of *work on work package tasks*. When it comes to *getting to know and staying in touch* and to the *dissemination of information to the OPAALS community* email is clearly seen to be less appropriate than face-to-face interaction and group meetings. Between the waves there seem to be no relevant changes in the ratings of appropriateness of managing work package tasks (Table 20).

Table 20 Appropriateness of collaboration tools for the management of work package tasks

	Wave 2			Wave 3			Wave 4			Δ mean Wave3 - Wave2	Δ mean Wave4 - Wave3	Δ mean Wave4 - Wave2
	N	Mean	SD	N	Mean	SD	N	Mean	SD			
Face-to-face interaction	47	4.15	1.06	32	4.41	.71	45	4.16	.88	.26	-.25	.01
Face-to-face group meetings	48	4.00	.99	32	4.31	.74	45	4.11	1.03	.31	-.20	.11
Video/audio conferences	48	3.40	1.05	31	3.28	.92	45	3.42	1.10	-.11	.14	.03
Web conferences	48	3.10	1.21	32	3.39	1.15	45	2.89	1.32	.28	-.50	-.22
Phone/Internet phone	48	3.69	.88	32	3.84	.72	45	3.51	1.16	.16	-.33	-.18
Email	47	4.28	.83	32	4.09	.78	45	4.22	1.06	-.18	.13	-.05
Mailing lists	48	3.44	1.09	32	3.13	1.01	45	3.13	1.18	-.31	.01	-.30
Instant Messenger	47	3.40	1.25	32	3.16	1.11	45	3.18	1.23	-.25	.02	-.23
Forums	48	2.85	1.07	32	2.66	.83	45	2.62	1.25	-.20	-.03	-.23
Blogs	48	2.38	.98	32	2.41	.87	45	2.47	1.16	.03	.06	.09
Wikis	48	2.98	1.19	32	3.09	.93	45	2.93	1.19	.11	-.16	-.05
File repository				32	3.38	.98	45	3.27	1.32		-.11	
Websites of researchers				32	2.59	1.10	45	2.56	1.22		-.04	
CMS/Knowledge platforms				31	3.16	1.10	45	3.11	1.27		-.05	

In wave 2 there was a significant mean difference ($p=.059$) concerning the appropriateness of instant messengers where female researchers rated the appropriateness of instant messengers higher ($M=3.93$) than their male colleagues ($M=3.18$). There were also significant mean differences ($p=.039$) between computer scientists and social scientists concerning the topic *management of work package tasks* in wave 2: Web conferences were rated significantly higher by the social scientists ($M=3.54$; $SD=1.1$) than by the computer scientists ($M=2.71$; $SD=.89$). Phone/internet phone was also rated higher by the social scientists ($M=4.15$; $SD=.987$) than by the computer scientists ($M=3.33$; $SD=.761$). This difference was statistically significant at $p=.008$. In keeping with this result, there was also a significant mean difference ($p=.002$) in wave 3 between computer scientists and social scientists concerning phone/internet phone. Computer scientists rated the appropriateness of phone/internet phone lower ($M=3.55$; $SD=.688$) than social scientists ($M=4.42$; $SD=.515$). In addition, in wave 3 a significant mean difference ($p=.043$) occurred where social scientists rated the appropriateness of mailing lists lower ($M=2.92$; $SD=.996$) than their colleagues from the computer science domain ($M=3.73$; $SD=.786$). In wave 3, phone/internet phone was rated higher by females in the project ($M=4.25$; $SD=.622$) than by male collaborators ($M=3.6$; $SD=.681$). This difference is statistically significant ($p=.011$). In wave 4 email was regarded more appropriate by male researchers ($M=4.50$; $SD=.803$) than by female researchers ($M=3.90$; $SD=.876$). This difference was statistically significant ($p=.050$). There was another significant mean difference ($p=.088$) between female and male researchers concerning websites of researchers/institutions, in that males rated appropriateness higher ($M=2.75$; $SD=1.218$) than females ($M=2.0$; $SD=1.054$). In wave 4 computer scientists rated the appropriateness of content management systems/knowledge platforms for the management of the work package tasks lower ($M=2.54$; $SD=.967$) than social scientists ($M=3.47$; $SD=1.407$). This result is statistically significant ($p=.056$).

Table 21 Getting to know and staying in touch with collaborators

	Wave 2			Wave 3			Wave 4			Δ mean Wave3 - Wave2	Δ mean Wave4 - Wave3	Δ mean Wave4 - Wave2
	N	Mean	SD	N	Mean	SD	N	Mean	SD			
Face-to-face interaction	56	4.54	.83	35	4.66	.64	51	4.43	.81	.12	-.23	-.10
Face-to-face group meetings	56	4.46	.91	35	4.60	.69	51	4.43	.76	.14	-.17	-.03
Video/audio conferences	56	3.32	1.08	35	3.37	1.09	51	3.57	.83	.05	.20	.25
Web conferences	55	2.89	1.24	35	3.31	1.08	51	3.02	1.14	.42	-.29	.13
Phone/Internet phone	55	3.58	1.03	34	3.56	.93	51	3.53	.92	-.02	-.03	-.05
Email	56	3.95	1.02	34	3.94	.98	51	3.92	1.06	-.01	-.02	-.02
Mailing lists	55	3.15	1.11	35	2.91	1.29	51	3.18	1.05	-.23	.26	.03
Instant Messenger	56	3.36	1.21	35	3.31	1.08	51	3.39	1.11	-.04	.08	.04
Forums	56	2.70	1.01	35	2.69	1.05	51	2.63	.96	-.01	-.06	-.07
Blogs	56	2.66	1.00	35	2.63	1.03	51	2.63	1.02	-.03	.00	-.03
Wikis	56	2.93	1.14	34	2.65	.81	51	2.90	.92	-.28	.25	-.03
File repository				33	2.45	1.20	51	2.76	1.31		.31	
Websites of researchers				35	2.80	1.05	51	2.67	1.03		-.13	
CMS/Knowledge platforms				34	2.74	1.16	51	2.78	1.22		.05	

Appropriateness of getting to know and staying in touch

For getting to know and staying in touch, face-to-face interaction and group meetings are regarded to be most appropriate in all the three waves. Among the CMC tools email was rated as most appropriate. The means have stayed quite stable over time which seems to suggest that community members did not experience a change in the usage of tools during the time of research. Interestingly, weblogs and websites do not seem to play an important role for keeping people updated by means of asynchronous tools of communication. Among the synchronous tools, phone/internet phone and web conferences were also not rated as highly appropriate. According to social presence theory and media richness one would expect that those tools would be rated better than email. This result seems to highlight the importance of emails in the project (Table 21).

In wave 2 computer scientists rated the appropriateness of phone/internet phone lower ($M=3.21$; $SD=.892$) than social scientists ($M=3.81$; $SD=1.109$), which was statistically significant ($p=.062$). Accordingly, computer scientists rated the appropriateness of phone/internet phone in conformance in wave 3 lower ($M=3.20$; $SE=.789$) than the social scientists ($M=4.21$; $SD=.699$). This difference was statistically significant ($p=.003$). There were no significant mean differences between female and male researchers in waves 2 and 3. In wave 4 female researchers rated the appropriateness of video/audio conferences and of mailing lists significantly higher than their male colleagues. Computer scientists rated the appropriateness of web conferences in wave 4 lower ($M=2.63$; $SD=1.025$) than social scientists ($M=3.50$; $SD=1.033$; $p=.023$). Websites were also seen to be more appropriate by social scientists ($M=3.13$; $SD=.885$) than by computer scientists ($M=2.13$; $SD=.885$; $p=.003$).

Table 22 Work on work package tasks and/or deliverables

	Wave 2			Wave 3			Wave 4			Δ mean Wave3 – Wave2	Δ mean Wave4 – Wave3	Δ mean Wave4 – Wave2
	N	Mean	SD	N	Mean	SD	N	Mean	SD			
Face-to-face interaction	56	4.02	1.12	35	4.23	.94	52	3.98	1.11	.21	-.25	-.04
Face-to-face group meetings	56	3.79	1.23	35	4.23	.97	52	3.92	1.08	.44	-.31	.14
Video/audio conferences	56	3.25	1.11	35	3.43	1.04	52	3.48	1.02	.17	.05	.23
Web conferences	56	3.20	1.17	35	3.51	1.01	52	3.21	1.16	.32	-.30	.02
Phone/Internet phone	56	3.45	1.06	35	3.77	.84	52	3.35	1.05	.33	-.43	-.10
Email	56	4.11	.93	35	4.06	.80	52	4.02	.90	-.05	-.04	-.09
Mailing lists	56	3.07	1.09	35	2.97	1.10	52	2.94	1.24	-.10	-.03	-.13
Instant Messenger	54	3.46	1.31	35	3.09	1.22	52	3.27	1.24	-.38	.18	-.19
Forums	56	2.61	1.09	35	2.69	.83	52	2.44	1.02	.08	-.24	-.16
Blogs	56	2.23	1.03	35	2.43	.88	52	2.40	1.03	.20	-.02	.17
Wikis	56	3.18	1.32	35	3.09	.98	52	3.19	1.07	-.09	.11	.01
File repository				34	3.38	1.13	52	3.37	1.17		-.02	
Websites of researchers				35	1.97	.82	52	2.17	1.12		.20	
CMS/Knowledge platforms				35	2.94	1.21	52	3.12	1.28		.17	

Appropriateness of working on work package tasks and/or deliverables

When it comes to the work on work package task and/or deliverables, email was regarded as the most appropriate medium for communication together with face-to-face interaction and group meetings in waves 2 and 4. Only in wave 3 the respondents rated the appropriateness of the face-to-face mode higher than email. The means are quite consistent over the three waves (Table 22). The fact that wave 3 is an exception may be the result of the intensive and important discussions between social scientists and computer scientists carried out in order to arrive at a consensus on the architectural issues of the OKS. This discussion was carried out to a significant extent via email. However, many researchers might have wished to have more face-to-face discussions.

Concerning the *work on work package tasks and or deliverables* females rated the appropriateness of mailing lists lower ($M=2.71$; $SD=1.047$) than their male colleagues ($M=3.23$; $SD=1.087$) in wave 2. This difference was statistically significant ($p=.099$)⁷. There was a significant mean difference ($p=.001$) between computer scientists and social scientists in wave 2: The social scientists rated phone/internet phone as more appropriate ($M=4.13$; $SD=.885$) than the computer scientists ($M=3.04$; $SD=.999$). In wave 3 the respondents from the computer science domain rated the appropriateness of phone/internet phone lower ($M=3.18$; $SD=.874$) than the social scientists ($M=4.36$; $SE=.633$), results that are in congruence with wave 2 as well as statistically significant ($p=.001$). In addition, social scientists rated the appropriateness of mailing-lists significantly lower ($M=2.64$; $SD=.842$) than computer scientists ($M=3.91$; $SD=1.044$). The difference was significant at a level of $p=.003$. In addition, the social scientists rated the appropriateness of web conferences significantly higher ($M=4.07$; $SD=.73$) in statistical terms than their colleagues from the computer science domain ($M=3.27$; $SD=1.009$; $p=.031$).

Female researchers rated the appropriateness of content management systems in wave 3 higher ($M=3.50$; $SD=1.19$) than male researchers ($M=2.57$; $SE=1.207$; $p=.024$).

⁷ In the analysis we have accepted a significant mean difference from the level of .1 onwards.

In wave 4 social scientists rated the appropriateness of web conferences ($M=3.88$; $SD=1.025$) higher than computer scientists ($M=2.71$; $SD=.920$). This result was statistically significant. Furthermore, social scientists rated the appropriateness of file repositories, websites, and content management systems significantly higher than computer scientists ($p<.05$).

Table 23 Appropriateness of creating and discussing new ideas with collaborators

	Wave 2			Wave 3			Wave 4			Δ mean Wave3	Δ mean Wave4	Δ mean Wave4
	N	Mean	SD	N	Mean	SD	N	Mean	SD	- Wave2	- Wave3	- Wave2
Face-to-face interaction	56	4.48	.95	35	4.80	.58	51	4.71	.78	.32	-.09	.22
Face-to-face group meetings	54	4.43	.94	35	4.71	.62	51	4.59	.90	.29	-.13	.16
Video/audio conferences	55	3.40	1.12	35	3.57	.98	51	3.80	.89	.17	.23	.40
Web conferences	55	3.00	1.12	35	3.40	1.01	51	3.12	1.34	.40	-.28	.12
Phone/Internet phone	56	3.29	1.09	35	3.54	1.20	51	3.39	1.13	.26	-.15	.11
Email	56	3.77	.99	35	3.69	.93	51	3.76	1.07	-.08	.08	.00
Mailing lists	55	3.00	1.07	35	3.14	1.17	51	2.96	1.46	.14	-.18	-.04
Instant Messenger	55	3.13	1.25	35	3.00	1.28	51	2.82	1.27	-.13	-.18	-.30
Forums	55	2.98	1.15	35	2.80	.87	51	2.55	1.24	-.18	-.25	-.43
Blogs	55	2.71	1.13	35	2.57	1.07	51	2.51	1.24	-.14	-.06	-.20
Wikis	55	2.87	1.11	35	2.51	1.04	51	2.67	1.39	-.36	.15	-.21
File repository				34	2.29	1.12	51	2.14	1.39		-.16	
Websites of researchers				35	1.91	.98	51	1.92	1.23		.01	
CMS/Knowledge platforms				35	2.60	1.24	51	2.51	1.42		-.09	

The creation and discussion of new ideas with collaborators can be regarded as a highly equivocal task. Accordingly, the respondents chose face-to-face interaction and face-to-face meetings as the most appropriate forms of communication. It is quite obvious that all CMC tools are rated remarkably lower than direct interaction. Interestingly there seems to be a development in video/audio conferences. There is a positive trend towards higher appropriateness rates from wave 2 until wave 4 (Table 23).

In wave 2 the social scientists rated the appropriateness of phone/internet phone higher ($M=4.00$; $SD=1.033$) than the computer scientists did ($M=2.98$; $SD=.956$). This difference was statistically significant ($p=.001$). In wave 3 female researchers rated the appropriateness of phone/internet phone higher ($M=4.14$; $SD=.949$) than their male colleagues ($M=3.14$; $SD=1.195$). This difference was statistically significant ($p=.013$). Female researchers rated the appropriateness of video/audio conferences ($M=3.93$; $SD=.997$) statistically significant higher ($p=.078$) than their male collaborators ($M=3.33$; $SD=.913$). In wave 4 female researchers also rated the appropriateness of video/audio conferences and web conferences significantly higher than their male colleagues ($p<.05$). In wave 3, social scientists rated the appropriateness of face-to-face interaction and face-to-face group meetings significantly higher in statistical terms ($p<.01$) than their colleagues from the computer science domain. This result seems to highlight that social scientists considered jointly creating and discussing ideas a higher priority. In wave 4 social scientists rated the appropriateness of web conferences ($M=3.56$; $SD=1.315$) higher than computer scientists did ($M=2.47$; $SD=1.125$). This result was significant ($p=.015$). The results highlight that joint development of ideas is still something that calls for face-to-

face contacts. Even in a multi-institutional community this aspect has to be considered actively.

Table 24 Appropriateness of dissemination of information to the community

	Wave 2			Wave 3			Wave 4			Δ mean Wave3 -	Δ mean Wave4 -	Δ mean Wave4 -
	N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
Face-to-face interaction	51	3.12	1.28	34	3.56	1.42	46	3.37	1.31	.44	-.19	.25
Face-to-face group meetings	51	3.67	1.16	34	4.00	1.28	46	3.80	1.26	.33	-.20	.14
Video/audio conferences	51	2.65	1.15	34	2.91	1.06	46	2.80	1.20	.26	-.11	.16
Web conferences	50	2.46	1.13	34	2.85	1.13	46	2.43	1.13	.39	-.42	-.03
Phone/Internet phone	51	1.98	.95	34	2.44	1.19	46	2.46	1.22	.46	.02	.48
Email	51	3.75	1.07	34	3.76	1.05	46	3.80	1.09	.02	.04	.06
Mailing lists	51	3.98	1.09	34	3.97	1.09	46	3.70	1.28	-.01	-.27	-.28
Instant Messenger	51	2.14	1.04	33	2.15	1.06	46	2.39	1.18	.01	.24	.25
Forums	51	3.27	1.15	33	3.09	1.13	46	2.65	1.35	-.18	-.44	-.62
Blogs	52	3.56	1.35	32	3.53	1.08	46	2.93	1.44	-.03	-.60	-.62
Wikis	51	3.96	1.20	33	3.52	1.00	46	3.50	1.21	-.45	-.02	-.46
File repository				33	3.39	1.22	46	3.11	1.37		-.29	
Websites of researchers				34	2.91	1.48	46	2.70	1.33		-.22	
CMS/Knowledge platforms				34	3.32	1.15	46	3.33	1.23		.00	

Appropriateness of dissemination to the OPAALS community

As far as the dissemination of information to the OPAALS community is concerned, face-to-face meetings, email, mailing lists and wikis were rated as most appropriate (Table 24). In wave 2 female researchers rated the appropriateness of phone/internet phone, instant messengers, and forums significantly higher than their male colleagues. When it comes to the dissemination in wave 3, computer scientists rated websites higher ($M=3.91$; $SD=.944$) than social scientists ($M=2.92$; $SD=1.32$). This result was statistically significant ($p=.051$). Interestingly, in wave 4 social scientists rated the appropriateness of weblogs, content management systems and file repositories for the dissemination higher than the computer scientists ($p<.05$).

The results of the questions concerning the appropriateness of tools reveal that there are some differences in perception depending on sex and domain. Social scientists seem to prefer synchronous communication in their work. They rated the appropriateness of phone/internet phone and web conferences higher than their colleagues from the computer science domain. There were some differences concerning the perception of the appropriateness of mailing lists in that social scientists rated appropriateness lower when the management of work package tasks and the work on tasks and deliverables was concerned.

From our results one can obviously draw the conclusion that an email does not function as a mere text message writing facility. It is rather the "killer application" of the Internet (and of the project) as it can be used to send text, data, etc. Furthermore, an email can be sent to one or multiple recipients. The asynchronous character is not necessarily a disadvantage: universal access is guaranteed (in the conditions of OPAALS) and the sender can expect that

the recipient will frequently check her emails as it is part of the daily routines in professional life nowadays, and an implicit netiquette of email forbids long delays in answering. The asynchronous character can furthermore help to take the time needed to formulate complex issues, which will help a non-native speaker to overcome the more obvious limitations of synchronous communication. Hence, emailing is quite a widespread activity that is highly defined in various situations for various purposes and thus functions as a common cultural practice. To sum up, despite the limitations of email for conveying multiple cues synchronously, email is a powerful tool. As a result, the high appropriateness ratings of email are not surprising.

Interestingly there are no signals in the data that point to a development of rating the appropriateness of CMC tools (with the exception of email) in the sense that it would get more appropriate from wave 1-4.

There is empirical evidence that face-to-face communication is still very desirable, even in such a multi-institutional and geographically dispersed community as OPAALS. Those results may be caused by the fact that during the period of analysis the joint collaborative platform (OKS) was not deployed yet. Overall, there seems to be the sign of a possible preference for conferencing systems, which in future may be rated higher than phone/internet phone if a critical mass of users in the project can be reached by this tool.

4.1.6 Professional and informal interaction

Participants of the surveys were asked about the self-perception of their professional and informal interaction with other members. The conceptual differences between informal and professional interaction were not stated in any survey. Each respondent had to decide on his or her own on how to distinguish between the two concepts. This approach seemed to be appropriate as it avoided giving a cultural bias by the authors of the questionnaire through defining the differences.

Moreover, each interaction type was divided into three subgroups: members of the same task group, members of the same institution, and the entire OPAALS community. Each respondent had to rate six different interaction situations on a five-point scale where 1 meant "no interaction" and 5 "a lot of interaction".

Based on the assumptions that domain, sex and cultural background of OPAALS members could influence their perception of and participation in OPAALS community the means of each rating were compared.

In the case of all respondents the professional and informal interaction is relatively constant – there is no remarkable trend from wave 2 to wave 4. The highest difference can be stated for *informal interaction with members of the same task group* where the mean decreased from a relatively high level about .45 points (s. Table 28). Professional interaction as well as informal interaction are highest with members of the same institution.

As regards the differences between subgroups some trends could be detected since wave 2 and became statistically significant in wave 4. This was also the case with participants from high IDV cultures who perceived their professional interaction with the entire OPAALS community as being significantly higher ($p=.017$) than respondents from low IDV cultures (Figure 4):

Low IDV: mean = 2.52 (SD: 1.12; N: 21)
High IDV: mean = 3.30 (SD: .93; N: 23)

Throughout all waves: the mean of professional interaction of people from high IDV cultures is higher than the mean of informal interaction (Figure 2 - Figure 4). These differences increased from wave 2 to wave 4 (Figure 4). On the other hand there are no differences of the perceived informal or professional interaction with members coming from low IDV cultures.

Members from low IDV cultures perceive their informal interaction with the OPAALS members of their institution significantly higher than people from high IDV cultures (Figure 6; $p=.024$).

In general MAS shows no continuous influence on perceived interaction intensity so that IDV is a more reliable predictor for discovering differences. Only for professional interaction with the entire OPAALS community low and high MAS groups show the contrary development (Figure 8). In wave 4 this difference became even significant ($p= .002$) and is stronger than the difference between the IDV groups (Figure 7):

Low MAS: mean = 2.4 (SD: 1; N: 20)

High MAS: mean = 3.38 (SD: .97; N: 24)

Table 25 Professional interaction with members of the task group

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 -	Δ mean Wave4 -	Δ mean Wave4 -
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
sex	all participants	56	4.04	.85	35	3.94	.97	49	3.86	1.04	-.09	-.09	-.18
	male	39	4.08	.87	21	3.62	1.02	35	3.71	1.10	-.46	.10	-.36
	female	17	3.94	.83	14	4.43	.65	14	4.21	.80	.49	-.21	.27
domain	computer science	28	3.96	.92	11	4.00	1.00	17	3.47	1.01	.04	-.53	-.49
	social science	16	4.06	.77	14	4.29	.61	16	3.75	1.13	.22	-.54	-.31
culture	low IDV	21	4.05	.86	11	4.09	.94	21	3.76	1.09	.04	-.33	-.29
	high IDV	27	4.11	.85	20	3.90	.97	23	3.91	1.04	-.21	.01	-.20
	low MAS	18	4.17	.79	9	3.89	.93	20	3.65	1.04	-.28	-.24	-.52
	high MAS	30	4.03	.89	22	4.00	.98	24	4.00	1.06	-.03	.00	-.03
	low PDI	26	3.92	.80	19	4.00	.88	23	4.00	.90	.08	.00	.08
	high PDI	22	4.27	.88	12	3.92	1.08	21	3.67	1.20	-.36	-.25	-.61
	low UAI	25	4.12	.78	18	3.94	.87	25	3.84	1.03	-.18	-.10	-.28
	high UAI	23	4.04	.93	13	4.00	1.08	19	3.84	1.12	-.04	-.16	-.20
	low MAS2	16	4.25	.86	10	4.10	.99	20	3.80	1.11	-.15	-.30	-.45
	high MAS2	31	4.00	.86	20	3.90	.97	22	3.91	1.06	-.10	.01	-.09

Range of Mean: 1 – no interaction to 5 – a lot of interaction

Table 26 Professional interaction with members of the same institution

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 - Wave2	Δ mean Wave4 - Wave3	Δ mean Wave4 - Wave2
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
all participants		56	4.34	.96	35	4.14	1.24	49	4.55	.77	-.20	.41	.21
sex	male	39	4.54	.76	21	4.19	1.17	35	4.46	.85	-.35	.27	-.08
	female	17	3.88	1.22	14	4.07	1.38	14	4.79	.43	.19	.71	.90
domain	computer science	28	4.39	.96	11	4.45	.52	17	4.65	.49	.06	.19	.25
	social science	16	4.31	.79	14	4.21	1.19	16	4.38	1.15	-.10	.16	.06
culture	low IDV	21	4.62	.67	11	4.18	1.25	21	4.71	.463	-.44	.53	.09
	high IDV	27	4.15	1.13	19	4.47	.61	23	4.39	.988	.33	-.08	.24
	low MAS	18	4.61	.70	9	3.89	1.27	20	4.65	.59	-.72	.76	.04
	high MAS	30	4.20	1.10	22	4.36	1.14	24	4.46	.93	.16	.09	.26
	low PDI	26	4.19	1.02	18	4.61	.61	23	4.52	.67	.42	-.09	.33
	high PDI	22	4.55	.91	12	4.00	1.13	21	4.57	.93	-.55	.57	.03
	low UAI	25	4.28	1.02	17	4.29	1.05	25	4.52	.65	.01	.23	.24
	high UAI	23	4.43	.95	13	4.46	.66	19	4.58	.96	.03	.12	.14
	low MAS2	16	4.63	.72	10	4.30	1.25	20	4.60	.60	-.33	.30	-.03
	high MAS2	31	4.26	1.06	19	4.42	.69	22	4.55	.91	.16	.12	.29

Range of Mean: 1 – no interaction to 5 – a lot of interaction

Table 27 Professional interaction with members of the entire OPAALS community

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 - Wave2	Δ mean Wave4 - Wave3	Δ mean Wave4 - Wave2
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
all participants		56	2.82	.79	35	2.80	.83	49	2.94	1.05	-.02	.14	.12
sex	male	39	2.90	.85	21	2.76	.89	35	2.97	1.15	-.14	.21	.07
	female	17	2.65	.61	14	2.86	.77	14	2.86	.77	.21	.00	.21
domain	computer science	28	2.71	.76	11	2.55	.82	17	2.71	1.21	-.17	.16	-.01
	social science	16	2.69	.70	14	2.79	.70	16	3.00	.97	.10	.21	.31
culture	low IDV	21	2.62	.59	11	2.55	.52	21	2.52	1.12	-.07	-.03	-.10
	high IDV	27	3.00	.92	20	2.85	.93	23	3.30	.93	-.15	.45	.30
	low MAS	18	2.78	.65	9	2.44	.53	20	2.40	.99	-.33	-.04	-.38
	high MAS	30	2.87	.90	22	2.86	.89	24	3.38	.97	.00	.51	.51
	low PDI	26	2.77	.86	19	2.74	.65	23	3.04	1.19	-.03	.31	.27
	high PDI	22	2.91	.75	12	2.75	1.06	21	2.81	.98	-.16	.06	-.10
	low UAI	25	2.84	.85	18	2.67	.69	25	2.84	1.11	-.17	.17	.00
	high UAI	23	2.83	.78	13	2.85	.99	19	3.05	1.08	.02	.21	.23
	low MAS2	16	2.56	.63	10	2.70	.67	20	2.50	1.10	.14	-.20	-.06
	high MAS2	31	2.94	.85	20	2.75	.91	22	3.36	.95	-.19	.61	.43

Range of Mean: 1 – no interaction to 5 – a lot of interaction

Table 28 Informal interaction with members of the task group

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 -	Δ mean Wave4 -	Δ mean Wave4 -
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
all participants		56	3.88	.94	35	3.60	1.14	49	3.43	1.12	-.28	-.17	-.45
sex	male	39	3.92	.84	21	3.67	.91	35	3.37	1.11	-.26	-.30	-.55
	female	17	3.76	1.15	14	3.50	1.45	14	3.57	1.16	-.26	.07	-.19
domain	computer science	28	3.89	.74	11	4.09	.94	17	3.29	1.05	.20	-.80	-.60
	social science	16	3.94	1.00	14	3.50	1.02	16	3.19	1.28	-.44	-.31	-.75
culture	low IDV	21	3.81	.93	11	4.00	.89	21	3.52	1.17	.19	-.48	-.29
	high IDV	27	3.89	1.05	19	3.58	1.02	23	3.26	1.14	-.31	-.32	-.63
	low MAS	18	3.72	.96	9	3.67	.87	20	3.25	1.12	-.06	-.42	-.47
	high MAS	30	3.93	1.01	22	3.59	1.30	24	3.50	1.18	-.34	-.09	-.43
	low PDI	26	3.65	.94	18	3.61	.92	23	3.61	1.16	-.04	.00	-.05
	high PDI	22	4.09	1.02	12	3.92	1.08	21	3.14	1.11	-.17	-.77	-.95
	low UAI	25	3.72	1.02	17	3.47	.87	25	3.28	1.14	-.25	-.19	-.44
	high UAI	23	4.00	.95	13	4.08	1.04	19	3.53	1.17	.08	-.55	-.47
	low MAS2	16	3.81	1.05	10	3.70	.82	20	3.45	1.15	-.11	-.25	-.36
	high MAS2	31	3.87	.99	19	3.79	1.08	22	3.41	1.18	-.08	-.38	-.46

Range of Mean: 1 – no interaction to 5 – a lot of interaction

Table 29 Informal interaction with OPAALS members of the same institution

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 -	Δ mean Wave4 -	Δ mean Wave4 -
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
all participants		56	4.05	1.05	35	3.77	1.33	49	4.27	.97	-.28	.49	.21
sex	male	39	4.18	.91	21	4.00	1.18	35	4.20	.99	-.18	.20	.02
	female	17	3.76	1.30	14	3.43	1.50	14	4.43	.94	-.34	1.00	.66
domain	computer science	28	4.14	.89	11	4.45	.52	17	4.47	.87	.31	.02	.33
	social science	16	3.88	1.20	14	3.36	1.34	16	3.94	1.24	-.52	.58	.06
culture	low IDV	21	4.14	.91	11	4.36	1.29	21	4.62	.80	.22	.26	.48
	high IDV	27	3.93	1.24	19	3.68	1.11	23	3.96	1.07	-.24	.27	.03
	low MAS	18	3.94	1.00	9	4.00	1.41	20	4.50	.89	.06	.50	.56
	high MAS	30	4.07	1.17	22	3.73	1.39	24	4.08	1.06	-.34	.36	.02
	low PDI	26	3.81	1.17	18	3.78	1.22	23	4.22	.85	-.03	.44	.41
	high PDI	22	4.27	.98	12	4.17	1.19	21	4.33	1.15	-.11	.17	.06
	low UAI	25	3.84	1.18	17	3.47	1.33	25	4.20	.87	-.37	.73	.36
	high UAI	23	4.22	1.00	13	4.54	.66	19	4.37	1.16	.32	-.17	.15
	low MAS2	16	4.06	1.00	10	4.00	1.49	20	4.45	.89	-.06	.45	.39
	high MAS2	31	4.06	1.12	19	3.95	1.08	22	4.14	1.08	-.12	.19	.07

Range of Mean: 1 – no interaction to 5 – a lot of interaction

Table 30 Informal interaction with members of the entire OPAALS community

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 -	Δ mean Wave4 -	Δ mean Wave4 -
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
all participants		56	2.68	1.03	35	2.51	1.01	49	2.76	1.03	-.16	.24	.08
sex	male	39	2.72	1.02	21	2.67	.91	35	2.83	1.10	-.05	.16	.11
	female	17	2.59	1.06	14	2.29	1.14	14	2.57	.85	-.30	.29	-.02
domain	computer science	28	2.64	.91	11	2.64	.92	17	2.71	.92	-.01	.07	.06
	social science	16	2.38	1.02	14	2.14	1.03	16	2.63	.96	-.23	.48	.25
culture	low IDV	21	2.43	.87	11	2.64	.92	21	2.76	1.09	.21	.13	.33
	high IDV	27	2.89	1.15	20	2.40	1.10	23	2.74	1.05	-.49	.34	-.15
	low MAS	18	2.28	.83	9	2.44	1.01	20	2.60	1.05	.17	.16	.32
	high MAS	30	2.93	1.11	22	2.50	1.06	24	2.88	1.08	-.43	.38	-.06
	low PDI	26	2.62	1.10	19	2.26	.73	23	2.78	1.20	-.35	.52	.17
	high PDI	22	2.77	1.02	12	2.83	1.34	21	2.71	.90	.06	-.12	-.06
	low UAI	25	2.48	1.12	18	2.17	.86	25	2.56	1.08	-.31	.39	.08
	high UAI	23	2.91	.95	13	2.92	1.12	19	3.00	1.00	.01	.08	.09
	low MAS2	16	2.13	.96	10	2.40	.97	20	2.60	1.10	.28	.20	.48
	high MAS2	31	3.00	1.00	20	2.55	1.10	22	2.95	1.00	-.45	.40	-.05

Range of Mean: 1 – no interaction to 5 – a lot of interaction

Figure 2 Wave 2: Self perception of professional/informal interaction (grouped by IDV)

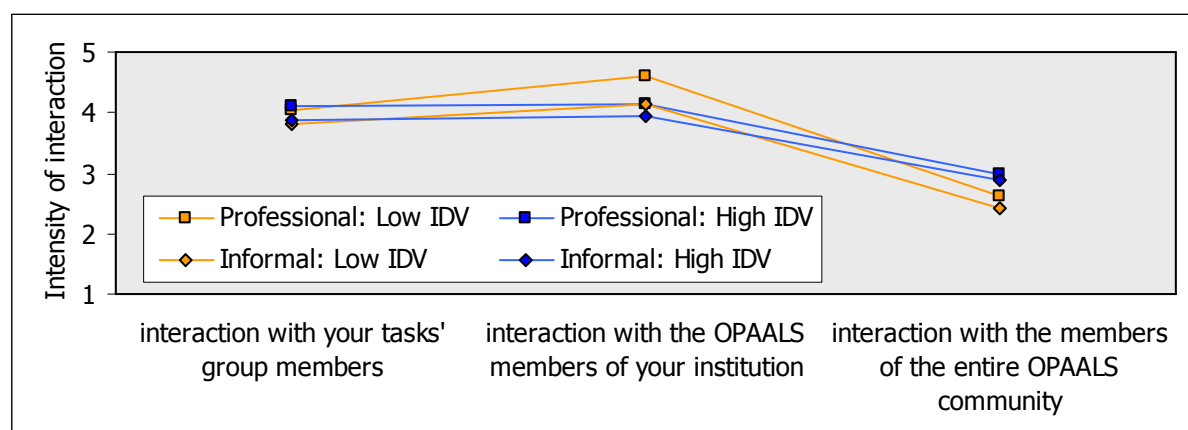


Figure 3 Wave 3: Self perception of professional/informal interaction (grouped by IDV)

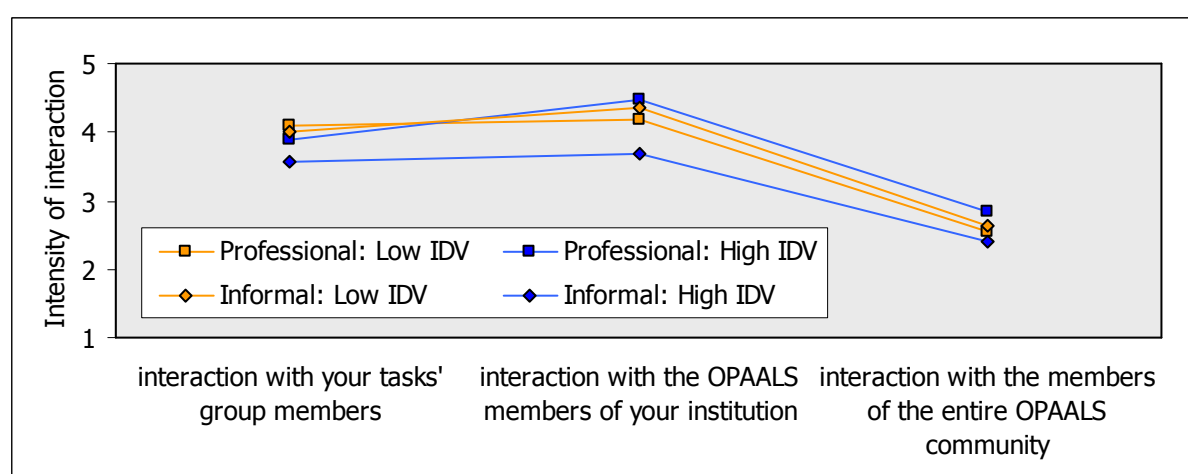


Figure 4 Wave 4: Self perception of professional/informal interaction (grouped by IDV)

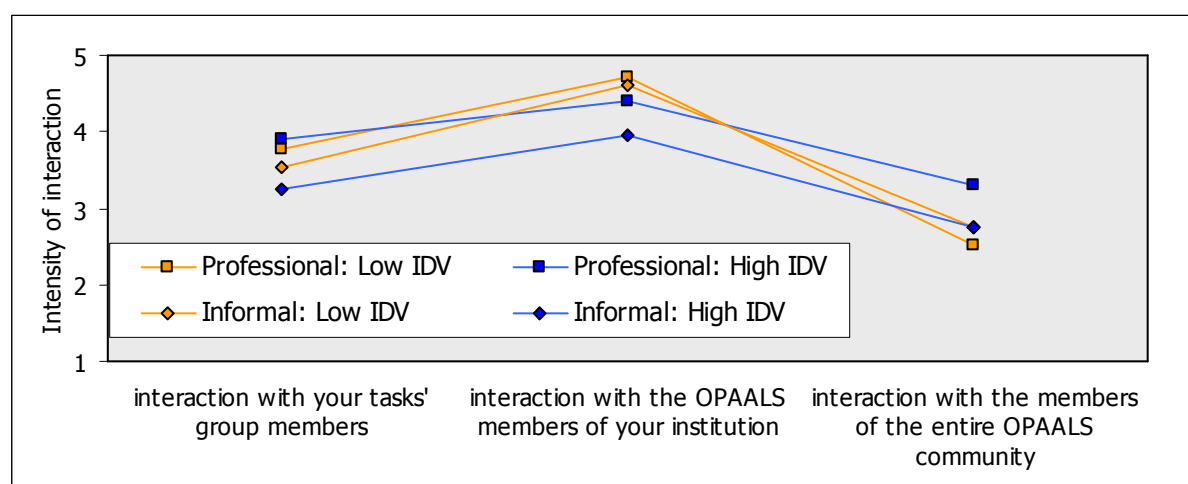


Figure 5 Informal interaction with your task group members

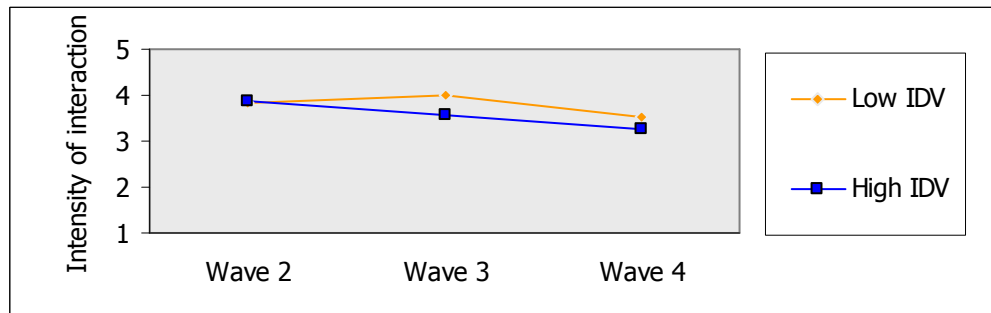


Figure 6 Informal interaction with the OPAALS members of your institution

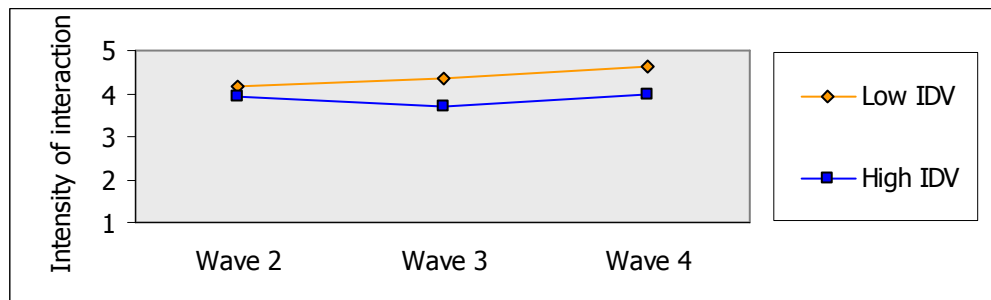


Figure 7 Professional interaction with the members of the entire OPAALS community (IDV)

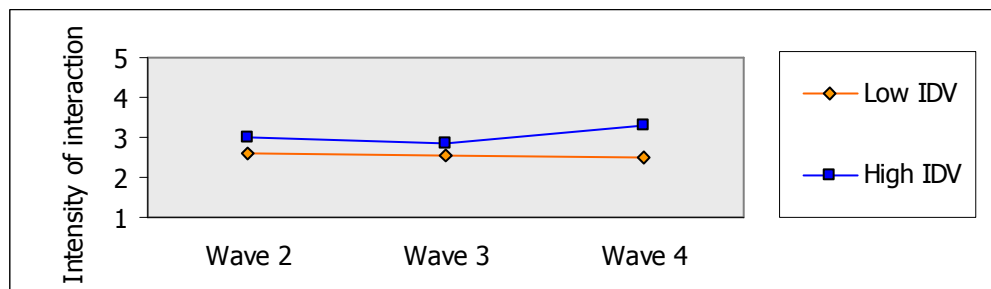
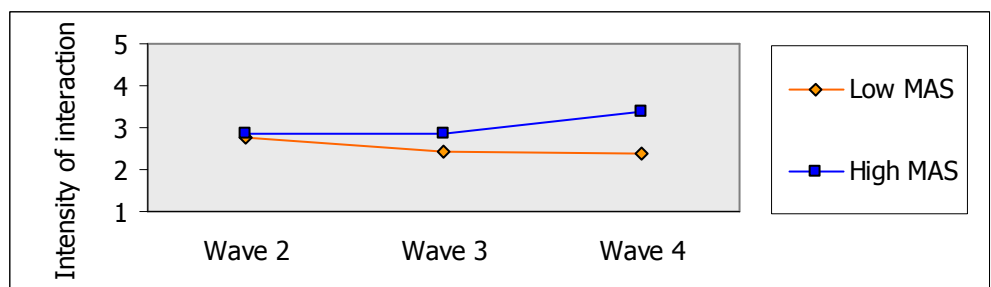


Figure 8 Professional interaction with the members of the entire OPAALS community (MAS)



4.1.7 Number and intensity of contacts

After rating the intensity of their professional and informal interaction respondents had to indicate with which partner institution they had had any contact with. Therefore the professional interaction was divided into four different types in wave 2:

- 1) Discussions of joint projects and tasks
- 2) Exchange of ideas on joint projects and tasks

- 3) Expect/seek input before making decisions
- 4) Information exchange

In wave 3 and 4 the interaction types 1) and 2) were summarised to *work on joint projects and tasks*. Since phase 2 of the project many new partners had joined, which is why wave 1 was not analysed in this context, but rather the analysis was conducted with a constant number of possible contacts.

Respondents had to rate the interaction with each partner on an ordinal scale consisting of five different values. These values needed to be transformed into an interval scale for analysis (Table 31). By using an interval scale it was possible to sum up an intensity index of one interaction type and also an intensity index for all interaction types accumulated (Table 34).

The intensity index was calculated considering the mean interaction intensity of each partner. The interaction intensity for one partner could be 20 as a maximum when having daily contact with that partner regarding all interaction types (four interaction types in wave 2; three interaction types in wave 3 and 4). The mean interaction intensities of each partner were accumulated and divided by the number of partners. So the maximum intensity of professional interaction was 20 when having daily contact with each partner in all interaction types and 0 when having no interaction at all. The simplest interpretation of index 1 would be that the person had *less frequent* contact with each partner in all the interaction types. Because the intensity index is a mean value this interpretation is of course not stringent.

Table 31 Scale for rating intensity of professional interaction with OPAALS partners

Ordinal value	Interpolated interval scale value
daily	20
several times a week	10
several times a month	4
less frequent	1
no contact	0

In order to count the number of contacts for each interaction type of one participant the number of contacts was increased by 1 whenever he or she had a minor interaction with a single partner in the particular interaction type. For the accumulated number of contacts counting was only done once regardless of whether the participant had multiple contacts with one partner. So the maximum number of contacts could be 20 corresponding to the number of possible interaction partners.

As has been mentioned before, members from high IDV perceive their professional interaction higher than people from low IDV do. Now the question is whether these differences can also be detected when considering the actual number and intensity of contacts for professional interaction (information exchange, work on joint projects and tasks, expect/seek input before making decision):

The overall number of contacts for professional interaction is slightly higher for people from high IDV (29.1 contacts vs. 27.7 for people from low IDV) but this is not statistically significant.

Moreover, when weighing the contacts with regard to the intensity for each contact the average intensity is even lower for high IDV people, but these differences are not statistically significant (the likelihood that the differences are random is above 10% in both cases)

Considering the hypothesis that people from low IDV will have weaker ties than people from high IDV cultures, the number of contacts with *less frequent* interaction for each respondent was counted and compared. The analysis shows that the expected difference can be noted, but it is decreasing (s. Table 32).

Table 32 Number of contacts with 'less frequent' interaction

	Wave 2			Wave 3			Wave 4		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
low IDV	21	5.29	3.41	11	6.45	4.27	21	6.67	4.98
high IDV	27	7.19	5.51	20	7.00	5.21	23	7.35	4.86

What is also remarkable are the differences between the domains. The number of contacts between computer scientists and social scientist⁸ differs in that computer scientists have more contacts in wave 2 but this converged in wave 4 (Figure 9). Although interdisciplinary oriented people have a slightly higher number of contacts and intensity of interaction in wave 4 and wave 2, these differences are not significant. Moreover, respondents who locate themselves in several domains have even less contacts and lower intensity in wave 3. As regards the intensity of contacts the female respondents were lacking most in intensity when compared with their male colleagues. However, they could very well cope with that manner so that the difference could no longer be noted in wave 4 (Figure 10).

Figure 11 shows that there are two groups of people with different numbers of interaction partners. The first is the bigger group where members have below 15 different contacts and the majority within this group has around 7 (+/- 2). The second and the smaller group has contact with 15 or more partners. The distinction between these two groups became most clear in wave 4 because the difference between these two groups regarding the mean of the number of interaction partners was growing since wave 2. The mean difference was:

- 1.3 in wave 2
- 1.7 in wave 3
- 12 in wave 4

The group with more interaction partners also has a significantly ($p = .001$) higher intensity of interaction in wave 4: group 1: mean = 1.11 (SD = .67; N = 34)

group 2: mean = 2.32 (SD = .86; N = 18)

The hypothesis that more people with an interdisciplinary background belong to this group showed modest approval. Seven (20,5% of group 1) interdisciplinary respondents belong to group 1 and six (33,4% of group 2) belong to the higher interaction group. The percentage of people from high MAS and high IDV cultures is slightly higher in the high interaction group, but these differences are basically caused by the partners from LSE, Surrey and T6 Eco who are, due to their special task within the NoE, overrepresented within this group. Besides these findings no significant differences between the two groups could be detected.

⁸ Only members who could be assigned to a single domain and were thus without an interdisciplinary background were considered.

Table 33 Number of contacts for professional interaction

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 - Wave2	Δ mean Wave4 - Wave3	Δ mean Wave4 - Wave2
		N	Mean	SD	N	Mean	SD	N	Mean	SD			
all participants		56	10.45	5.44	35	11.66	5.54	49	11.67	6.04	1.21	.02	1.23
sex	male	39	11.15	5.48	21	11.24	5.20	35	12.29	6.06	.08	1.05	1.13
	female	17	8.82	5.13	14	12.29	6.17	14	10.14	5.93	3.46	-2.14	1.32
domain	computer science	28	11.29	5.49	11	13.18	6.15	17	11.76	6.02	1.90	-1.42	.48
	social science	16	6.88	3.48	14	11.64	5.71	16	10.75	6.09	4.77	-.89	3.88
	interdisciplinary	9	12.11	4.98	8	9.88	5.81	13	13.31	5.87	-2.23	3.43	1.20
culture	low IDV	21	10.14	4.82	11	11.27	4.63	21	12.00	6.02	1.13	.73	1.86
	high IDV	27	11.15	5.99	20	12.10	6.09	23	12.17	6.42	.95	.07	1.03
	low MAS	18	10.00	5.10	9	10.56	4.95	20	10.75	6.32	.56	.19	.75
	high MAS	30	11.13	5.73	22	12.32	5.81	24	13.21	5.92	1.18	.89	2.08
	low PDI	26	9.88	5.21	19	12.05	5.68	23	12.83	6.41	2.17	.77	2.94
	high PDI	22	11.68	5.74	12	11.42	5.57	21	11.29	5.93	-.27	-.13	-.40
	low UAI	25	9.96	5.16	18	11.50	5.94	25	11.44	6.34	1.54	-.06	1.48
	high UAI	23	11.52	5.81	13	12.23	5.17	19	12.95	5.98	.71	.72	1.43
	low MAS2	16	9.69	5.26	10	10.30	5.52	20	10.90	6.23	.61	.60	1.21
	high MAS2	31	11.45	5.52	20	12.75	5.60	22	13.91	5.58	1.30	1.16	2.46

Table 34 Mean intensity index of contacts for professional interaction

		Wave 2			Wave 3			Wave 4			Δ mean Wave3 -	Δ mean Wave4 -	Δ mean Wave4 -
		N	Mean	SD	N	Mean	SD	N	Mean	SD	Wave2	Wave3	Wave2
all participants		56	1.34	.72	35	1.51	1.11	49	1.58	.91	.17	.07	.24
sex	male	39	1.49	.74	21	1.56	1.00	35	1.58	.89	.07	.02	.09
	female	17	1.01	.55	14	1.45	1.29	14	1.59	.99	.43	.15	.58
domain	computer science	28	1.39	.76	11	1.73	1.24	17	1.56	.83	.34	-.17	.17
	social science	16	1.11	.66	14	1.49	1.27	16	1.50	.91	.38	.01	.39
	interdisciplinary	9	1.65	.72	8	1.42	.73	13	1.79	1.00	-.23	.37	.14
culture	low IDV	21	1.56	.79	11	1.63	.96	21	1.77	.68	.08	.14	.21
	high IDV	27	1.22	.68	20	1.41	1.17	23	1.53	1.08	.18	.13	.31
	low MAS	18	1.52	.78	9	1.51	1.02	20	1.62	.74	.00	.10	.10
	high MAS	30	1.28	.71	22	1.48	1.14	24	1.67	1.05	.19	.20	.39
	low PDI	26	1.24	.63	19	1.49	1.12	23	1.64	1.03	.25	.15	.39
	high PDI	22	1.52	.85	12	1.48	1.09	21	1.66	.78	-.04	.18	.14
	low UAI	25	1.23	.57	18	1.38	1.13	25	1.54	.98	.14	.16	.31
	high UAI	23	1.52	.88	13	1.64	1.06	19	1.79	.82	.12	.15	.27
	low MAS2	16	1.49	.75	10	1.64	1.39	20	1.61	.69	.15	-.03	.11
	high MAS2	31	1.31	.75	20	1.41	.97	22	1.77	1.07	.10	.36	.47

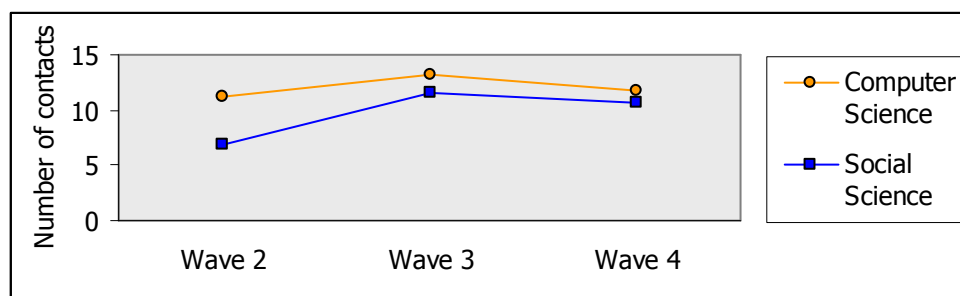
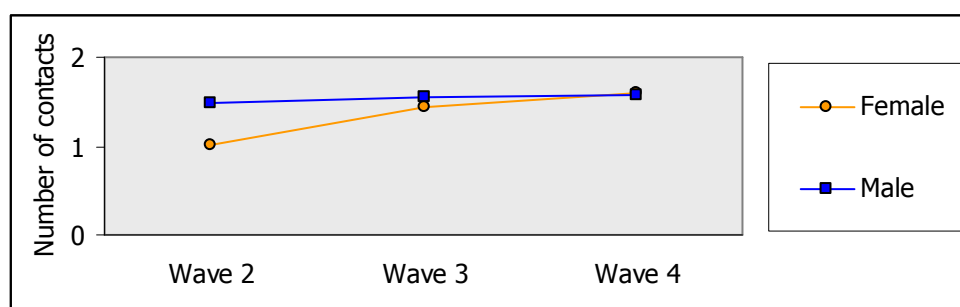
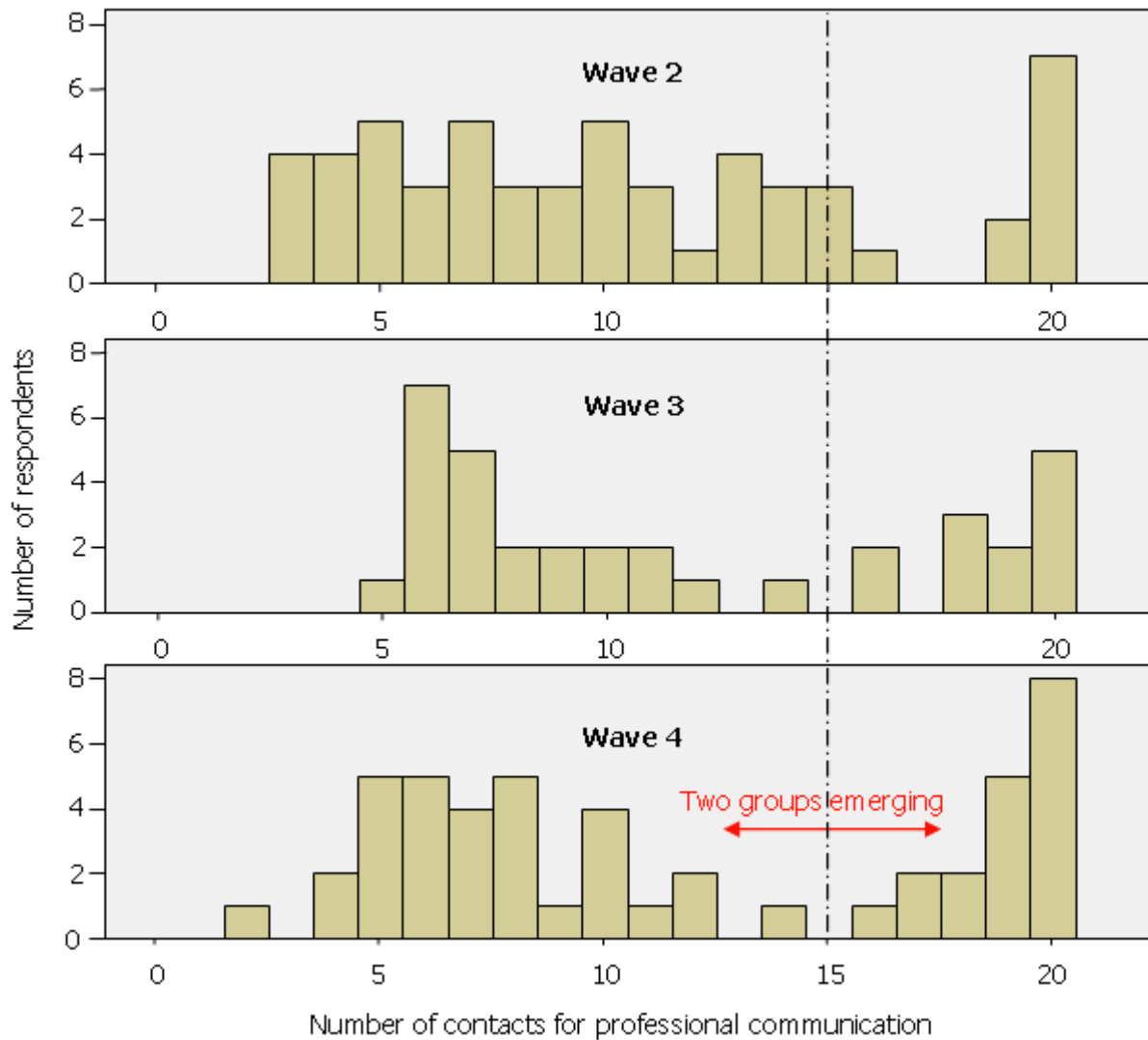
Figure 9 Number of contacts for professional interaction (grouped by domain)**Figure 10** Mean intensity of contacts for professional interaction (grouped by sex)

Figure 11 Histogram for number of contacts for professional communication

4.1.8 Decision making

Within the OPAALS community frequently decisions (deadlines for tasks, etc.) need to be taken. So members were asked about how they evaluated the decision making process(es) they were involved at the work package level (i.e. if they participated in different work packages, they should think of the one they were most active at the time). The work package level was chosen in respect to the fact that insights in the decision making style at the consortium level did not seem to be enough for sufficient perception by an individual member. So this management level appeared to be the highest for a valid opinion.

What is most significant, is the development of the perception in decision making with regard to MAS. While people from low MAS are relatively discordant and the number of respondents who say *The "democratic" decision style is our underlying concept, but sometimes decisions are made authoritatively because of different constraints* is slightly decreasing, it was highly increasing for high MAS respondents: 78% of high MAS members agreed with this diagnosis. Regarding the institutions this difference becomes even clearer: 25 of the 28 respondents (89%) in wave 4 who agreed with this opinion work at an institution in a high MAS nation. At the same time the opinion *We have a "supervisor" who is*

responsible for decision making was not shared by anyone of high MAS culture. Considering that the perception of *Decision making is not based on specific rules, it is more ad hoc* increased in the low MAS culture group, these institutions have not such a clear decision making style.

Table 35 Decision making

		Wave 2					Wave 3					Wave 4				
		N	1	2	3	4	N	1	2	3	4	N	1	2	3	4
all participants		56	18%	18%	45%	20%	35	20%	3%	49%	29%	49	14%	4%	57%	24%
sex	male	39	13%	15%	46%	26%	21	19%	0%	48%	33%	35	17%	6%	57%	20%
	female	17	29%	24%	41%	6%	14	21%	7%	50%	21%	14	7%	0%	57%	36%
domain	computer science	28	11%	18%	46%	25%	11	18%	0%	36%	45%	17	18%	12%	47%	24%
	social science	16	38%	19%	31%	13%	14	21%	7%	43%	29%	16	13%	0%	56%	31%
culture	low IDV	21	19%	14%	52%	14%	11	27%	0%	36%	36%	21	19%	10%	33%	38%
	high IDV	27	15%	22%	37%	26%	20	20%	5%	45%	30%	23	9%	0%	78%	13%
	low MAS	18	28%	11%	44%	17%	9	22%	0%	44%	33%	20	20%	10%	30%	40%
	high MAS	30	10%	23%	43%	23%	22	23%	5%	41%	32%	24	8%	0%	79%	13%
	low PDI	26	15%	19%	38%	27%	19	16%	5%	53%	26%	23	9%	0%	74%	17%
	high PDI	22	18%	18%	50%	14%	12	33%	0%	25%	42%	21	19%	10%	38%	33%
	low UAI	25	24%	16%	32%	28%	18	11%	6%	56%	28%	25	16%	8%	60%	16%
	high UAI	23	9%	22%	57%	13%	13	38%	0%	23%	38%	19	11%	0%	53%	37%
	low MAS2	16	31%	13%	38%	19%	10	30%	0%	50%	20%	20	20%	10%	35%	35%
	high MAS2	31	6%	23%	48%	23%	20	20%	5%	35%	40%	22	9%	0%	77%	14%

- 1 - For a major decision to pass in our work, it must have the approval of the majority
- 2 - We have a "supervisor" who is responsible for decision making
- 3 - The "democratic" decision style is our underlying concept, but sometimes decisions are made authoritatively because of different constraints
- 4 - Decision making is not based on specific rules, it is more ad hoc

Figure 12 Development of perception of decision making process in OPAALS (low MAS)

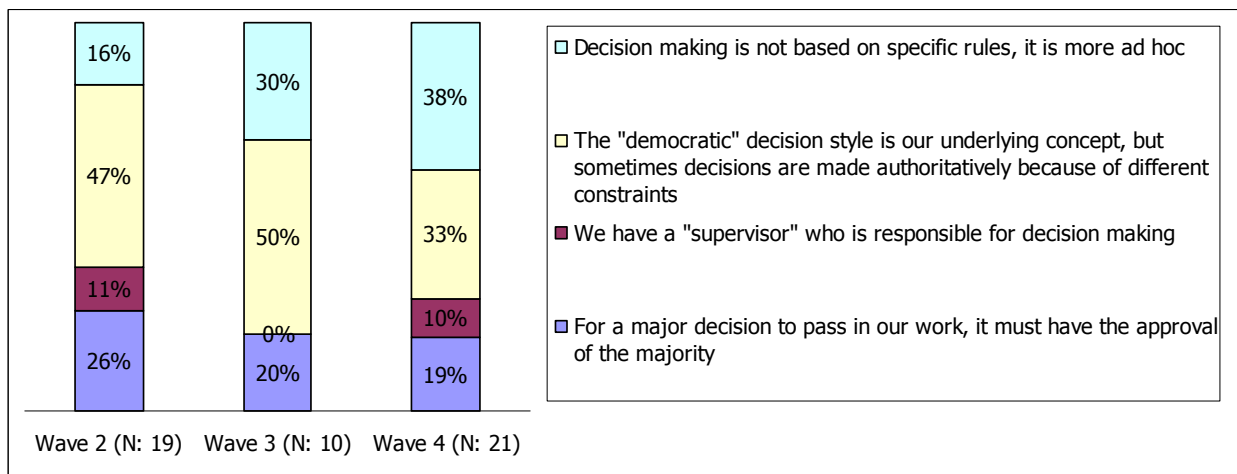
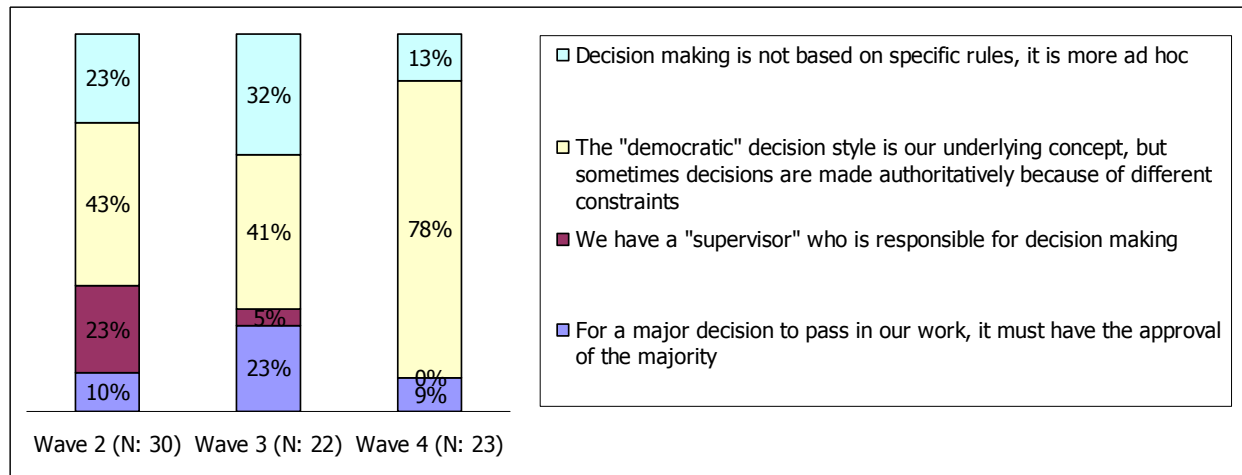


Figure 13 Development of perception of decision making process in OPAALS (high MAS)



4.1.9 Role understanding

Because of methodological considerations participants were not asked about their own role understanding as the influence of a social desirability bias and of the third person effect were expected to be too high. Hence respondents could choose between four possible answers to evaluate the governance of role understanding:

- 1) There is no shared understanding developed yet
- 2) I think a few members have already a clear idea about their role
- 3) A majority has already developed a vague idea about the role
- 4) A majority has already developed a clear perception of the role

In Table 36 the percentage of all the answers given are shown. The number of people who said that *there is no shared understanding developed yet* increased from one in wave 2 to five in wave 3 and 4, which is not the desired tendency. For the other items the percentage of agreeing respondents did not change significantly.

It needs to be noted that only 50% of the social scientist agree to *A majority has already developed a clear perception of the role* in wave 3 and 4 whereas 50% of the computer scientists agree to *A majority has already developed a vague idea about the role*. So there is also a small difference between the domains. However this difference is not dramatically as the items itself are similar in content.

Table 36 Role Understanding

		Wave 2					Wave 3					Wave 4				
		N	1	2	3	4	N	1	2	3	4	N	1	2	3	4
all participants		56	2%	23%	46%	29%	35	14%	11%	37%	37%	49	10%	20%	35%	35%
sex	male	39	3%	21%	46%	31%	21	24%	10%	43%	24%	35	11%	26%	37%	26%
	female	17	0%	29%	47%	24%	14	0%	14%	29%	57%	14	7%	7%	29%	57%
domain	computer science	28	0%	25%	57%	18%	11	27%	9%	55%	9%	17	12%	29%	47%	12%
	social science	16	6%	25%	38%	31%	14	7%	21%	21%	50%	16	6%	19%	25%	50%
culture	low IDV	21	0%	29%	38%	33%	11	27%	27%	36%	9%	21	14%	33%	38%	14%
	high IDV	27	4%	11%	56%	30%	20	5%	5%	45%	45%	23	4%	13%	30%	52%
	low MAS	18	6%	28%	28%	39%	9	22%	22%	33%	22%	20	10%	35%	40%	15%
	high MAS	30	0%	13%	60%	27%	22	9%	9%	45%	36%	24	8%	13%	29%	50%
	low PDI	26	4%	19%	62%	15%	19	16%	11%	37%	37%	23	9%	13%	35%	43%
	high PDI	22	0%	18%	32%	50%	12	8%	17%	50%	25%	21	10%	33%	33%	24%
	low UAI	25	4%	16%	56%	24%	18	17%	11%	33%	39%	25	4%	20%	40%	36%
	high UAI	23	0%	22%	39%	39%	13	8%	15%	54%	23%	19	16%	26%	26%	32%
	low MAS2	16	0%	31%	25%	44%	10	20%	20%	30%	30%	20	10%	35%	35%	20%
	high MAS2	31	0%	13%	61%	26%	20	10%	10%	50%	30%	22	9%	14%	32%	45%

- 1 - There is no shared understanding developed yet
- 2 - I think a few members have already a clear idea about their role
- 3 - A majority has already developed a vague idea about the role
- 4 - A majority has already developed a clear perception of the role

4.1.10 Associations

In each wave the participants were asked to provide metaphors for several concepts, which have a strong link to OPAALS. These concepts (terms) were *language*, *knowledge*, *network*, *Digital Ecosystem*, *collaboration*, *community*, and *OKS*. For each term several input fields (three in wave 1, six in wave 2, and four in wave 3 and 4) were provided so that the participants could type the associations which came in their mind. So far, we have analysed three of these terms, which seem to have most relevance till now: *collaboration*, *community*, and *OKS*.

For the analysis of the associations mentioned most frequently with regard to these terms, similar words and word groups were considered together so as to give clusters of meaning. For example, all associations which included the term "share" were considered to form the cluster "sharing". Subsequently, the number of entries belonging to each cluster could be counted. The result is a ranking of the clusters based on the number of entries through all four waves which shows the evolution of associations for one term. The evolution of the associations of the three most frequent association clusters in each wave for the terms *collaboration*, *OKS*, and *community* is shown in Figure 14 to Figure 16.

Regarding the term *collaboration* (s. Figure 14) we can state that through all waves *collaboration* is most associated with "working together" whereas the association clusters "commonality" and "help" lost considerably in significance. On the other hand, the diffusion of the cluster "sharing" became more relevant.

The three most frequently mentioned associations for *OKS* "collaboration", "sharing", and "knowledge" stayed relatively constant in its relevance, whereas "openness" and "free" lost

from wave 1 to wave 4 due to the higher number of entries since wave 2. These associations stayed relatively constant in absolute number but they lost in relative relevance.

The picture for the term *community* (s. Figure 16) shows a high fluctuation for the associations "commonality", "group", and "people". Only the relevance of "sharing" and "network" were (constantly) increasing.

Regarding all terms, it can be stated that the association "sharing" is very often mentioned for all three terms and its relevance was constantly increasing from wave 1 to wave 4. So people tend to associate something which is shared in a community, in the OKS and through collaboration. It is also comprehensible that the concepts of having something in common and of sharing something are strongly related. However, for the associations of *OKS* the entries show that "commonality" is totally marginal whereas "sharing" is highly relevant. So it can be stated that obviously there are some differences between these concepts, which is why we did not put them in a single association cluster.

The question arises whether the groups of people who share a common association can be characterized by sex, domain or cultural background. For that purpose each of the following associations was analysed in more detail:

Collaboration	OKS	community
- <i>working together</i>	- <i>collaboration</i>	- <i>sharing</i>
- <i>sharing</i>	- <i>knowledge</i>	- <i>network</i>
	- <i>sharing</i>	

However, the analysis revealed no significant characteristic of the people who shared these associations. There was only a weak tendency of female respondents to be slightly overrepresented in most of the association groups.

Figure 14 Evolution of the five most mentioned association clusters for the term *collaboration*

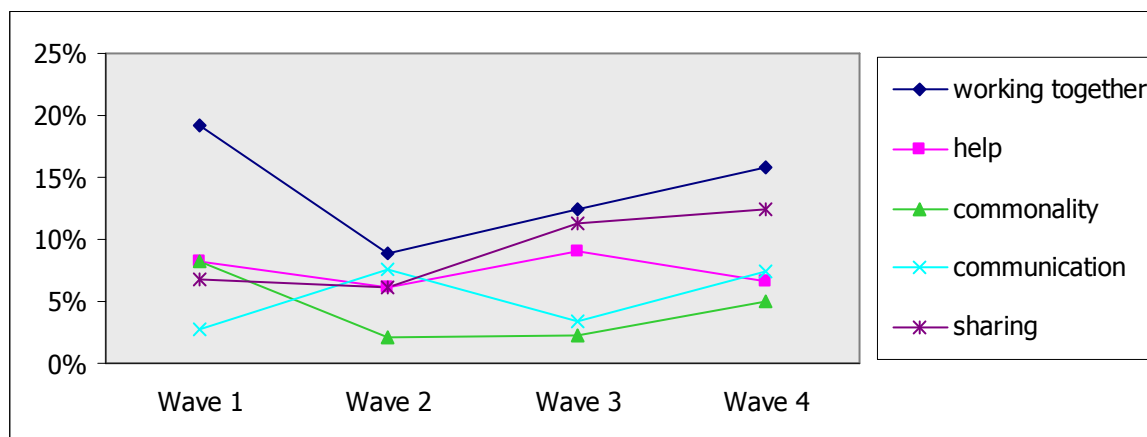


Figure 15 Evolution of the five most mentioned association clusters for the term *OKS*

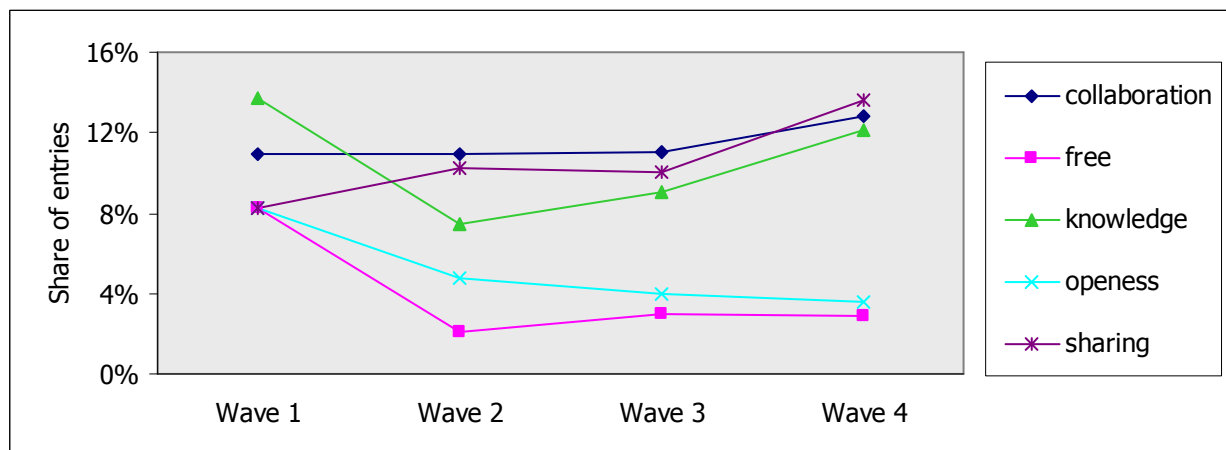
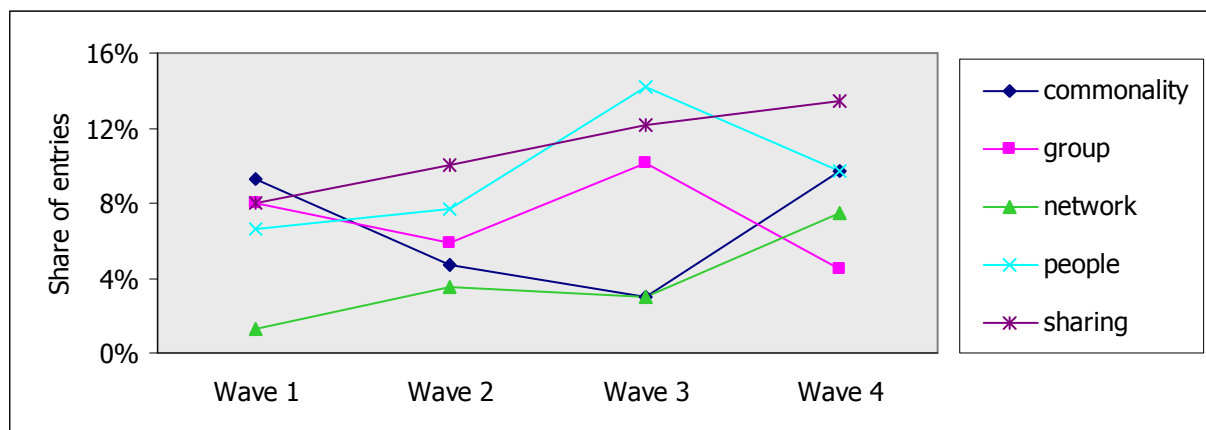


Figure 16 Evolution of the five most mentioned association clusters for the term *community*



4.1.11 Language Usage

When asking about the use of English and the respective native language a distinction was made between written and verbal communication. Respondents could rate the frequency of their language use on a five-point scale:

- most of the time
- often
- not often
- seldom
- not at all

In addition, in wave 3 and 4 a distinction was made between *task group level, During the work for my institution*, and between *interaction with the entire OPAALS community*, whereas in wave 1 and 2 it was only asked for *the work for OPAALS*. The change in the questionnaire appeared to be more sophisticated in respect to the same distinction between informal and professional interaction.

In a first step wave 1 & 2 and wave 3 & 4 were compared, but they showed no notable development. For written communication as well as for verbal communication, many non-native speakers of English used the English language more often than their native language. Even during the work for their institution many respondents rated their native language to be of less importance than English or of the same relevance.

Table 37 Relevance of English language compared to native language in wave 4

		Total N	English used more often	English used as often as native language	English used less often
During work for institution	Written English	33	17	5	11
	Spoken English	32	12	4	16
On task group level	Written English	34	25	6	3
	Spoken English	33	21	2	10
With entire OPAALS	Written English	32	32	0	0
	Spoken English	32	32	0	0

Table 38 Development of language usage

		Wave 1			Wave 2			Wave 3			Wave 4		
		N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
During the work for OPAALS	I write in my native language	23	3.39	1.44	38	4.08	1.08	-	3.81	-	-	3.84	-
	I write in English	23	1.13	.34	38	1.16	.68	-	1.41	-	-	1.47	-
	I speak my native language	23	2.48	1.50	38	3.18	1.35	-	3.51	-	-	3.66	-
	I speak English	23	1.70	1.15	38	1.55	.98	-	1.73	-	-	1.66	-
On task group level	I write in my native language	-	-	-	-	-	-	25	3.72	1.51	34	3.68	1.49
	I write in English	-	-	-	-	-	-	25	1.36	.76	34	1.44	.86
	I speak my native language	-	-	-	-	-	-	25	3.28	1.62	33	3.67	1.51
	I speak English	-	-	-	-	-	-	25	1.64	1.15	33	1.55	.94
During the work for my institution	I write in my native language	-	-	-	-	-	-	25	3.00	1.73	33	3.12	1.62
	I write in English	-	-	-	-	-	-	25	1.88	.97	34	1.85	.99
	I speak my native language	-	-	-	-	-	-	25	2.68	1.70	32	2.72	1.69
	I speak English	-	-	-	-	-	-	25	2.56	1.47	34	2.29	1.19
When I work/interact with/within the entire OPAALS community	I write in my native language	-	-	-	-	-	-	25	4.72	.61	33	4.73	.57
	I write in English	-	-	-	-	-	-	24	1.00	.00	34	1.12	.69
	I speak my native language	-	-	-	-	-	-	25	4.56	.77	32	4.59	.71
	I speak English	-	-	-	-	-	-	25	1.00	.00	34	1.15	.70

Scale of mean:
 1 - most of the time
 2 - often
 3 - not often
 4 - seldom
 5 - not at all

In order to compare the responses given in wave 1 with the responses given in wave 4 the ordinal scale was treated as interval scale so that the mean could be calculated. All means from written and from verbal communication in wave 3 and 4 were then merged to a general mean so that all the waves could be compared with each other. Finally, the numbers revealed a decrease in the relevance of the spoken native language about more than one point of the scale. Because the relevance of English remained static at a high level the loss of

the relevance of the native language can be regarded as an indirect result of the relevance of English (see Table 38).

4.2 Dynamics and directions of the OPAALS-all list – A content analysis

The content analysis considered emails that were sent from December 2007 until December 2008. 163 emails were analysed, which means that 163 emails were sent in that time period via the OPAALS-all list.

The whole of 163 mails were coded by two researchers. In order to check the reliability of the codebook, 27 emails were coded by both researchers independently from each other. Those 27 messages were analysed concerning the inter-coder reliability. Table 39 provides an overview of the reliability for the “content” categories. The reliability is from .85 up to .96. The coding instrument can be regarded as highly reliable.

Table 39 Intercooder reliability coefficients

variable	intercooder reliability in %
primary_purpose	96.3
secondary_purpose	85.2
content	92.6
content_forward	96.4
subject_content	88.9

4.2.1 Sender Characteristics

The mailing list itself displays a certain level of dynamic which is quite difficult to catch up with. We decided to add to the number of subscribers in December 2008 five persons who had written emails to the list in the period of analysis but had left the project in the meantime. 124 persons were subscribers of the list in December 2008. Thus, the number of people in the list was 129. On the whole, 44 persons posted mails via the all list during the period of analysis. That means that 34.1 percent of the members were active during the time of analysis.

If we take a look at the domain background of the senders it can be said that out of the 163 messages posted between December 2007 and December 2008, 49 messages (28.8%) came from social scientists, 30 messages (17.6%) came from computer scientists, and 73 messages (42.9%) were sent by researchers with a various domain background. Finally eleven messages (6.5%) were sent from persons whose domain could not be specified. Those 11 messages were probably sent by administrators (e.g. financial administrators) of the project.

In a next step we analysed the ratio of messages sent by researchers and administrators. Only five messages were sent by clearly defined administrators (e.g. financial administrators). The largest portion of messages was sent by researchers from the project (148 messages, 87.1%), while the origin of 10 messages could not be specified (5.9%). Those messages came from those responsible for the dissemination of the project. The results presented so far do not allow us to answer the question of whether communication in the mailing-list actually is or can be claimed to be democratic.

Exactly 86 messages were sent by work package leaders (52.8%), which seems to show an overweight of messages from the persons in charge of responsibility in the project. However,

it is important to note that to be a work package leader is a scientific position. In order to provide a context-sensitive answer to the democratic aspects of the OPAALS mailing-lists we identified the messages that were sent by the project coordinator in the period of analysis. 62 (36.5%) of all messages were sent by the project coordinator. Those results seem to allow the conclusion that the mailing-list is not undemocratic and not hierarchical. The situation seems to reflect more or less the situation of a complex self-governance process.

4.2.2 Message Characteristics

So far we have presented only data regarding the function of the sender. Now we turn to the content characteristics of the messages that were sent. In our codebook we differentiated between a primary and a secondary purpose of the message in order to be able to provide more detailed insights. Concerning the primary purpose, 117 messages (68.8%) were informational messages, 30 messages (17.6%) were questions (requests for information, collaboration), and four messages (2.4%) were meta-comments (comments on work practices, group processes, and the use of media). 12 messages (7.4%) could not be subsumed under this pattern.

A secondary purpose means that besides one clear primary focus, the messages also served a second purpose. Not every message had a secondary purpose. 76 messages were coded with a secondary purpose. Among them there were 16 informational messages (21.1%), 26 questions (34.2%), and 34 messages (44.7%) can be regarded as meta-comments.

If we add the messages with meta-comments, a sum of 38 messages displays statements as comments on work practices, group processes or the use of media. This results shows that the all-list is also used reflectively in order to negotiate or to display meaning.

In addition, we differentiated between messages that could be grouped under the topics of administration, research or messages that could be assigned to both dimensions. Only three out of the 163 messages could not be grouped according to those dimensions. 71 (43.6%) messages were research related, 45 messages (27.6%) were administration-related, and finally 44 messages (27%) were both research and administration oriented. However, it is worth noting that research related messages also contained the administration of research activities within the project, e.g. research-based requests for papers or presentations. A message was coded as only administrative when it contained no direct research related content, like attendance affirmation or nutrition preferences.

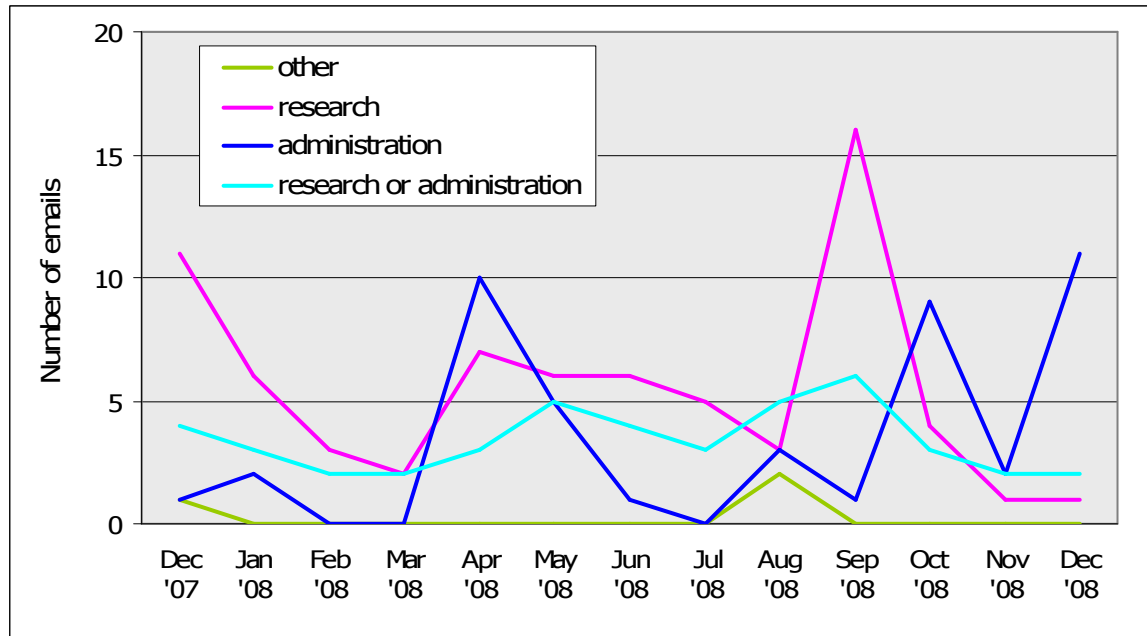
In another dimension we have analysed whether messages forwarded emails from outside the community or from various subgroups or individuals from the community. 144 messages were original messages, not including or forwarding additional messages. 17 emails (1.4%) from outside the community were forwarded and two mails (1.2%) from subgroups or individuals were forwarded.

Finally, we considered to what extent the emails provided links to OPAALS-internal resources as e.g. the OPAALS wiki, the OPAALS website, and the OPAALS file repository. From the 163 messages, 145 messages provided no link to OPAALS resources. There were 16 messages with links to the OPAALS wiki (9.8%), and one link to the OPAALS website and one to the OPAALS file repository (each .6%). We also analysed whether the messages contained links to external sources. 21 messages contained links to external resources.

Figure 17 provides an overview of the topics of the emails that were sent throughout the time of analysis. We can see that there is no significant development in the sense that communication patterns get thicker over time. It is more likely that there are peaks in

communication in the environment of specific project events. There are two clear peaks that can be identified: One is in May 2008 where the Computer Science/Social Science meeting took place, quite an important event in 2008. The other peak is in September 2008 where the 2nd project review took place in Brussels.

Figure 17 Relevance of email topics in the all-list

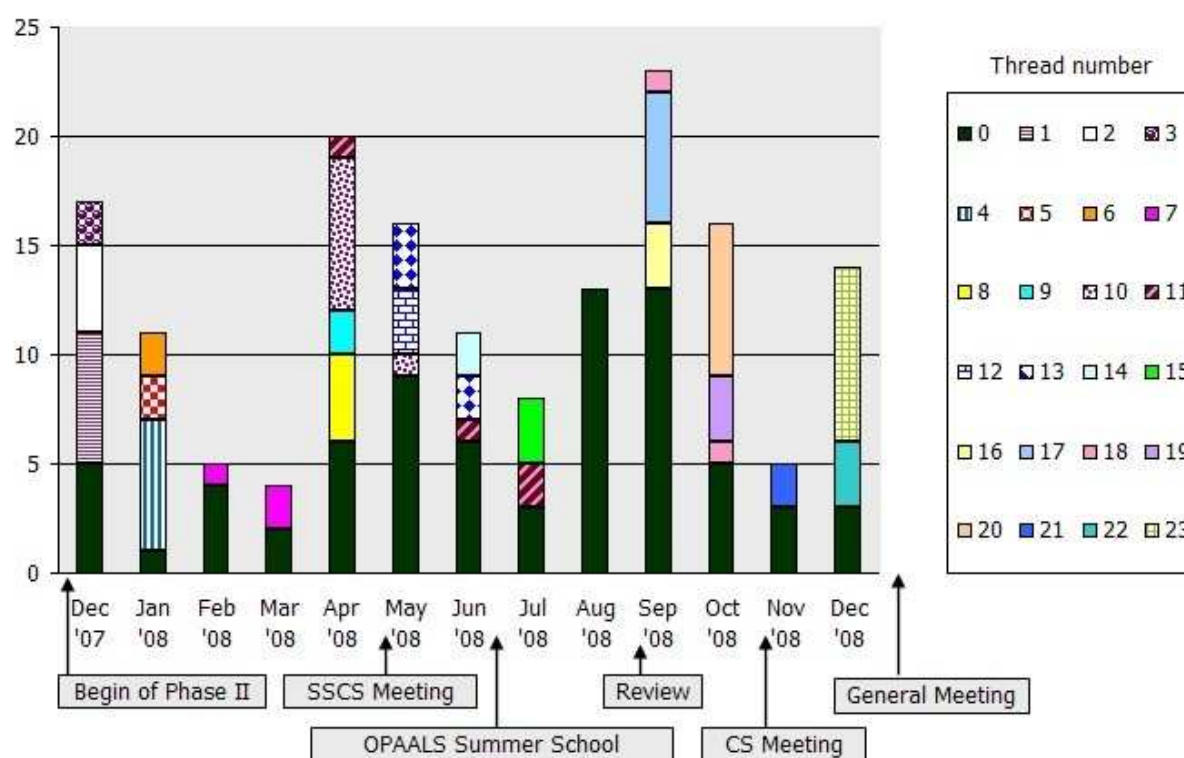


In order to get an impression of the dynamic in the mailing list we defined the various discussion threads (a thread consists of at least two messages of similar content that are related to each other). Therefore, in a first step the subject lines of the emails were used to assign each email to a particular thread. Because 11.7 percent of subject lines were not aligned with the message content, we had to check their content more closely to clarify whether they really belonged to the thread indicated by the subject or not. Finally, we identified 23 threads. Table 40 provides an overview of all threads we have identified in chronological order and Figure 18 displays a graphical representation of the threads in relation to important project events over the time of analysis (thread No. 0 actually is not a thread, but summarizes all emails which do not belong to a thread). We can see that in the temporal closeness of the Social Science/Computer Science meeting in May 2008 and the Y2 Project Review in September 2008 there are peaks in emails circulated via the all-list.

Table 40 List of threads in the OPAALS all-mailing list

#	No. of e-mails	No. participants	Thread name	Summary of content	Root inside all-list	Date of first email	Duration (days till last email)
0	73	25	<Single emails without reply>	various	-	-	-
1	6	4	[Fwd: Re: 1st draft minutes of our phone-call]	phase 2 negotiations	no	2007-12-07	3
2	4	4	Update on Phase II negotiation process	Phase 2 workplan negotiations	yes	2007-12-12	0
3	2	2	V9 Phase II workplan	Phase 2 workplan negotiations	yes	2007-12-20	1
4	6	5	[Fwd: Re: Feedback requested]	Community's feedback on a specific document concerning revision of phase 2 workplan for PO	yes	2008-01-09	2
5	2	1	[Fwd: Re: V10 OPAALS Phase II workplan]	Forwarding of email correspondance with PO concerning version 10 of phase 2 workplan	yes	2008-01-10	11
6	2	1	OPAALS/New Deliverable cover page	Layout specifications for deliverables	yes	2008-01-24	1
7	3	2	[Fwd: Re: OPAALS AMENDMENT]	Amendment 3 negotiations	no	2008-02-29	3
8	4	3	[Fwd: RE: Collection of data from the IST-RTD projects in the context of the 2007 Monitoring exercise - D(2007)846608]	Request for the list of OPAALS publications during 2007	no	2008-04-01	3
9	2	2	Something to discuss (during computing - social domain meetings/workshops at UniS and LSE)	Discussion about network infrastructure	yes	2008-04-15	1
10	8	8	8-9 May Mtg Attendance	Planning of the SSCS meeting in May 2008	yes	2008-04-28	3
11	4	2	OPAALS 2008: Reminder for submission deadline and free attendance	Several single emails for reminding to submit papers for OPAALS 2008	yes	2008-04-29	76
12	3	1	OPAALS Summer School - University of Limerick, Ireland	Request for attendees number for summer school 2008	yes	2008-05-19	6
13	5	3	Introduction to D1.2	Request for feedback on the introduction of D1.2	yes	2008-05-29	5
14	2	2	Minutes from meeting with EC	Reminder on PAR submission	yes	2008-06-16	4
15	3	3	Amendment 4 draft doc	Request for feedback on the Amendment 4 voting document	yes	2008-07-22	3
16	3	1	OPAALS 2008: Registration	Reminder on the registration deadline for	yes	2008-09-04	18

				the OPAALS 2008 conference			
17	6	5	Review presentations	Sending review presentations in advance of review	yes	2008-09-16	1
18	2	2	Y2 Review presentations	Requests to upload review presentations from year 2	yes	2008-09-18	39
19	3	2	Next General Meeting	Request for feedback on the suggested date for GM 2009	yes	2008-10-16	4
20	7	7	OPAALS: Next Computer Science Meeting	Negotiations on computer science meeting preparation	no	2008-10-16	4
21	2	1	OPAALS Computer Science Meeting (Addendum)	Directions to the computer science meetings	no	2008-11-14	0
22	3	3	General Meeting, 12-14 Jan 2009, LSE: Attendee Numbers	Request for attendees number from each institutions for GM 2009	yes	2008-12-09	3
23	8	8	[Fwd: RE: OPAALS Contract Amendment 5 request]	General meeting date negotiation	yes	2008-12-18	1

Figure 18 Overview of threads in the OPAALS-all mailing list

4.2.3 Summary and notes from observations

The overall number of emails that were sent in the period of analysis shows that the mailing list does not suffer from too much traffic. Interestingly, most messages came from social scientists although social scientists rated the appropriateness of mailing lists for conducting

actual work lower than computer scientists (see chapter 4.1.3). All in all, the sender as well as the message characteristics seem to indicate that there are no major “critical” issues regarding the development of the OPAALS-all mailing list.

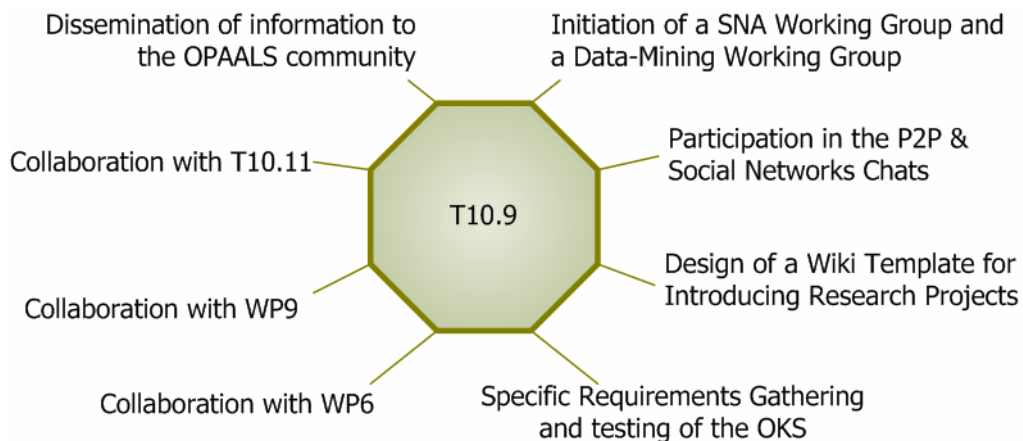
However, this result should be contextualised and interpreted together with several observations that could be drawn from participating as a researcher in the community. In the OPAALS community there are several mailing lists where specific topics that do not necessarily concern the whole community are discussed. There is much more email communication within the project than the analysis of the mailing list would suggest. Regarding the relations of the OPAALS-all list and those various sub-communities, a detailed discussion and a set of recommendations will be presented in chapter 5.

One remarkable “indirect” result reveals that links to the OPAALS wiki are only scarcely given. This might suggest that the OPAALS wiki is not given the attention that it might deserve as a broad project-internal information basis. In the course of a systematic observation of the wiki we have detected several social situations where the wiki was actively used in order to disseminate and document relevant research related content. Conclusions from this observation and respective recommendations will be presented in chapter 5 as well.

4.3 Coordination activities

This chapter is dedicated to elaborate on the coordination activities conducted in task 10.9.

Figure 19 Overview of coordination and collaboration activities of T10.9



4.3.1 Dissemination of information to the OPAALS community

In chapter 2.4.3 the framework for coordination was introduced. We differentiated between the level of the whole community and the level of subgroups in OPAALS. At several points we decided to communicate initial results drawn from our research to the community.

The first time, we introduced the task at the Phase 2 kick-off meeting London where we had prepared a presentation on the aims of task 10.9. At the next meeting in Surrey/London in May 2008 we presented initial data drawn from the second wave of our trend survey study. In addition we sent an email via the OPAALS-all list with a link to a special wiki page where we had uploaded the presentations on the initial survey results.

In order to have the opportunity to disseminate and to discuss research results to the community and to the digital ecosystems community, we submitted two research papers to the OPAALS 2008 conference in Tampere in order to be able to initiate a discussion with the wider digital ecosystems community.

An additional effort made to arrive at a better understanding of self-reflection was to publish a short article on the OPAALS newsletter in January 2009.

4.3.2 Initiation of a Social Network Analysis Working Group and a Data-Mining Working Group

After the OPAALS 2008 conference in Tampere, a timeslot in order to discuss OPAALS internal issues was reserved by the organising committee. At this meeting we suggested to initiate a "social network analysis working group" where OPAALS researchers could share their expertise and experiences with SNA as we had observed that several researchers and partners are conducting social network analysis as well as other partners are designing social networks. Hence social networks are a recurring topic in OPAALS that should be provided with specific communication channels. In addition, a data mining working group was initiated at the Tampere meeting. This information was disseminated to the whole OPAALS consortium via the OPAALS-all list.

Collaborations between the TUT-Team, the IPTI partner, and UniKassel are currently emerging. While IPTI is analysing the social networks created by the OPAALS wiki, UniKassel researchers (in particular the authors of this deliverable) are working together with the IPTI research team on a social network dynamics analysis of the trend survey data and of the all-list as well. Results will probably be presented in D 10.8 "Report on Social Networks in cross-domain collaborations".

4.3.3 Participation in the P2P & Social Networks Chats

The task 10.9 research team was invited to take part in the regular chats initiated by the task teams of T10.11 and T3.8. This participation provided us with very important insights into the necessity to address the importance of social networks to the whole community. Furthermore we observed a multi-institutional, multi-disciplinary, and geographically dispersed collaboration process (which resulted in the initiation of the social network analysis working group).

The chatlogs and the documents that were discussed during the chats have been worked out as a special genre on the projects' wiki⁹.

4.3.4 Design of a Wiki Template for Introducing Research Projects

In OPAALS, various "research projects" are conducted. From the description of work (DoW) it is possible to extract the information on the research conducted within different tasks. In addition it also possible to retrieve information about the research methods and the research design used. If one needs to contact the persons in charge of the task, one can contact the responsible institution. However, this can only be done with enormous efforts.

There are several regular events in order to learn more about the research that is conducted within OPAALS. The Annual General Meeting offers the opportunity to present research results. Furthermore, there are the Summer School and the OPAALS conference.

⁹ http://wiki.opaals.org/Phase2/WP10/Cross-Domain_P2P_Networks

OPAALS as a NoE is composed of many different researchers with a huge variety of skills and expertise on many different research topics. One aspect of reaching sustainability is reached, if additional collaborations not captured in the DoW emerge. Hence, a transparent and accessible resource where the different research projects are introduced could facilitate the process of sustainable community building. Furthermore, this resource would also support ongoing research activities when researchers contact other researchers in order to share expertise and experience.

Based on those considerations we developed a wiki template that should enable research teams to introduce their research projects and circulated the information to the community. The template contains information on the research design (approaches, applied methods, and basic concepts) and a space to provide further resources (for example presentations, links to other wiki pages, etc.). A sidebar consists of information in which work package and the task of the project are indicated as well as information on which partners and individual researchers are involved.

This template should help to increase transparency in the research community and facilitate getting in touch with each other and using the network more effectively. By making explicit to the OPAALS researcher community the different approaches and results, the interdisciplinary work can be supported and it is possible to come up with additional results, ideas, and future research project plans. We are currently in contact with the TUT researchers in order to visualise the relations and how they can be integrated into to OKS.

4.3.5 Data input and exchange with other Tasks/WorkPackages

Due to the OPAALS survey trend study a rich data set is available to the OPAALS community that can be used in order to conduct secondary analyses:

- In collaboration with the T10.11 research team we discussed how to use our data in order to conduct social network analysis on the emergence of inter-institutional collaboration networks. In this process we are collaborating with the IPTI partner.
- In collaboration with WP9 we provided a secondary analysis of our data concerning the multi-disciplinary character of the community and the establishment of a group identity. Those data were used in D9.7.
- In collaboration with WP6 we analysed the associations from the OPAALS survey. For the analysis we used linguistic statistical tools as proposed in the Metaphorological Toolkit (MTK). One result of the joint analysis was also published in D6.7 (pp. 23-25).
- In addition we have provided a group of computer scientists involved in the design of the OKS with data from our survey.
- Together with the ICT we have conducted the specific requirements gathering and testing of the OKS (see next chapter).

4.3.6 Specific Requirements Gathering and testing of the OKS

In December 2008 we were asked to help implementing an online environment where people can rate several features in terms of their relevance to the beta version of the OKS. The aim of that rating was to find out about the priorities concerning the implementation of different functionalities in the OKS. Therefore specific members of the consortium chosen by Anne English and Thomas Kurz were invited to submit their prioritising of specific requirements. The questionnaire was structured according to feature categories which were based on a

wiki article¹⁰ which was open for editing by the whole consortium. Each feature could be rated with *no priority*, *low priority*, *high priority* and *absolute priority*. In a first analysis this priority-scale was mapped on an interval-scale, estimating 1 for *no priority* and 4 for *absolute priority*. The other scale items got the values 2 and 3. Taking this estimation the means (and standard deviations) of the priority ratings were calculated and an overview was sent to the developers of Sironta and Guigoh to help them find an implementation strategy that should fulfil the needs of the OPAALS consortium most efficiently. For a better distinction of the answers the prioritization of each feature was correlated with the number of tools (like Sironta, Guigoh, Facebook, Skype etc.) used by each respondent. The underlying hypothesis was that people who use more tools would be able to give more sophisticated answers because of their experience with using more tools similar to the OKS. If more experienced respondents should tend to a specific prioritization the correlation would show this tendency. Consequently the answers by these people could be considered with higher relevance. Actually the only significant correlation appeared with the feature "Version control: Ability to save history of document, including changes, edited versions, etc." at $r=.63$ ($p=.007$), suggesting that more experienced users tend to lower prioritisation of that feature. However, as it can be seen in Table 41 more experienced respondents still rate this feature with high priority.

Table 41 Relation of participants rating "Version control" in respect to their experience

		Number of used tools (max. 8)					Total N
		1	3	4	5	6	
Version control: Ability to save history of document, including changes, edited versions, etc.	High priority	0	1	2	4	2	9
	Absolute priority	1	3	4	0	0	8
Total N		1	4	6	4	2	17

In a next step the whole consortium was asked about their perception of the progress of the implementation of each feature in Sironta and Guigoh. Respondents could rate their perception on a scale where *Nil* represented the lowest and *Fully implemented* the highest level of implementation. The levels between these extremes were represented through *Partially implemented* and *Mostly implemented*. This ordinal scale was chosen because an interval scale, represented through percentage values, would pretend an inter-subjective precision which actually does not exist. If the implementation level could be rated in percentages it would be necessary that all rated features are phrased in a consistent precision and all respondents need to have the same perception of differences in the implementation level. The ordinal scale as mentioned respects the more subjective perception of the implementation level. For a more objective rating of the quality a second ordinal scale was added to this questionnaire. By using the second scale the respondents could indicate the quality of the functionality of the current implementation. Therefore they could rate *no bugs*, *minor bug(s)* (functionality not considerably affected, i.e. layout bugs, bad usability,...), or *major bug(s)* (functionality considerably affected, i.e. also other functions affected). Because a feature can contain minor as well as major bugs the respondents were asked to indicate the largest bug detected for the particular feature. The

¹⁰ <http://wiki.opaals.org/OKSSpecificRequirementsGathering>

results of this questionnaire will be published together with a second analysis of the prioritising questionnaire with focus on the ordinal nature of the priority scale.

5 DISCUSSION AND RECOMMENDATIONS

The analysis of the survey trend study and the email-list revealed several differences with regard to media choice, perception of governance issues and indicators for a sustainable community building between subgroups defined through the observed independent variables. However, we can also state that there are only weak differences between members of different sex and no significant differences at all between people from high or low PDI or UAI. It can also be stated that there are no notable trends in the relevance of the different work topics in OPAALS.

In this closing chapter we now want to summarise the main findings and to recommend some specific governance measures regarding collaboration and community building as well as a more general governance concern, based on the observed differences and general trends. Those recommendations are intended to ensure that OPAALS will achieve **sustainability** in its community building and to facilitate **interdisciplinary collaboration**. The results are grouped in the dimensions of collaboration, governance, and community building.

5.1 Collaboration

- Finding 1: The analysis of the email subject lines from the all-list showed that there are some emails with subject lines which however are not appropriate to their content. There were not too many emails with wrong subject lines, but still too many for a perfect collaboration (see section 4.2.2., p. 55).
 - Recommendation 1.1: The problem is that on the one hand improper subject lines could cause unnecessary distraction through reading irrelevant emails. On the other hand exact subject lines ensure that the attention of people interested in the matter will be caught and will thus enable an easier retrieval of that email. Moreover, as emails are perceived as a very appropriate tool for many work topics it is necessary that the usage of emails is guided by clear rules which are motivated by an efficient and effective communication for senders and receivers. Of course it is sometimes difficult to find a fitting subject line, especially when replying to a long email which gives many opportunities to refer to. That is why we recommend to change the subject line even when referring to a former email. This tactic seems better than keeping the subject line – especially when the subject line of the root email was already mismatching. It is more important to have a matching subject line than to keep the "Re:" in the reply.
 - Recommendation 1.2: For the OKS as well as for further collaboration we recommend to include a well deliberated communication etiquette which also includes an email etiquette.
- Finding 2: From the content analysis we can draw the conclusion that there were only a few linkings to the OPAALS wiki. By designing a specific wiki-template for introducing research projects (FactsAbout Research Project) we intended to initiate more collaboration between the partners. However, our observations seem to provide the conclusion that the wiki is not regarded to be the general information platform in the project (see section 4.2.2., p. 55).

- Recommendation 2.1: We would recommend that every subscriber of the mailing list should automatically be invited to also subscribe to the OPAALS wiki.
- Recommendation 2.2: Despite the fact that not every OPAALS member seems to have a fact-about card on the wiki, a detailed process how to integrate the OPAALS wiki into the OKS is needed. This process should be defined by the ICT and the OKS developers. There is highly valuable content on the wiki and the wiki is an important record of the OPAALS collaborative history.
- Recommendation 2.3: The systematic wiki observations revealed that the wiki was indeed used for collaboration. However, the architecture of the current wiki version does not support collaboration as it lacks a clear structure and provides no means for discussion. Hence, we recommend to migrate the current wiki version into a more suitable wiki system that facilitates collaboration. OKS tools should take those weaknesses of the current wiki system into consideration in order to develop a better application.
- Finding 3: Concerning the appropriateness of collaboration tools, our analysis revealed domain-related differences in the appropriateness ratings especially for phone/internet phone as well as for web conferences (see section 4.1.5, p. 28).
 - Recommendation 3.1: It is important that the researchers involved in interdisciplinary collaboration are aware of different communication media preferences. Therefore it is important that the persons who want to communicate with each other do not hesitate to negotiate the specific communication channel which fits to the needs of all persons involved.
- Finding 4: Face-to-face interaction and face-to-face meetings are highly valued by the community members. Furthermore, the results regarding the information sources and sources for scientific exchange reveal that conferences and interpersonal interaction are very important for the community members (see section 4.1.5, p. 28).
 - Recommendation 4.1: OPAALS should take into account that besides the efforts taken in order to build the OKS, face-to-face meetings should also be supported in future. That relates to the already existing OPAALS conference and the OPAALS summer school. Those events are quite important for sustainable research community building.
 - Recommendation 4.2: The utility of communication media rises with the diffusion of them within a community. A critical mass needs to be addressable by a specific medium in order to be perceived as appropriate. For the OKS it means that it is of high importance to develop a concrete implementation governance process that ensures that community members are encouraged to use the OKS from the beginning.
 - Recommendation 4.3: Furthermore, our results suggest that there will be differences in the use and perception of the usability of the OKS according to different domain-backgrounds. In addition we would expect that possible differences might also occur between different institutional backgrounds (university vs. company). Hence, we would like to suggest that the further development of the OKS should be informed by usability studies with different user groups.

- Recommendation 4.4: The OKS might profit from an application where work-in-progress papers, discussion notes, etc. can be presented and discussed.
- High level recommendation concerning collaboration processes: Considering that there are many other mailing lists in the community (see section 4.2.3), we suggest that it would be appropriate for the OPAALS community to create a webpage with a comprehensive list overview. This overview should include the descriptions of the respective mailing lists and its aims and target groups. This enables the individual researcher to choose to subscribe to different mailing lists. Furthermore we would encourage that the fact-about cards (from the OPAALS wiki) of the senders be added to each email as signature.

5.2 Governance

- Finding 5: A highly significant difference between institutions in high MAS cultures and those in low MAS cultures appeared (see section 4.1.8, p. 47). Where respondents from low MAS institutions do not have any common perception of their decision making style, the decision making style which is perceived as most relevant in high MAS (The "democratic" decision style is our underlying concept, but sometimes decisions are made authoritatively because of different constraints) actually is what we would also expect to be the general decision making concept within OPAALS. Thus, there could be a kind of social desirability bias in these answers. However, because of the high discordance in low MAS cultures, the respective institutions should reconsider their decision making style and try to come to a clearer perception of it.
- Finding 6: The role understanding differs most between the domains (see section 4.1.9, p. 49). Whereas many social scientists think that most members have already developed a clear perception of their role, computer scientists tend to admit that members only have a vague idea of the role understanding. Actually it is hard to give a good recommendation for coping with this finding because the perception of the role understanding does not differ fundamentally between the subgroups. Maybe the lower trust of the computer scientists in the role understandings of the others is caused by the long discussion on the OKS architecture where two ambivalent approaches were followed. The data show only a little movement to a clear perception of the role understanding of a majority of all members, but also a little movement towards no understanding at all. However, the aim of any community is to develop a shared understanding and of course to ensure that each member gets an understanding of the own role within the community. At the moment the empirical data do not support a development in the intended direction in OPAALS.
 - Recommendation 6.1: More efforts to develop a shared role understanding should be conducted as it is already implemented through the Integration and Coordination Team (ICT). Because the participants had to rate their perception of the role understanding of the other members, the missing positive perception does not necessarily mean that it is really a serious absence of an individual role understanding. However the heterogeneous picture could be caused by too little face-to-face contact. Other reasons will also need to be discussed in the whole community. All in all, coping with this issue should be one of the major governance tasks for the future development of OPAALS.

- Recommendation 6.2: The statements on the OPAALS' group identity developed in D9.7 (pp. 14-17) should be made more accessible (on the wiki, on the OPAALS web page, in a newsletter edition) in order to arrive at a discussion of the OPAALS members on their own identity.
- Recommendation 6.3: In order to update the community on the integration efforts the ICT could report regularly about the success of their activities.

5.3 Community Building

- Finding 7: With regard to the community building it can be stated that there are differences between low IDV and high IDV cultures. As the study by Hichang & Jae-Shin (2008) suggests, persons from low IDV have more interaction with members of their in-group, which is represented through the institution they work for in OPAALS (see section 4.1.6, p. 36). However, they do not differentiate between informal and professional interaction as much as persons from high IDV cultures do. Those people tend to perceive their professional interaction significantly higher than their informal interaction. To get a sustainable and homogenous network it is necessary to be aware of these cultural differences. There is the danger that people from low IDV cultures might stick to their in-groups. Fortunately this effect has not yet arisen in OPAALS. Probably professionalism of the members masks the cultural differences.
 - Recommendation 7.1: We recommend that persons from high IDV cultures ensure that they have a balanced relation of contacts with members from all cultural backgrounds so that they can push people from low IDV cultures beyond their specific in-group by contacting them regularly so that the chances to develop interpersonal trust can increase. Of course also people coming from low IDV cultures need to ensure such a balance. Otherwise they might have a lot of interaction with their in-group and with people from high IDV cultures but less with people from other low IDV cultures. That's why for them it might be more relevant that the OKS has features which support the development of interpersonal trust through elaborated reputation systems (cp. Resnick et al., 2004).
- Finding 8: What has shown itself to be crucial to the task of building a homogenous community is the emergence of two groups: a smaller group with a lot of contacts and second group with fewer contacts (see section 4.1.7, p. 47). It was not possible to characterise these two groups in respect to domain, sex or cultural background or even regarding the work package they belong to. So it is difficult to deduce reasons and recommendations for coping with this difference. However, it is important to ensure that not only these persons will sustain the community, so it is also a question of governance. We assume that there are many WP-leaders as well as members from the ICT in the group with higher interaction. Because no questions were asked about the individual role in OPAALS this is merely an assumption.
- Finding 9: As seen from the analysis of the associations there is one major association whose importance was growing through all waves and through all keywords which were analysed so far (OKS, community and collaboration): sharing of something (see section 4.1.10, p. 50). The relevance of other associations was growing as well, but there is no dominating association at all. So far there is no group sharing a particular association which could be characterised sufficiently by any other

variable. Actually this is a good tendency because it indicates that a common understanding emerges beyond any structural or social boundaries.

- Finding 10: English language usage remained static on a high level and was even indirectly growing in its relevance through the loss of the relevance of the verbal native language (see section 4.1.11, p. 52). This is an indicator that most members accept English as the common language: it became even more important for the work in OPAALS than their native language.
- High level recommendation concerning community building and network enlargement: OPAALS is open for new community members. However, the actual public resources do not provide new members with clear guidelines how to become a member of the OPAALS community. OPAALS should develop policies that concern the joining and leaving of the community, the access to resources, appropriate communication channels, and rules concerning the behaviour of its members. If this won't be provided the sustainability of the community might be in serious danger as members are free to leave at any time so new members should be able to join easily to avoid a steady loss of members. Moreover OPAALS should consider to develop a concrete community enlargement strategy.

5.4 Applied fieldwork methodologies – Lessons learned from T10.9

Our research design was aimed at detecting trends in the establishment of the OPAALS research community. Those data would enable self-reflection and thus support the community building process.

Indeed, we applied fieldwork by conducting a mixed method study comprising a quantitative survey with qualitative (language) elements and a content analysis. Furthermore we actively observed the activities of the community as members of the community. With the choice of our methods we have decided to apply methods that provide a distant perspective on the field. By analysing survey data and data drawn from content analysis it is possible to provide an alternative view on the emergence of the community. Each method constitutes its own image of social reality. We decided to use a survey and a content analysis in order provide a more comprehensive picture than focus groups, semi-structured interviews or virtual ethnography could have drawn. However, a combination of those methods seems to appear highly desirable for future research. From our observation we could gather very important insights into the community that are able to contextualise our research results.

Our data were of use for other tasks in other work packages, and we hope that the recommendations we have drawn from our analysis serve the further development of the OPAALS community. We would still like to argue that self-reflection cannot be underestimated in this respect. Coordination and integration in OPAALS is applied by the initiation of the ICT (Integration and Coordination Team) facilitating cross-disciplinary interaction between specific work packages and tasks. We hope that the data we have analysed are of particular value for that team.

5.5 Future prospects

The general trend towards a sustainable community building does support neither enthusiastic optimism nor frustrated pessimism. As our analysis showed there are some issues (e.g. development of a shared role understanding, the emergence of two groups with different interaction intensity, handling of media choice), which need to be coped with so as

to ensure a sustainable community building. Other indicators (e.g. English language usage, interaction density in general, emerging of a shared understanding regarding particular concepts) already move towards the desired direction.

However, we invite the community to reflect upon the results of our research as well as upon the recommendation we have drawn from those results. Hence, we will initiate a wiki page with the results and recommendations that is open for discussion and further elaboration. We will then summarise the results of that discussion, put it in a short paper and send it to the community via the all-mailing list. This involvement of the whole community should foster a successful self-governance and support a transparent and integrative self-reflection.

For our task in phase 3 we plan to integrate the revealed differences in media choice in the usability testing of the OKS. Furthermore we would like to continue analysing the email traffic through the all-list to get a complete picture of its communication patterns. Additionally we will continue analysing the evolution of language.

6 REFERENCES

OPAALS References

- Botto, F., Briscoe, G., Chatterjee, J., Dini, P., Iqani, M., Marinos, A., Pattanaik, D., & Rivera-León, L. (2009). *Foundations of the Theory of Associative Autopoietic Digital Ecosystems: Part 2*. OPAALS Project Deliverable D12.1.
- Bräuer, M., Dini, P., Dory, B., English, A., Iqani, M., & Zeller, F. (2007). *Principles, Models, and Processes for the Development of the Open Knowledge Space*. OPAALS Project Deliverable D10.5.
- Bräuer, M., Crone, A., Lapteva, O., & Zeller, F. (2007). *Studies/Papers on Discourse Organisation of Epistemic Cultures – Theoretical and Methodological Analyses and Practical Interpolation*. OPAALS Project Deliverable D6.1.
- Bräuer, M., Crone, A., Dürrenberg, C., & Zeller, F. (2008). Governance in the OPAALS Community. In O. Nykänen, J. Huhtamäki, J. Salonen, S. Pohjolainen & K. Silius (Eds.), *Proceedings of the 2nd International OPAALS Conference on Digital Ecosystems: OPAALS 2008* (pp. 28-36). Tampere: Hypermedia Laboratory at the Tampere University of Technology.
- Bräuer, M., Crone, A., Dürrenberg, C., Lapteva, O., & Zeller, F. (2008). Appropriateness of Communication and Collaboration Tools in an International Virtual Research Community. In O. Nykänen, J. Huhtamäki, J. Salonen, S. Pohjolainen & K. Silius (Eds.), *Proceedings of the 2nd International OPAALS Conference on Digital Ecosystems: OPAALS 2008* (pp. 22-27). Tampere: Hypermedia Laboratory at the Tampere University of Technology.
- Brennan, N., Iqani, M., & Rathbone, N. (2009). *Paper on best practice in communication and dissemination in distributed research networks*. OPAALS Project Deliverable D9.9.
- Crone, A., & Bräuer, M. (2008). *Discussion of Different Social Theories as Epistemological Basis within OPAALS*. OPAALS M10.11.
- Crone, A., & Bräuer, M. (2007). *Report on Epistemological Basis of Interdisciplinary Research*. OPAALS M10.7.
- Darking, M. (2007). Understanding the role of governance in the context of digital ecosystems. In F. Nachira, A. Nicolai, P. Dini, M. Le Louarn & L. Rivera Leon (Eds.), *Digital Business Ecosystems* (pp. 78-82). Luxembourg: Office for Official Publications of the European Communities.
- Darking, M. (2008). *Governance in Digital Ecosystems*. OPAALS Project Deliverable D12.2.
- Fitzgerald, B., Gaughan, G., & Ågerfalk, P. J. (2007). *Papers on Basic Characterisation of the OSS 2.0 Phenomenon*. OPAALS Project Deliverable D8.1.
- Fitzgerald, B., Gaughan, G., & Ågerfalk, P. J. (2007). *Inner Source Principles*. OPAALS Project Deliverable D8.2.
- Iqani, M., & Rathbone, N. (2009). *New Branding Guidelines Incorporating Bottom-up Development of a 'Style'*. OPAALS Project Deliverable D9.7.
- Lapteva, O. (2009). *Metaphorological Tool Kit: implementation and results*. OPAALS Project Deliverable D6.7.
- OPAALS (2006). *Annex 1: Description of Work*.
- Shaikh, M., & Berdou, E. (2008). *Review of Open Knowledge Initiatives – Successes and Failures: Evolving Characterization of the OSS 2.0 Phenomenon*. OPAALS Project Deliverable D8.3.

Further References

- Best, S. J., & Krueger, B. S. (2006). Online Interactions and Social Capital: Distinguishing Between New and Existing Ties. *Social Science Computer Review*, 24, 395-410.
- Bouwman, H., van den Hoof, B., van de Wijngaert, L., & van Dijk, J. (2005). *Information and Communication Technology in Organizations. Adaption, Implementation, Use and Effects*. London, Thousand Oaks, New Delhi: Sage.
- Bouwman, H., & van de Wijngaert, L. (2002). Content and Context: An Exploration of the Basic Characteristics of Information Needs. *New Media & Society*, 4(3), 329-353.
- Checkland, P., & Holwell, S. (2007). Action Research. Its Nature and Validity. In N. Kock (Ed.), *Information Systems Action Research. An Applied View of Emerging Concepts and Methods* (pp. 3-17). Springer.
- Cummings, J., & Kiesler, S. (2007). *Coordination Costs and Project Outcomes in Multi-University Collaborations*. Retrieved April 8, 2009, from: <http://www.cs.cmu.edu/~kiesler/publications/PDFs/ResearchPolicy7-15-07.pdf>
- Daft, R. L., & Lengel, R. H. (1984). Information Richness: A New Approach to Managerial Behavior and Organizational Design. In L. L. Cummings & B. M. Staw (Eds.), *Research in Organizational Behavior*, (pp. 191-233). Homewood, IL: JAI Press.
- Fulk, J., Schmitz, J., & Steinfield, C. W. (1990). A Social Influence Model of Technology use. In J. Fulk & C. W. Steinfield (Eds.), *Organizations and Communication technology* (pp. 117-140). Newbury Park: Sage.
- Foth, M. (2006). Network Action Research. *Action Research*, 4(2), 205-226.
- Früh, W. (1998). *Inhaltsanalyse. Theorie und Praxis*. (4th ed.) Munich: Ölschläger.
- Gibbons, M.C., Limoges, H., Nowotny, S., Schwartzman, P. S., & Trow, M. (1994). *The New Production of Knowledge*. Sage: London.
- Granovetter, M. S. (1973). The Strength of Weak Ties. *American Journal of Sociology*, Volume 78, 1360-1380.
- Hargittai, E., & Hinnant, A. (2008). Digital Inequality. Differences in Young Adults' Use of the Internet. *Communication Research*, 35(5), 602-621.
- Hichang, C., & Jae-Shin, L. (2008). Collaborative Information Seeking in Intercultural Computer-Mediated Communication Groups. *Communication Research*, 35(4), 548-573.
- Hofstede, G. H. (2001). *Culture's Consequences. Comparing Values, Behaviors, Institutions, and Organizations across Nations* (2nd ed.). Thousand Oaks: Sage.
- Lee, A. S. (2007). Action is an Artifact? What Action Research and Design Science offer to Each Other. In N. Kock (Ed.), *Information Systems Action Research. An Applied View of Emerging Concepts and Methods* (pp. 44-60). Springer.
- Markus, M. L. (1987). Toward a "Critical Mass" Theory of Interactive Media. In J. Fulk & C. W. Steinfield (Eds.), *Organizations and Communication Technology* (pp. 194-218). Newbury Park: Sage.
- Kollock, P., & Smith, M. (1996). Managing Virtual Commons: Cooperation and Conflict in Computer Communities. In S. C. Herring (Ed.), *Computer-Mediated Communication. Linguistic, Social and Cross-Cultural Perspectives* (pp. 109-128). Amsterdam: John Benjamins.
- Ono, H., & Zavodny, M. (2003). Gender and the Internet. *Social Science Quarterly*, 84(1), 111-121.

- Ono, H., & Zavodny, M. (2007). Immigrants, English Ability and the Digital Divide. *IZA Discussion Papers 3124*, Institute for the Study of Labor (IZA). Retrieved April 8, 2009, from <ftp://repec.iza.org/RePEc/Discussionpaper/dp3124.pdf>
- Orlikowski, W., & Yates, J. (1994). *Genre Repertoire: Norms and Forms for Work and Interaction*. Retrieved April 8, 2009, from <http://dspace.mit.edu/bitstream/handle/1721.1/2510/SWP-3671-45181414-CCS-166.pdf>
- Reason, P., & Bradbury, H. (Eds.). (2001). *Handbook of Action Research: Participative Inquiry and Practice*. London: Sage.
- Schiller, S. Z., & Mandviwalla, M. (2007). Virtual Team Research: An Analysis of Theory Use and a Framework for Theory Appropriation. *Small Group Research*, 38(1), 12-59.
- Schmitz, J., & Fulk, J. (1991). Organizational Colleagues, Media Richness, and Electronic Mail. A Test of the Social Influence Model of Technology Use. *Communication Research*, 18(4), 487-523.
- Short, J., Williams, E., & Christie, B. (1976). *The Social Psychology of Telecommunications*. London: John Wiley.
- Stegbauer, C., & Rausch, A. (2006). Neue Wissensproduktion durch das Internet? Vernetzung von wissenschaftlichen Diskussionsforen am Beispiel des Mailbase-Systems. In C. Stegbauer & A. Rausch (Eds.), *Strukturalistische Internetforschung. Netzwerkanalyse internetbasierter Kommunikationsräume* (pp. 149-168). Wiesbaden: VS Verlag.
- Resnick, P., Zeckhauser, R., Friedman, E. & Kuwabara, K. (2004). Reputation Systems: Facilitating Trust in Internet Interactions. Retrieved April 8, 2009, from <http://www.si.umich.edu/~presnick/papers/cacm00/reputations.pdf>
- Rössler, P. (2002). Content Analysis in Online Communication: A Challenge for Traditional Methodology. In B. Batinic, U.-D. Reips & M. Bosnjak (Eds.), *Online Social Sciences* (pp. 291-307). Seattle, Toronto, Bern & Göttingen: Hogrefe.
- Trevino, L. K., Lengel, R. H., & Daft, R. L. (1990). Understanding Managers' Media Choices: A Symbolic Interactionist Perspective. In J. Fulk & C. Steinfield (Eds.), *Organizations and Communications Technology* (pp. 71-94). Newbury Park, CA: Sage.
- Van Eimeren, B., & Frees, B. (2008). Internetverbreitung: Größter Zuwachs bei den Silver-Surfern. In: *Media Perspektiven 7/2008*. Retrieved April 8, 2009, from http://www.daserste.de/service/studie08_1.pdf
- Wenger, E. (n.d.). Communities of Practice. A brief Introduction. Retrieved April 8, 2009, from <http://www.ewenger.com/theory/index.htm>