

Information Spaces in Large-Scale Organizations

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Abstract. Common information spaces are sometimes used to help analyse and understand collaborative work. This paper uses this concept and the 7 parameter-framework created by Claus Bossen to analyse the collaboration infrastructure in a major international oil and gas company. The paper builds on the framework by weighing different parameters by classifying their importance into one of three categories in order to identify whether some of the parameters are more or less important than others.

Keywords: Common Information Space, Large-scale IS, Bossen's parameters, analysis

1 Introduction

Very few people conduct their work in complete solitude. Most people have to interact with other individuals in order to conduct their work. Some are able to do this face-to-face, but most people use some sort of technology-based collaboration tool. Such tools include the phone, text-messaging, email and instant messaging. These tools are to some extent pure communication tools that facilitate communication rather than true collaboration tools. Of course communication is an important part of collaboration, but it is not sufficient in order to be what is known as collaborative work. Hence, understanding collaborative work is an important area of research and the focus of Computer Supported Cooperative Work (CSCW) research.

The notion of a Common Information Space (CIS) is one of the concepts used within the area of CSCW in order to understand and analyze collaborative work. A CIS acknowledges the importance of the context under which this collaborative effort is conducted, and facilitates the examination of information sharing among the various actors involved. The paper builds on previous work [1] in the area of information spaces in large-scale organizations and uses the notion of CIS, and, more precisely, the 7 parameters of CIS identified by Claus Bossen [2] to analyze the implementation of a new collaboration infrastructure in a large Norwegian-based international oil and gas company (dubbed OGC). Through this exemplification, the paper contributes to a deeper understanding of CIS, as well as an evaluation of the appropriateness of Bossen's 7 parameters as a mean of analysis. The paper also extends Bossen's framework by evaluating the relevance of each of his 7 parameters – suggesting that some of the parameters are more important than others.

The paper is organized as follows: It starts off with a look at related work focusing on the concept of CIS generally and Bossen's parameters specifically. Then the research approach and case is described before the appropriateness of the framework is discussed. The paper rounds off with a few concluding remarks and suggestions for further research.

2 Related Work

Common Information Space as a notion was initially conceptualized by [3] as an alternative to the so-called workflow perspectives for analyzing work practices. CIS seeks to bring attention to an area of "critical importance for the accomplishment of many distributed work activities" [3] and focuses on the relationship between actors, artefacts and information, as well as the context in which these occur. The role of artefacts to support and articulate work in cooperative situations is also important [2-4].

As mentioned, CIS provides an alternative to workflow perspectives for analyzing work practices, and, based on [5], explains how workflow perspectives fail to consider how work is done in practice in contexts where continuous negotiation and problem solving is required. Therefore, [3] argue for an alternative approach that would "allow the members of a cooperating ensemble to interact freely" [3]. According to the authors, cooperation is not facilitated through simply having access to the same information in a shared database, but it also requires a common understanding of this information. This is because information always has to be interpreted by the human actors involved.

Then, [4] takes the concept of CIS one step further and explores the duality of the concept. A common information space has a dualistic nature, being both open and malleable on one hand, and closed and rigorous on the other. Within this duality, the openness is necessary in order for the individual community of practice to experience the CIS as meeting their needs, and the closure is important in order to be able to share information across different communities of practice. In addition, [4] argue that there are many different types of common information spaces. For instance, people can be working together across different physical locations [6], or they can be working across different times [7]. However, all the different types of CIS all have some characteristics in common.

Bossen [2] further refines the concept by introducing 7 parameters he argues contribute to provide a more detailed framework, and thus can be applied to characterize the particularities of a given CIS. The 7 parameters are as follows: 1) *The degree of distribution*, which focuses on the physical distribution of the collaborative parties. It is believed that the more physically distributed the members of a given community are, the more difficult the collaboration will become. 2) *The multiplicity of webs of significance*, which relates to the background (culture, language, education, etc.) of the community members. Again, the more diverse backgrounds the community members have, the more difficult the collaboration will be. 3) *The level of required articulation work*, which looks at how close collaboration is required for a given CIS. The closer people have to work together, the more articulation work is

required. 4) *The multiplicity and intensity of means of communication*, which is about the different channels people use to communicate. Face-to-face communication is generally considered to be the most effective method of communication, but because of the distributed nature of much collaborative work this is not always possible so video conferences, telephone, email, instant messaging, text messaging, etc. might be necessary. Using a more intense channel like video conferencing will require less work in order to achieve a common interpretation or understanding of something, than a less intense channel like email. For instance, when communicating something using email, it will often be necessary for the recipient to respond with more or less the same content, but presented slightly different, in order to have their understanding confirmed. Using face-to-face communication, non-verbal signals like looks and gestures will often provide this confirmation. 5) *The web of artefacts*, which are the coordinating mechanisms like plans, strategies, schedules, etc. necessary for the collaboration to be possible. 6) *Immaterial mechanisms of interaction*, which are more informal than the web of artefacts. Here we are focusing more on the work practices within the organization – how the work is *really* done (in opposition to how the work is described in various work flow models). 7) *The need for precision and promptness of interpretation*, which relates to how closely together people work, and how important this is. In general, the more safety-critical a task is the higher the need for precision and promptness become. Table 1 lists the 7 parameters.

Table 1. Bossen's 7 parameters

1	The Degree of Distribution
2	The Multiplicity of Webs of Significance
3	The Level of Required Articulation Work
4	The Multiplicity and Intensity of Means of Communication
5	The Web of Artefacts
6	Immaterial Mechanisms of Interaction
7	The Need for Precision and Promptness of Interpretation

3 Research Approach

This paper reports from findings in an ongoing interpretive case study [8]. The study looks at both the technological and social complexity of ICT implementation and use in large organizations. In this earlier phase of the study the approach has been emergent, rather than highly structured. The aim has been on identifying areas suitable for further research.

Data has been gathered through document analysis, semi-structured interviews and observations. The document analysis has been very important in order to understand the background and motivation behind the decisions made by the management. Having gotten (limited) access to OGC's systems has been important as it has given access to internal plans and strategies that has been very useful.

There have also been conducted 10 semi-structured interviews. Both ICT-professionals (managers and developers) and "normal" users have been interviewed.

The interviews have lasted between 1 and 3 hours. Only two of the interviews have been recorded as the others have chosen to decline our request to record the interviews. But as we have been two researchers conducting the interviews one could focus on the interview, while the other could focus on taking notes. In such a situation it is really useful being two researchers working together.

More recently, an internal research project conducted by OGC's research centre has opened up new possibilities. The project looks at ways to improve collaboration within the organization, and by doing this it is very relevant to our research. Being able to sit-in on (a total of 4) meetings where collaboration is discussed has been very useful in providing insight into what aspects of collaboration that is important to OGC, and to identify future interview subjects.

4 Case Description

In 2003, the OGC introduced a collaboration system based on Microsoft SharePoint that was to encompass all of the organization's 29,500 employees located in 40 countries world wide. This system was replacing an older system based on Lotus Notes - a system that had grown out of control with more than 5000 different databases without any central management. Nor did the old system have any centralized indexing functionality, meaning that to retrieve any information you would have to know which database to search. This was believed to cause a lot of redundancy, both with regard to the information stored within the system and the work being done (as people had to do work again because they where not able to find evidence of others having done it). The new solution was a "once size fits all"-solution and was intended used by all parts of the organization, from cleaning staff, via Marketing and Human Resources, to specialists within well drilling and production (e.g. geologists, geophysicists, drilling engineers, production engineers, etc.). They all got the same system with practically no room for customization.

Different groups (based on geographical or organizational location, department, disciplinary belonging, work area, etc), as well as different multi-disciplinary projects, got their own area, called a *Team Site*, on the MS SharePoint architecture. However, in essence all team sites were very similar. A project working with drilling planning got the same infrastructure for supporting their work as an ICT-project looking into best practices for the use of video conferencing. The only differences were in the availability of *metadata* used to categorize and classify information.

By late 2007, the MS SharePoint architecture had about 8000 different team sites. An average employee would typically belong to about 6-8 different team sites. This high number of team sites was not believed to cause the same problems as the 5000 different databases from the Lotus Notes-based system as the MS SharePoint infrastructure had one central indexing function, meaning that it would be possible to search the entire infrastructure from one single interface. This central indexing and search functionality was, according to one ITC-manager, the big selling point for choosing Microsoft SharePoint.

Another important aspect of the solution was the rule that all permanent employees would have read-access to all team sites within the infrastructure even though they

were not members of said team sites (of course some team sites, e.g. some belonging to Human Resources, would have restricted access).

5 Discussion

Using the parameters identified by Bossen [2] we will in this section focus on analyzing the common information space created by the introduction of MS SharePoint in OGC. Here one can argue that this is more of a theoretical exercise with little practical value as we here look at the entire organization and one given technology as one single information space. It can be argued that it would be of more practical value and relevance to look at OGC as a collection of overlapping interdependent common information spaces where the different communities of practice and organizational units make up a common information space, and analyze these individually. However, this would become an enormous task that, in addition to a lot of time, would require intimate knowledge of all areas of OGC – something we do not have, nor aspire to acquire.

Of course we could have focused on one specific area of the organization and conducted the analysis from this point of view, but as there are aspects of the introduction of the collaboration system that suggest a desire to create one single information space. The argument is that since OGC has *one* common, standardized and uniform solution to *all* employees, and that *all* employees have read-access to all team sites, the management look at this as a one-size-fits-all solution, and therefore *one* common information space. The fact that research questions this assumption does not diminish the assumption in any way. We also believe that this approach will be more general and easier applicable to other organizations.

In the next section we will look into the 7 parameters in more detail, and relate them to OGC and their collaboration context. Each of the parameters is then evaluated based on its importance in the setting in question. The level of importance is classified using a three-tier scale: *High* importance, *average* importance and *low* importance.

5.1 The degree of distribution

As mentioned, OCS operates in 40 countries world wide, and within many of these countries they have a number of different geographical locations. This point to that OGC is a quite distributed organization. In it self, this is not an indication of the importance of this parameter. However, when we know that projects within OGC often involve people from various geographical locations this signify the importance of this parameter. For instance, the internal research project we have been able to follow lately consists of people from 4 different locations in Norway, in addition to support people from locations in 2 other countries.

Another aspect that support the stand the degree of distribution is of high importance is the following quote from a participant at one of the meetings discussing collaboration we got to attend:

“The way the organization is built with geographical differences, it is important with simple and readily available tools where collaboration can take place across. This is lacking today.”¹

The degree of distribution is evaluated to be of high importance.

5.2 The multiplicity of webs of significance

Even though OGC has about 29,500 employees, and they naturally come from a variety of cultural backgrounds, OGC is a company with a mainly Western tradition and philosophy. Of course, a geologist from – and working in – Norway has a completely different background than a driver from – and working in – Nigeria, but this seems to be of less importance. This suggests that even though people have different backgrounds, they all also have a common understanding of what it means to be an employee within OGC.

However, even though cultural and national backgrounds seem less important, there are areas within OGC where the multiplicity of webs becomes evident. In an oil and gas company like OGC there are people with a lot of different professional backgrounds working together. For instance, a geologist and a drilling engineer use completely different vocabularies in their daily work. But when they have to work together in order to plan or coordinate some activity they align their webs of significance in order to collaborate effectively. This is something that happens quite often, so in order to facilitate this process people from different disciplines are often (geographically) co-located.

The multiplicity of webs of significance is evaluated to be of high importance.

5.3 The level of required articulation work

Of course, the level of coordination varies between various projects within OGC. Looking into the various projects one would most likely come up with needs for coordination that spans any range one choose to classify it with. However, on a more generic note, we can say that as people work on projects across organizational units there has to be coordination between said projects and units. This is recognized as a challenge within OGC, as illustrated by a quote from a different meeting, but we have no findings that indicate that this problem is of high importance.

“Program and project management are detached from the unit – [this] creates difficulties with regards to reporting and resource coordination.”

The level of required articulation work is evaluated to be of average importance.

5.4 The multiplicity and intensity of means of communication

Face-to-face communication is commonly recognized as being the most effective form of communication[2]. This means that in addition to phone and email – because

¹ All quotes are translated from Norwegian by the author

of the distributed localisation of the organization people tend to travel a lot. One unit, with about 2400 employees created a statistic of all travels done by the employees over a 4 month period at the end of 2007 and the beginning of 2008. The statistics showed that the unit had more than 18,000 travels during this period. More than half of these were one-day travels. People recognize this as a problem, and believe that many of these travels could – and should – have been avoided. As one person noted, they have to “*balance the need for travel/personal contact against remote collaboration*”. This has also been recognized by OGC which are fronting efforts to promote the use of video conferencing as a collaboration tool..

Another interesting finding is the wish for more informal, personal communications equipment. As people are used to use instant messaging with web cameras in their personal life, they want to use it at work as well. As one person said, getting to work is like “*going 5 years back in time technologically*”, and we “*have better collaboration tools at home*”. Simply put, they want a web camera and a headset at their work place.

The multiplicity and intensity of means of communications is evaluated to be of average importance.

5.5 The web of artefacts

OGC have production facilities (for instance a refinery plant on land or a production platform at sea) on a number of different locations around the world. Traditionally, these locations have been somewhat isolated islands. Each location have been allowed to evolve in a way that best suits there special situation. Hence, over the years the different locations has developed their own business models, plans and strategies. However, the introduction of the new collaboration infrastructure was seen a catalyst to help harmonize and standardize the different parts of OGC. As it is stated in a presentation of the new infrastructure, the new infrastructure is “*10% IT, 90% change*”. This suggests that the goal of the new infrastructure was not only to give the workers a new tool, but also to reduce complexity, i.e. reduce the number of artefacts.

Whether or not the plans to reduce the number of artefacts are successful or not will not change the fact that OGC still has a lot of plans, strategies, schemas, schedules, etc. that the employees have to comply with. Of course this is not only due to organizational complexity within OGC, but is also caused by the complexity of being in the oil and gas industry.

The web of artefacts is evaluated to be of average importance.

5.6 Immaterial mechanisms of interaction

Within the different areas of OGC there are a lot of work practices, habits, and informal ways of getting things done. However, narrowing down from all these areas to the ones related to the introduction and use of the MS SharePoint infrastructure we see that there really aren't that many. This is of course mainly because the infrastructure is new and informal work practices have not really been established yet. There are signs that indicate that people are not using the *metadata* to categorize and

classify information as intended, nor are they using the search functionality as anticipated, but this appear to be more because of lack of formal practices (aligned with the work processes) rather than the existence of informal practices.

The immaterial mechanisms of interaction are evaluated to be of low importance.

5.7 The need for precision and promptness of interpretation

In some parts of OGC, like for instance in the control rooms at refinery plants and on platforms, precise and prompt communication is of utmost importance. In these settings there are safety critical systems that ensure the safety of both people and environment. However, in most everyday work tasks this is not the case (even though HSE² is very important in a potentially dangerous industry like the oil and gas industry). We have no findings that suggest that there is any extra importance related to precision and promptness when it comes to the collaboration infrastructure – nor would we expect to find any since the collaboration infrastructure is not used for safety critical operations. There are other systems for these operations.

If people for some reason need more clarification about something, or they require a prompt response, our findings suggest that they would rather call the person up – or initiate an instant messaging session.

The need for precision and promptness of interpretation is evaluated to be of average importance.

The discussion above shows how the various parameters relate to the common information space established within OGC with the introduction of the MS SharePoint collaboration infrastructure. Table 2 summarizes the evaluation result for the 7 parameters.

Table 2. Classification of parameters

Parameter	Importance
1 The Degree of Distribution	High
2 The Multiplicity of Webs of Significance	High
3 The Level of Required Articulation Work	Average
4 The Multiplicity and Intensity of Means of Communication	Average
5 The Web of Artefacts	Average
6 Immaterial Mechanisms of Interaction	Low
7 The Need for Precision and Promptness of Interpretation	Average

6 Concluding Remarks

Using CIS and Bossen's framework appear to provide a useful framework for analyzing collaborative work within a given setting. As illustrated through the

² Health, Safety & Environment

analysis of the collaboration system at a major oil and gas company this framework provide an useful insight in what is required with regards to communication and collaboration within a certain context.

However, the analysis suggests that not all 7 parameters are equal. In different settings, different parameters are more important than others. In the case described here the degree of distribution and the multiplicity of webs of significance seem to be more important, while the immaterial mechanisms of interaction are less important. This is of course based on the analysis of a single case, and further research in other cases and settings are necessary, and are likely to yield different results.

Categorizing the parameters according to importance can be useful as it highlights the focus areas for a given information space. Using a three-level scale seems appropriate and is a compromise between the ease of classification (few categories) and the need to differentiate the result (many categories). Further research may suggest a better classification schema.

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