

Analysis of collaborative tools usages in heterogeneous contexts

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Abstract: Situations of collaborative working are more and more complex and various in organizations. Such diversification is little studied in the literature. Researches about “technologies usages” in “collaborative situations” mainly focus on specific contexts where a given group is using a specific technology. In this paper, we focus on the richness of a real world environment of collaboration technologies’ implementation, where different groups are working in various contexts (profession, localizations, tasks, etc) and using different tools. We propose a model to analyze usages and to bring with patterns in such complexity. First, we propose a brief introduction about the notion of “usage”. In the second section, we present a research framework obtained by the integration of elements from different models and disciplines. The model was applied to analyze collaborative work tools usage in a French automotive company. As result, this study allowed us to map a global tools usage description, identify user groups’ configurations, their needs, practices and usages.

1 Introduction and research issues

The need for collaboration and more adequate communication is currently growing, because of organizational trends towards decentralization, group dispersion and work contexts diversification, as a response to increased market competition and the need to continuously adapt to environment and social changes. Beside these organizational trends, there is a growing supply of enabling technology applications intended to support collaboration and increase group performance [De01]. This diversification, added to the intrinsic difficulties of collaborative working, create a context where the implementation of collaborative working technologies is a very complicated purpose at the technical, human and organizational levels. Consequently, usages issues are more and more complex, ambiguous and difficult to catch and to represent.

Although the CSCW research field is steadily growing, more detailed insights concerning usage elements and dynamics in various collaborative work settings are needed. This study contributes to this purpose.

The research object of this study is “the usage” of collaborative tools. The aim here consists on the diagnosis and representation of usages in a high-diversified organizational context. Such representation will offer a better visibility of work practices, technologies appropriation processes in a real world context, and usages patterns. This valuable insight will help to identify concrete challenges and solutions for the implementation of collaborative technologies.

It is the goal of this paper to present a conceptual framework that seeks to describe and analyze collaborative tools usages and to report the results of its validation through case studies. The structure of this report is as follow. First, we briefly introduce how the notion of usage is perceived in different literatures (section 2.1); inspired by this state of the art, we then propose a conceptual framework more adequate to the particularities of a diversified research environment (section 2.2). Section 3 discusses the case studies. Finally, we present our findings (section 4) and conclude this paper with the lessons learned (section 5).

2 Research framework

2.1 Related work

“Usage” is the purpose of a mass of research studies from different disciplines such as “Engineering”, “Management Sciences” and “Social Sciences”. Specifically, technologies usage is a central question for CHI (Computer Human Interaction), CSCW (Computer Supported Cooperative Work) and MIS (Management Information Systems) research communities who produced different models to analyze various aspects of this notion, at its different levels (adoption, use and appropriation)¹.

The original focus of CHI researches is the interfaces design and their acceptability by users [Ba92], [Ko05]; recent studies from this domain integrate both logging techniques and qualitative evaluations of user interfaces [Bl05] [Ca05] [Ma05].

In MIS domain, the problematic is well established with validated models and methods (e.g. [Da89], [Da92], [DV96], and [Ve03]) of usages analysis inspired from social psychology and cognitive sciences theories [Ka99]. The main tendency of these models is to predict user behavior and its acceptance of technology².

¹ For more details about usage levels see [Ou05]

² For example, the largest famous and applied approach of usage analysis: TAM (technology acceptance model) of Davis et al, proposes "ease of use" and "perceived usefulness" of the technology as key predictors of its acceptance by user [Da89]. Each of these concepts is measured using detailed variables.

As underlined since the 90s (e.g. [Ba93], [Gr94]), CHI researches originally addressed the usage at the single user level, MIS researches were more oriented to the study of organizational information systems usages at the organizational level, whereas the CSCW literature³ focuses on technology introduction within group and stress on the collective usage of tools at the group level [Gr94]. At this level, the better knowledge of the intended users' workplace and context was identified as success keys of CSCW development [Gr88]. Thus, usage models and empirical meta-analysis from this field of interest were more oriented toward the understanding of "group context" (e.g. group structure, task characteristics, personal factors etc), "group processes" (e.g. decisional characteristics, communication characteristics, tasks articulations, etc) and how technologies features can support them [PK89], [McL92], [Be93], [Hi98], [De01]. Such models aim to understand the appropriation mechanisms of collaboration technologies [DeS94], [Pi05], as well as aspects and impact of technology-context fit on group's performance [Daf86], [Gu90], [McG93], [Ga94], [Hi98], [De01].

2.2 limits of existent researches

Models and approaches of usage analysis evoked in the previous section could not be entirely adopted to our research context due to several differences at various levels: the context, the depth of analysis and the analysis scope. In this section, we present the particularities of this context and the limits of previous works.

- **Context specificities:** In this study, we aim to understand collaborative tools usage patterns in an industrial context to bring with insights that guide further technologies implementation. This environment is richly diversified in terms of groups' composition; work and worker types, work contexts (norms, procedures, etc) as well as used technologies. Although such diversification is common in organizations, they express the lack of adapted tools of diagnosis and analysis. The research seem to neglect this reality, oblivious to this richness, and continue to focus on very particular and homogenous contexts (one group and/or one technology), which is very helpful to the community but not sufficient; in particular while the recent tendencies for more integrated tools⁴ and more flexible workers.
- **Depth of analysis:** It is evident that the aimed model could not offer a deep knowledge of technologies usages in a specific situation of collaboration, as it is generally the case. Its purpose is to bring with, and validate, more general insights about usages patterns and correlation between different contextual parameters (e.g. group composition, shared documents types) and technological features (e.g. functional decomposition, interfaces, ease of use, etc).

³ CSCW literature integrate GDS, Small Group Research, Group conferences, etc

⁴ e.g. MS SharePoint, Oracle collaboration Suite, IBM workplace, etc

- **Scope of analysis:** This approach holds a comparative dimension of usages from different contexts. As it is, the scope of the intended model should cover the context diversity and be practicable for different purposes. Many of targeted questions are already asked separately or partially in the literature. Thus, this model could be obtained by the integration and the reorganization of elements from the CHI, MIS and CSCW findings.

2.3 Questionnaire development

According to the objectives previously clarified, we proposed a questionnaire composed of six modules. A module is set of coherent questions. These modules are the following:

- **The level of use:** It consists of statistical elements about frequency of use, number of user and members' information [these variables are generally tested in models form MIS and CHI researches].
- **The context of use:** that we decompose into organizational, geographic and structural perimeters. Through the last one, we wished to understand the structure of the collaboration teams. The organizational level refers to users' belongings and their hierarchical distribution.[CSCW and GROUP researches strongly focus on these variables in order to understand groups patterns and usages trends]
- **Functional usages:** This part of the study is dedicated to detailed description of functionalities use and evaluation of their usability, usefulness and fit to the collaborative tasks [both models form MIS and CSCW researches investigated these variables].
- **Content usages:** This module offers a detailed description of content⁵ use in collaborative situations. Documents and information are shared and co produced by workers and we interpret them as a part and valuable information about collaborative processes. We suppose that the understanding of document usages (types, volumes, life cycle, etc) is a promising area to identify collaborative usage patterns. Previous works neglected this aspect of usage.
- **Evaluation and user satisfaction:** user satisfaction is measured through two dimensions 1) *usability*: which includes interfaces evaluation, ease of use, access mode, etc; [these variables are mainly borrowed from the CHI domain] and 2) *system usefulness*' for (and effects on) group work.
- **Evolutions:** In this last part, respondents express all the ameliorations they wish observe on the systems. Free commentaries are allowed to them to precise their desires. Thus, evolution may concern ergonomics, functionalities, change management, or any other issue. Answers were then, deeply analyzed and categorized.

⁵ content = document and information

3 Case study

3.1 Collaborative work tools

In this section, we present a description of the studied collaboration tools and we focus on their similarities and differences. Deployed systems could be classified in three main types:

- Document tools offer functionalities of collaborative documents management. Two applications belong to this category :
 - **DocShare** offers to a small size and distributed group (limited number of members) functionalities of document sharing, tagging and versioning.
 - The second system called **Base-Doc** is more appropriate to the publication of institutional and static documents. This later could be used by a large population and accessible to an unlimited number of users.
- Activity management tools are small technological modules, which offer functionalities of collaborative activities tracking. Many tools belong to this category, for example :
 - **µBug** allows the identification, listing, evaluation and resolution of project risks or group's activities problems.
 - **TdBi** is a tool of collaborative reporting on project advancement, group goals realization, etc.
 - **Group-Task** is a tool of shared tasks management in any context of teamwork (project, taskforce, etc). The tool allows to a group of user to define tasks, sub-tasks and their pilots in order to share the same awareness of their execution advancement and status. This system contains notifications functionalities, which inform users (by email) if a task status was changed.
- The third kind of tools is a package of services for teamwork collaboration. This system, called **Group-Service**, is entirely modular and customizable in function of group needs. A Group-Service could contain one or many modules or collaborative services. Offered services include, for example, documents sharing (DocShare), problem-tracking tool (µBug) and shared tasks management (Group-Task).

All these systems and modules are in house developed and maintained. These tools, called *Generic Tools*, were mainly on demand, except Base-Doc. Users could command them using an internal electronic workflow, and generally, they obtain their urls very quickly. Base-Doc command process is more complex, since this system is more structured; it requires a super administrator intervention and a prealable customization of documents meta data.

The following table summarizes the essential characteristics of three tools selected to be presented in this study (Doc-Share, Doc-Base and Group-Services). The principal use refers to the general purpose of the tool. The perimeter of use means the temporal and spatial dimensions of its utilization, according to Johansen matrix (1988) [Jo88]. Tools are also described in terms of their recommended duration of use and recommended number of users. Finally, we briefly resume the main functionalities of each tool and the possible roles of users.

Note that the three tools do not offer the same level of collaborative functions' richness:

- Group-Service is dedicated to the support of advanced collaboration. It offers to users a rich awareness about the collaboration context.
- At a second level, Doc-Share is intended to support medium level collaboration. It offers to users the possibility to interact through documents, to co-produce them and to contribute to their evolution.
- A third level, Base-Doc could be considered as a tool of very weak collaboration. It is more a publication tool since interaction modes are only one-way (from authors to lecturers) and the status of author is given to a limited number of users.

Tool	DocShare	Base-Doc	Group-Services
category	Collaborative document management		Packaged services of group Support
Principal use	Group or project members could use this tool to share a limited number of "working documents".	This tool could be used both in : - Restricted contexts (to share and stock a given group's or project's documents) - Open contexts for the publication of "reference documents". In this case the Base-Doc is accessible for any employees (similar to knowledge repositories)	This tool is suitable for the support of teamwork. The principal uses are : - Sharing of "working documents", project information's and group bookmarks; - Centralization of project or group members' information; - Management of group members' tasks; - Management and tracking of problems and risks;
Perimeter of collaboration	Asynchronous tool Co-located and distributed teams accessible only for Internal teams	Asynchronous tool, Co-located and distributed teams, Could be accessible for external suppliers and partners.	Asynchronous tool Co-located and distributed teams accessible only for Internal teams
Duration of collaboration	limited duration of collaboration (the duration of a project or specific teamwork activity)	Long term collaboration	limited duration of collaboration (the duration of a project or specific teamwork activity)
Group Size	Small size groups	Groups of variable sizes Public Bases are opened to all the employees	Small and medium size groups
Main Functionalities	Functionalities of document management (document meta data, updating and classification) Document Search and filtering by criteria Alert, notification, and subscription,	Functionalities of document management (document meta data, updating and classification) Definition of different document views (filtered by author, date, subject, project and any other meta data) Documents versioning, "full text" Search, functionalities of alert and notification	The same functionalities as DocShare for documents sharing, The same functionalities as µBug for problems and risks tracking; Functionalities of shared tasks, Favorite links sharing, Notice board of information (News)
Administered roles	Administrators Editors Authors Readers	Administrators Authors Readers Groups of authors Group of readers	Administrator Members
Functional complexity	Simple	Simple	Advanced

Table 1. Description of studied tools

3.2 Methodology

The diversification of this study's scope oriented us toward an empiric research with administrated questionnaire. The organizational context in which we operated was very favorable to such methodology, essentially for two reasons. The first is the receptivity of users. Questioned employees were informed that the results of the study would serve to identify their requirements and to help us to take suitable decisions about the evolution of the collaborative tools. Second, the employees were habituated to this mode of investigation since we used an in-house developed tool of online inquiry. This application allows us to store the questions and to present them under a web format.

Questionnaires were nominative; in this way only referenced users could access and respond to them. However, users could respond anonymously after their login.

Since the number of users is very important (thousands of users for each tool), we choose to limit the investigated population to tools responsables. Generally, he/she is the person who administers the system, coordinates the activities and animates the community of the tool users. In addition, he/she is, usually, the initial demander of the tool. We choose to do so because we suppose that these persons are sufficiently positioned, by their specific role, to understand and to evaluate the usage of their tools. In this way, one response corresponds to an evaluation of one tool's usage. If we proceeded differently and asked all users to answer the questionnaires, many different users with different profiles and backgrounds could evaluate very differently the same used tool. In such way, the identification of usage patterns needs a strong effort of responses consolidation at the level of each tool instance, which technically impossible in the case of thousands of instances and in the context of our study. Questionnaires data are represented in the following table (Table 2).

	DocShare	Base-Doc	Group-Services
Targeted population size	600 persons	1900 questioned persons for 1000 instances of the tool.	390 persons
Number of persons who answered the questionnaire	145 answers	195 (Many of them answered for many bases)	87 answers
Rate of answered questionnaires	24,2%	> 20 %	22,3%
Number of questions that composed the questionnaire	43	53	50
Duration of questionnaires	2 weeks	1 month	2 weeks

Table.2. Questionnaires data

4 Results and discussion

4.1 Level of use of collaborative working tools

Levels of use were measured through quantitative and qualitative metrics. The quantitative metric is the frequency of tool's use. The qualitative metric translates the opinion of tools animators if the use level of their systems was sufficient or not for their team's collaboration. We noted that both Doc-Share and Group-Services tools were variably and mainly low used (less than once a week in more than 70% of cases). Tools administrators confirmed that the levels of use of their systems were insufficient.

DocShare users estimate that the principal cause of its low rate of use is due to its functional limitation and the evolution of their group's needs [35% of cases]. Group-Services are designed for more rich collaboration support, but the low collaborative culture of users [in 30% of cases] and the few developed communication and training efforts [in 20% of cases] let them low used.

Concerning Base-Doc, the use was much more frequent. In more than 30% of cases the system was "daily used", whereas occasional use level is observed in only 15% of cases. Base-Doc users confirm that they are satisfied with the use frequency of their bases. This could be explained by the more structural aspect of Base-Doc compared to the other tools. This aspect is present through the process of instances creation, which must be validated by a super administrator and hierarchies, by the time spent to identify users' requirements and to choose appropriated meta-data, and by the institutional dimension of this tool which is dedicated to the management of validated and static documents⁶.

At a second level, users identified mainly and recurrently, five known aspects of useless causes which are the "technical problems" of the systems (essentially the response time), the "ergonomic aspects", the "lack of training and user support", the "limitedness of functionalities" and finally non favorable "cultural aspects".

4.2 Contexts of collaborative working tools' use

Contexts are analyzed at different levels: groups' typology, geographic distribution of users and groups heterogeneity.

⁶ We will focus in more details on the document management and sharing aspects in the section 4.3.

Groups' typology

We identified four types of groups that existed in the organization. We proposed to respondents the following definitions for these group kinds⁷: [We02].

- Project team
- Processes team
- Community of interests
- Community of practices

Users could choose more than one group type. They can, also, propose another type group if they estimate that none of the defined types could represent their community. However, we observed that (in the three questionnaires) in more than 95% of cases, groups belong to the proposed taxonomy. Groups are, in the majority of cases, monotype (in 95% cases for DocShare, 90% for Group-Services and 70% for Base-Doc). The following table describes their typologies for the different tools:

	DocShare	Base-Doc	Group-Services
Project team	36%	32%	50%
Process team	24%	30%	19%
Community of Practices	21%	28%	15%
Community of Interest	13%	10%	7%
Group size (pick)	[6-10] and [10-20]	[> 50]	[6-10]

Table.3. Groups' typology

⁷ used definitions :

- *Project team*: a project team is constituted of individuals from same organization or belonging to different directions. It is formed for a given time with a precise production objective. Its aim is to deliver a product or a given benefits.
- *Processes team*: a process team is constituted of individuals from various professions. This group is more permanent in the time and is aligned with (and defined in) the organization. The objective of a process team is to accomplish an activity (continuation of tasks).
- *Community of interests*: it is composed of individuals that have or not any connected activities but these members share a common interest concerning a precise subject. The purpose of a community of interest is to create and exchange ideas, opinions and beliefs.
- *Community of practices*: Composed of individuals exercising the same profession; the community of practices may be a club of experts, a benchmarking club or any other form of persons meeting that desire to share their professional practices. The main aim of a community of practices is to create and exchange practices, experiences and knowledge.

We can clearly observe the same tendencies of groups repartition for the three tools. This let us to conclude that project teams are the most common form of collective work, followed by process teams. Communities are essentially mobilized around shared practices. Communities of interests, which are much more heterogeneous groups, are common less. DocShare and Group-Services tools results are closely correlated ($r=0.97$) which confirm that users similarly understand and use these two tools. This result is not surprising when we know that 93% Group-Services contain at least one Doc-Share service.

We note that groups of different sizes (see the last row) use these three tools. Group-Services systems are essentially used by small size teams. Whereas Base-Doc systems are essentially used by large size populations. We can interpret this by the inversed correlation between richness of collaborative functions of the tool and the number of users. Thus, it seems that collaboration is easier supported and richer in the case of small size groups.

Geographic repartition

Three kind of geographic repartitions of users are possible. Users may be situated 1) in the same site in France, or 2) in two different regions (sites) in France, or 3) from different countries.

Results show that the publication tool (Base-Doc) is more used to support users from different countries and to diffuse documents and information as widely as possible. DocShare and Group-Services, as collaboration support tools, are less used in international situations. They essentially support collaboration and document sharing in distributed teams in France. Co-located teams need less such tools to collaborate and prefer to interact in face-to-face situations due to their physical proximity. The technology usage is thus opportunistic, because users tend to use tools to bridge some gaps and difficulties when it is necessary (the case of distributed teams) and less to replace usual practices that work correctly (the case of co-located teams).

Although the international dimensions of the company, international and intercultural collaborations' development is very slowly. Language barrier and more general cultural differences inhibit this development. Theses barriers are less insistent when collaboration is limited to corporate communication and institutional information diffusion (where Base-Doc is the suitable tool)

Hierarchical composition of groups

The three questionnaires show that groups are composed by members from heterogeneous hierarchical levels [more than 80% of cases]. Due to technical constraints, the three tools may not be used by external members (partners, suppliers). The need to this kind of collaboration is growing and 20% of users expressed it.

4.3 Functional usage

In this section, we detail functionalities' usage of the three tools. Studied applications offer functionalities of collaborative document management, we will firstly focus on this aspect. Second, we will pay further attention to Group-Service functional decomposition and its usages.

Functionalities of collaborative documents management

Results show that the publication tool (Doc-Base) is essentially used to search information and documents punctually, when it is needed. Since the documents of base-docs are not very evolutive, notification and subscription functionalities are rarely used. In more collaborative settings (DocShare and Group-Services), users are more interested by these latest functionalities. In these contexts, the need for information is more continuous and frequent.

Functional usage of Group-Services

Group-Service is a customizable tool. Services can be added or suppressed by administrators. As it is explained before, a Group-Service could contain one or many modules or collaborative services. Offered services are documents sharing (DocShare), problem-tracking tool (μ Bug) and shared tasks management (Group-Tasks), shared bookmark (Group-Links), news (News), and shared contacts management (Group-Contacts). A Group-Service could encapsulate many instances of one tool. For example, a Group-Service could contain two Doc-Share tools, to manage different types of documents.

The following graph represents Group-Services components, their effective use and their presence rate in the instances. For example, 97% of instances contain at least one DocShare (blue curve), these services are used effectively in 90% of cases (red curve) and the yellow curve show that some systems contain multiple DocShare services for different documents management needs.

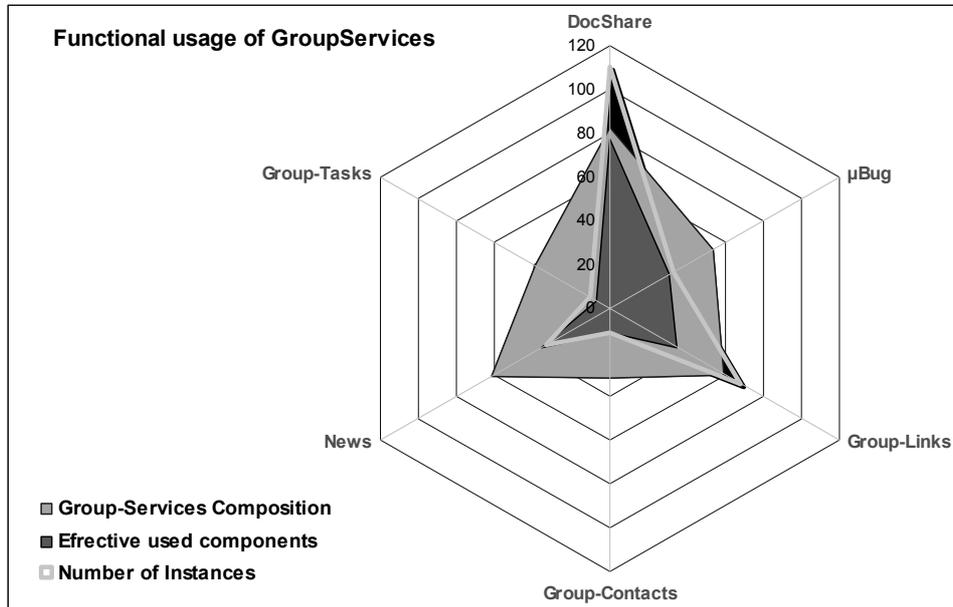


Figure.1. Functional decomposition of Group-Services

The different services are not appropriated in the same ways. To analyze these differences we first define and observe three levels of functional usage:

- *An advanced level usage*, when the service is present and used in all the instances⁸ as it is the case for DocShare service.
- *A medium level usage*, when the service is present at almost 2/3 of instances, and it is used in at least in half of these cases; as it is the case for “μBug”, “Group-Links” and “News” services.
- *A very limited usage*, when very few instances (< 10 %) contain this service such is the case for “Group-Tasks” and “Group-Contacts”.

Users were asked to assess the different services’ usefulness using a scale going from zero to 10 [zero means that the service is not used and useless considered... 10 is given when the service is very useful and considered as indispensable]. These evaluations of functionalities are coherent with the observed usage levels. For example, “μBug” and “Group-Links” services are quoted, respectively, at 5.41/10 and 5.48/10. Whereas, “Group-Contacts” usefulness is evaluated at 3.51/10.

Users explain the useless of “Group-Contacts” by the existence of other wide used and centrally administrated tools offering this functionality, such as the intranet portal. They also estimate that “Group-Tasks” service is difficult to use and agree that shared tasks are hard to conceptualize and to articulate.

⁸ An instance is an example of the tool, which is allowed to a specific population and administered by a tool responsible form this community.

A deeper analysis of Group-Services compositions and verbatim proved the extreme heterogeneity of the real world collaboration situations. A simple statistic analysis of services covariances and correlations did not raise any patterns. In contrary, a cross-analysis of teams' typology and Group-Services composition raised interesting results concerning groups' practices. For example:

- "Communities of interests" strongly share documents, in some cases share news and do not use any of activity management tools.
- More than 80% of "communities of practices" use "Group-links". In some cases, they also use activity management tools (μ Bug and Group-Tasks). This result is surprising and need further investigation to understand in which way these functionalities are suitable for a community of practice.

Finally, verbatim analysis proved that users need more fit of technology to their tasks. They become closer when asking for very specific functionalities of activity management tools (μ Bug and Group-Tasks services).

4.4 Content usage

The common usage of the three systems is the possibility of documents and information management and sharing between team members. Thus, we compared the usage of this common function between the three tools.

First, we suppose that regarding a group documents, three objectives are possible, and may coexist:

- Documents sharing for their collaborative editing and revision (evolutionary documents).
- Documents sharing for publication and diffusion (less evolutionary documents).
- Documents storage for future reuse (concerns validated and static documents).

The following table resumes the results:

	Base-Doc	DocShare	Group-Services
Sharing/ Collaborative editing/ revision	26%	72%	69%
Publication/ Diffusion	58%	60%	69%
Storage / documents repository	54%	29%	44%

Table.4. Document Usage

These statistics explain the proportion of tools used for the three principal "Document Usages". We note that it is hard to separate these three usage kinds. It is only possible to observe the trend of these usages and their picks. We note for example that:

- In collaboration settings (DocShare and Group-Services), archiving documents is less needed compared to the need of sharing and diffusing them to other members.
- Since the publication tool (Base-Doc) is widely used by large size groups, sharing and evolving documents in this context is rarely needed (only 26% of cases).

We second analyze the content nature. By “content”, we mean all kind of documents and files we find in the tools’ databases. Document typology, volume, duration, statue and life-cycle are the most important attributes that allow us to describe this content. We supposed that five types of documents may be used in the case of group work:

- Work documents (minutes, presentations, project outcomes, etc),
- Organizational-Reference documents (samples, procedures, etc),
- Profession-Reference documents (technical reference documents),
- Benchmark documents (scientific papers, news about concurrents, etc),
- Personal documents (emails copies, pics, etc).

In the case of collaboration tools (DocShare and Group-Services), content is generally very heterogeneous and is a melting of work and reference documents. In the majority of cases (> 70%) the content is light, so the number of document rarely exceeds 50 and should be useful for 6-12 months at maximum.

Concerning Base-Doc, content is more homogeneous and structured. It consists of a unique type of documents in more than 70% of cases (essentially document of reference). Here the documents number is much more important (> 200 per base) and has a longer duration of use (> 18 months).

Cross analysis of groups’ typology and documents typology, raise interesting results. For example, in the case of the three tools, we noted that project team members essentially share “working documents” (more than 90% of cases). In only 16 % of these communities bench documents are shared. This type of documents is specifically shared between communities of interests’ members. This kind of results is interesting in the way they allow us to understand practices and needs of different group kinds and to propose suitable functionalities to them. It is evident that users do not share different documents types in the same ways. “Working documents”, for instance, need to be reviewed and co-authored whereas bench documents need only to be shared and commented by users. Thus, for theses different usages, different functionalities should be proposed for specific types of groups.

4.5 Evaluation aspects

We suppose that group performance is a result of good fit and suitable appropriation between technology and group. Performance has been used in different ways by different researchers [Be93], [De98], [De01] and mainly defined in terms of three major factors:

- 1) Quality or effectiveness as defined by decision quality and outcomes quality,
- 2) Efficiency as defined by the time to complete the task or to take decision and the quantity of production and
- 3) Participants' satisfaction with the process and/or outcomes.

Respondents think that these collaboration and publication tools have little effect on their group efficiency, so they are not more productive when using these tools. Moreover, tools usage ameliorates their results quality [38% of responds] and essentially improves group members' reactivity [45% of responds].

As said before, interface ergonomics was mentioned as a principal cause of low use levels. Users of Doc-Share and Group-Service asked essentially for more simplified and convivial interfaces, the possibility of their personalization, simplified use of functionalities and easier administration tools and facilities. Although the interface simplifications demands, users are very interested in new collaborative functionalities such as shared calendar, Forum, data bases, and workflows!

Users of Base-Doc are more interested in a more sophisticated research engine and in reporting tools, which allow them to track the number of logs and documents utilization statistics.

5. Conclusion

The originality of this work is the analysis of usage of collaborative systems in a heterogeneous environment. A previous bibliographical research, in different literatures corpuses, was conducted to identify the usage elements in order to get a complete vision about this notion. Pertinent elements were then selected, reorganized and translated in modules of questions addressed to a large population of users from very different contexts.

The study was based on an empiric methodology approach. We did not wish to present a detailed analysis of a specific tool usage by a specific group of persons. We preferred, to have a wider and less deep vision of group technologies usages (we did not take care of all usage aspects, which is very complex task, but targeted all tools and all users). Different systems were studied (offered services/functions, perimeters of use and functional complexity). The analysis focused on the aspects of: functional use of tools, configuration of user groups and collaborative content usage. It shows some similarities in use of collaborative tools and a quiet difference between publication tool usage and collaboration tool usage. We observed more maturity in the use of publication tools and evolution needs to better support collaborative work.

The major limit of this work concerns principally the perimeter of the study, which focused on the descriptive aspects of the "usage". Other aspects of usage, including its logics, symbols and cognitive representations were not investigated. This requires additional methodologies of observation and deep interviews with users.

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References

- [Ba92] Bannon, L.J.: Perspectives on CSCW : From HCI and CMC to CSCW, In Proceedings International Conference on Human-Computer Interaction (EW-HCI'92), St. Petersburg, Russia, August 1992; p148-p158.
- [Ba93] Bannon, L.J; Hughes, J.: The Context of CSCW, In: K.Schmidt (ed): Developing CSCW Systems: Design Concepts, Report of COST14 "CoTech" Working Group 4, Risø National Laboratory, Denmark 1993; p 9-p36.
- [Be93] Benbasat, I.; Lim, L.H.: The effects of group, task, context, and technology variables on the usefulness of group support systems: a meta-analysis of experimental studies, Small Group Research, 24(4), 1993; p430-p462.
- [BI05] Blackwell, A.; Jones, R.; Milic-Frayling, N.; Rodden, K.: Combining Logging with Interviews to Investigate Web Browser Usage in the Workplace, Position paper, CHI2005 Workshop 6, Portland, 2005.
- [Ca05] Campbell, J.: Log and Qualitative Analysis of Collaborative Systems, Position paper CHI2005 Position paper, CHI2005 Workshop 6, Portland, 2005.
- [Da89] Davis, F.D. : Perceived Usefulness, Perceived Ease of Use, and user Acceptance of information Technology. MIS Quarterly, 1989; p319-p339.
- [Da92] Davis, F.D.; Bagozzi, R.P.; Warshaw P.R.: Extrinsic and Intrinsic Motivation to Use Computers in the Workplace, Journal of Applied Social Psychology, Vol. 22, No. 1992; p1111-p1132.
- [Daf86] Daft, R.L.; Lengel, R.H.: Organizational information requirements, media richness and structural design, Management Science, 32(5), 1986; p554-p571.
- [DeS94] DeSanctis, G.; Poole, M.S.: Adaptive Structuration Theory, Organization Sciences, vol.5 No 2, 1994.
- [De88] Dennis, A.R.; George, J.F.; Jessup, L.M.; Nunamaker, J.F.; Vogel, D.R.: Information technology to support electronic meetings, MIS Quarterly, 12(4),1994; p591-p624.
- [De01] Dennis, A.R.; Wixom, B.H. Vandenberg, R.J.: Understanding Fit And Appropriation effects In Group Support Systems Via Meta-Analysis, MIS Quarterly, Vol. 25 Issue 2, 2001; p167-p194.
- [DV96] Davis, F.D.; Venkatesh V.: A critical assessment of potential measurement biases in the technology acceptance model: three experiments, International Journal of Human-Computer Studies, Vol. 45, No. 1, 1996; p19-p45.
- [Ga94] Galegher, J.; Kraut, R.E.: Computer-mediated communication for intellectual teamwork: an experiment in group writing, Information Systems Research, 5(2), 1994; p110-p138.
- [Gr88] Grudin J.: Why CSCW applications fail: problems in the design and evaluation of organization of organizational interfaces, Proceedings of the ACM conference on Computer-supported cooperative work. Portland, Oregon, United State, 1988; p85-p93.
- [Gr94] Grudin, J.: Groupware and social dynamics: eight challenges for developers. Communications of the ACM, Volume 37 , Issue 1, 1994; p92-p105.
- [Gu90] Gutek, B.A.: Work group structure and information technology: a structural contingency approach, In: Galegher, J., Kraut, R.E., Egidio, C. (Eds.), Intellectual teamwork: social and technological foundations of cooperative work, Hillsdale, NJ: Lawrence Erlbaum, 1990; p63-p78.
- [Hi98] Hinssen, P.: What difference does it make? The use of groupware in small group, PhD thesis, telematika institute, Netherlands, 1998.
- [Ka99] Karahanna, E.; Straub, D.W.: The psychological origins of perceived usefulness and ease-of-use, Information & Management, Vol. 35, No. 4, 1999; p237-p250.
- [Ko05] Kort, J.; De Poot, H. Usage Analysis: Combining Logging and Qualitative Methods, CHI2005 Workshops, Portland, 2005.

- [Ma05] Mankoff, J.; Carter, S.: Crossing Qualitative and Quantitative Evaluation in the domain of Ubiquitous Computing,, Position paper, CHI2005 Workshop 6, Portland, 2005.
- [Mc92] McLeod, P.L.: An assessment of the experimental literature on electronic support of group work: results of a meta-analysis, *Human-Computer Interaction*, 7(3), 1992.; p257-p280.
- [McG93] McGrath, J.E.; Hollingshead, A.B.: Putting the "group" back in group support systems : some theoretical issues about dynamic processes in groups with technological enhancements, In: Jessup, L.M., Valacich, J.S. (Eds.), *Group support systems: new perspectives* New York: Macmillan, 1993; p78-p96.
- [Ou05] Ouni, A. : Une synthèse bibliographique de « l'analyse des usages », 10^{ème} congrès de l'AIM, Toulouse, 2005.
- [Pi05] Pipek, V.: From tailoring to appropriation support: negotiating groupware usage, PhD thesis, faculty of science, department of information processing science, university of oulu, Oulu 2005.
- [PK89] Pinsonneault, A.; Kraemer, K.L.: The impact of technological support on groups: an assessment of the empirical research, *Decision Support Systems*, 5(2), 1989; p197-p216.
- [Ve03] Venkatesh, V.; Morris, M.G.; Davis, G.B.; Davis, F.: User Acceptance Of Information Technology: Toward A Unified View, *MIS Quarterly* Vol. 27 No. 3. 2003.; p425-p478.
- [We02] Wenger, E.; McDermott, R.; Snyder, W.: *Cultivating communities of practice A guide to managing knowledge*, Harvard Business School Press, 2002.