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Successful Implementation of Collaborative Environments: Human Factors and Implications

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Abstract

Collaborative Environments (CEs) are now implemented at scale in a wide range of companies in the offshore oil and gas industry with the rationale to optimize and improve the efficiency of drilling and production operations. CEs provide a new environment for the exchange of real-time data aiming at closer onshore-offshore collaboration and improved decision making. Such implementation projects are associated with a considerable commitment in finances, personnel resources, and organizational restructuring, which makes it crucial to identify factors influencing the long-term success of such large-scale endeavors.

As experiences in other industries show, human factors in terms of attitudes, expectations, and behaviors of personnel play a decisive role in achieving those objectives. At present an empirical study is conducted during an ongoing CE implementation initiative in a major oil and gas E&P company to identify the factors influencing personnel acceptance, satisfaction and attitudes towards CEs. Between February and September 2007 data was collected from thirteen assets at two different geographical locations. The assets were at different stages of the implementation process ranging from a few weeks, to some years of experience of working within CEs. At time of data collection two assets had not yet moved into the new environment. Over the 8 month period, the first author interviewed 86 onshore and offshore personnel at different levels in the organization and observed work processes prior to and after the implementation of CEs.

Based on the collected data the following eight factors were identified as conclusive for the success of CE implementations: general engagement process, inclusion of offshore personnel, inclusion of management, staffing, preparation and training, technology design and implementation, design of the physical environment, and post-implementation evaluation process. Concrete positive and negative examples found in the diverse projects will be discussed to demonstrate challenges and lessons learned. Further, practical recommendations will be offered for the planning and design of similar future implementation projects.

1 Introduction

Working over distances including the resulting logistic, informational, and communication challenges are a natural part of the offshore oil and gas industry. Processes like information exchange, planning, or decision-making are hindered by the fact that data cannot be transferred easily from one location to another and that communication between remote locations is often lagging and intermittent. This situation frequently limits access to necessary expertise, delays reactions to critical situations, or impedes the distribution of resources with subsequent negative impacts for operation efficiency and safety.

To counter some of these challenges, the industry has seen a general move towards the use of Collaborative Environments (CEs) over the last year representated by programs such as *Smart Fields* (Shell), *i-fields* (Chevron), *Digital Oilfields* (Schlumberger), or FIELD OF THE FUTURE. CEs provide newest collaboration and visualization technologies to allow for the immediate availability of real-time process and plant data and the possibility for constant audio-visual communication between onshore and offshore (Dudley et al., 2006). Expectations are that Collaborative Environments will shorten decision making timescales, improve the quality of decision making, lead to a more effective use of limited technical expertise worldwide, remove barriers between disciplines, and increase safety for the workforce (Edwards et al., 2006; Murray et al., 2006). Overall, performance improvements and savings through the implementation of Collaborative Environments have

been estimated as, e.g., 3-25% higher operating efficiency, 5-15% drilling cost reduction, or 1-4% reduction in downtime (Cambridge Energy Research Associates, 2003).

The planning and execution of such large-scale initiatives require considerable financial and personnel commitments that can only be justified if they achieve the targeted objectives. According to a recent survey, however, only about 38% of all organizational initiatives ever fully reach their projected value with 62% either failing completely or falling short of the expected gains (Jørgensen, Albrecht, & Neus, 2007). Differentiating reasons for failure, the single most important factor proved to be attitudes and behaviors of personnel (65%), followed by lacking resources (41%), organizational culture (40%), and engagement of management (35%). Human factors thus account for the majority of failed or ineffective implementations. It thus seems that despite a growing awareness of the importance of human factors in change initiatives, organizations by and large still have difficulties to act appropriately. Most often a precise knowledge of the factors that influence or create positive or negative attitudes, perceptions, and behaviors in affected personnel is lacking to guide such initiatives.

The evidence from other industries such as flight control, military, or software development that use concepts similar to Collaborative Environments suggests that critical success factors are to create a high degree of situation awareness for all players involved and to clarify roles and responsibilities in the distributed setting (Heath & Luff, 1992; Petterson, Randall, & Helgeson, 2004; Watts et al., 1996). The setting in these industries, however, differs from the situation in the oil and gas industry and it is unclear to what extend these findings are directly applicable to the E&P sector. It is therefore important to conduct further research to capture the human factors specific to CE implementations in the oil and gas industry and their impact on the implementation process. The study described in this paper presents a first step into this direction using models and methods known from industrial psychology. This approach offers an alternative view on CE implementations and opens up a window into the human side of organizational change processes adding to the practical and theoretical knowledge to guide future planning and implementation decisions.

1.1 Human factors in the implementation of Collaborative Environments

Collaborative Environments are foremost a technological solution to the operational problem of distributed, but interdependent work processes. Accompanying the introduction of new or additional technical capabilities are often structural changes in terms of team composition, i.e., a move from functional silos to cross-functional teams, and changes in work arrangements by moving offshore personnel onshore. Organizations are thus confronted with two separate, but interlinked change processes: first, the diffusion and adoption of new technology and second, team building and adjustment of work processes by individuals and teams. This paper will concentrate on the first issue, but will make reference to the second where necessary.

1.1.1 The role of technology adoption for innovation effectiveness

The implementation and adoption of a new technology is a two-level process: on the organizational level, *adoption* refers to the decision of an organization to purchase and install a technology throughout the organization; on the individual level, adoption denotes individuals' decisions to accept and integrate the offered technological innovation into their work routines (Klein, Conn, & Sorra, 2001). While organizations often take great pains in choosing and deciding on the right type and extent of technology they want to implement, they often fail to make equal efforts for the subsequent adoption by individual users. It is this latter process, however, that primarily determines whether a technological innovation will be effective in the long run.

The process of individual adoption is described in Rogers' theory of innovation diffusion (2003). *Innovation diffusion* denotes "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers & Scott, 1997) resulting in the adoption and routinization of its use. For the individual this process usually takes place in five consecutive steps (see **Fig. 1**; see also Dayton, 2006):

1. Knowledge acquisition: general awareness about what is going to happen depending on information available, perception of a need for the innovation, and contact with change agents
2. Persuasion: development of personal involvement and in-depth consideration which solidifies attitudes towards the innovation
3. Decision: individual decision to try or ignore the innovation
4. Implementation: rejection of the innovation or incorporation into normal work routines
5. Confirmation: feeling that the decision taken was correct

In judging implementation success it is important to differentiate between the *effectiveness of the implementation* and the *effectiveness of the innovation.* Implementation effectiveness is defined as "the consistency and quality of targeted organizational members' use of the specific innovation" in contrast to innovation effectiveness which refers to "the benefits

an organization receives as a result of its implementation of a given innovation" (Klein & Sorra, 1996, p. 1058). In this sense, implementation effectiveness and thus the individual user's choice to adopt or reject the innovation is a prerequisite for achieving the planned organizational benefits (i.e., innovation effectiveness). Based on the differentiation between implementation and innovation effectiveness it is also possible to predict three likely outcomes of organizational innovations: a) the implementation is effective and use of the implementation enhances the organizations performance, b) implementation is effective, but use does not enhance the organizations performance; and c) implementation fails. While the second case is primarily a question of poor choices by the organization in terms of a poor fit between technology and organizational tasks, implementation failures result when employees "use the innovation less frequently, less consistently, or less assiduously than required for the potential benefits of the innovation to be realized" (Klein & Sorra, 1996, p. 1055). Preventing implementation failure thus becomes a question of properly managing behaviors and attitudes of personnel during the complete cycle of innovation adoption from knowledge acquisition to confirmation.

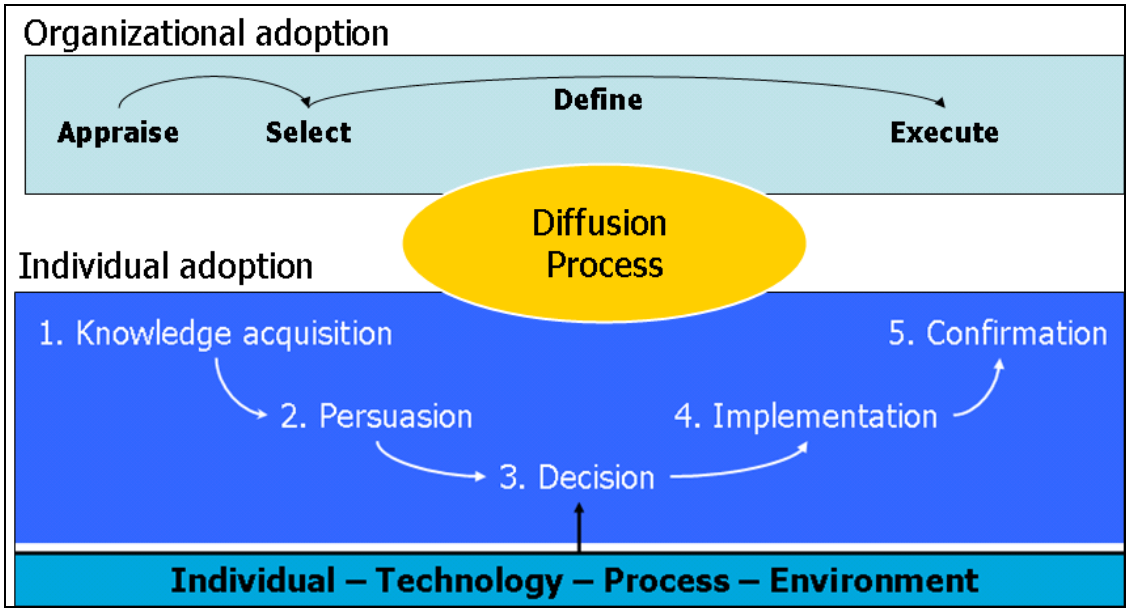

Fig.1: Process of organizational and individual adoption (based on Rogers, 2003)

Recent studies have shown that a number of individual, environmental, and process factors as well as features of the technology itself influence employees' consistency and quality of its use. Perceived usefulness of the new technology, degree of top management support, computer experience of individuals, and degree of user support, for instance, play a role in the acceptance of the new technology by individual users (Jeyarai, Rottman, & Lacity, 2006). The degree of user support also influences the satisfaction of individuals with the implementation process, while task-technology fit affects innovation effectiveness (Dennis, Wixom, & Vandenberg, 2001). The existing literature, however, does not provide clear insights into when in the diffusion process these individual factors have the highest impact. Existing studies also focus primarily on implementations in co-located teams as well as single technologies which is not true for Collaborative Environments. Compared to the many of the implementations reported in the literature Collaborative Environments in the oil and gas industry present a number of specific challenges:

- Most CEs offer multiple alternative and competing technological capabilities for the same tasks, and individuals can choose between these alternatives without experiencing immediate consequences for their performance.
- Employees in the oil and gas industry have a long history and amble experiences in working over distances using existing technologies like mail, phone, and audio-conferencing.
- A specific challenge of CE implementations in the E&P business is also the strong asymmetry between onshore and offshore personnel. This asymmetry not only lays in the geographic distance between onshore and offshore, but also in the difference in onshore and offshore culture. Approaches that will work well in one community are not necessarily similarly effective in the other. Quality of relations and mutual perceptions between onshore and offshore will further influence how implementations efforts for either side are perceived and reacted to.

Initial findings from a pilot project in the drilling sector indicated that those developing and implementing Collaborative Environments have a more positive view of them than the end-users and that implementers often underestimate the human factors implications of this new way of working (Lauche, Sawaryn, & Thorogood, 2006). Yet, more systematic research is needed to understand the full implications of implementing Collaborative Environments in the E&P sector.

1.2 Research program and rationale

The present study is part of a two year research program investigating Collaborative Environments in the oil and gas industry. Based on approaches and methods from industrial psychology, the rationale is to capture short- and long-term effects of the introduction and design of Collaborative Environments on collaboration between onshore and offshore, quality of decision making, and performance. In the first phase (February to September 2007) the focus lays on investigating the implementation process and the human factors that influence implementation success.

2 Research methods

2.1 Data collected

From February to September 2007 data was collected at two different locations of a major oil and gas company. Location 1 at present is in the process of implementing CEs, while location 2 has been operating with CEs for a considerable time. To obtain a comprehensive understanding of the implementation process and its effects all groups directly or indirectly involved or affected by the implementation of Collaborative Environments were included in the sample. Thus, besides experiences from immediate users of Collaborative Environments also those of surrounding personnel and individuals supporting the implementation efforts were collected. The following five groups were identified as relevant for the implementation process:

- CE personnel: Personnel onshore and offshore working within Collaborative Environments
- 'Second tier' personnel: Individuals closely collaborating with CE personnel
- Management: Onshore and offshore managers supervising CE personnel
- IT-support: Individuals responsible for the deployment and long-term technical support of CEs
- Implementation group: Individuals responsible for the engagement and preparation of personnel throughout the implementation process

Between February and September 2007 semi-structured interviews with 86 individuals from all five groups were conducted. In addition, numerous informal conversations with the same or different individuals considerably increased the amount and depth of information. Further, 35 morning calls and meetings between onshore and offshore as well as a variety of informal team situations and processes were observed at different points in time. In addition, 306 documents such as reports on strategic implementation decisions, weekly updates of the implementation progress, internal newspapers and flyers, or reports on benefits were collected. For an overview on the type and amount of data collected, see **Table 1**.

	Total	**Location 1**		**Location 2**
		Operations	Drilling	Operations
Stage in the implementation		pre + post	pre + post	post
Number of teams studied	*13*	4	3	6
Number of interviews (excluding informal conversations)	*86*			
a) CE personnel		27	11	6
b) Second tier personnel		4	--	6
c) Management		6	3	3
d) IT-support		7		2
e) Implementation group		6		1
Number of observations (excluding unscheduled observations)	*35*	17	14	4
Documents (independent of group)	*306*	295		11

Table 1: Type and amount of data collected (as of September '07)

2.2 Data analysis

Our focus of interest in this first round of data collection was the identification of factors contributing to the success or failure of CE-implementations. Using the full transcripts of the interviews we identified all experiences and examples that indicated either a favorable or negative attitude towards the implementation process or the concept. Often individuals also gave explicit reasons for positive or negative attitudes, examples of why they decided to accept or reject the concept or reasons why and how they changed their attitudes during the process. Reviewing all information available we then grouped narratives according to similarity or common topics. Based on this first clustering of information we identified the underlying reasons for specific attitudes or attitude and behavior changes. These reasons were then grouped into higher-order categories

each denoting an independent factor that influences employees' attitudes and decisions in the diffusion process. In the interviews with the support and implementation group we also looked specifically for information on implementation strategies and barriers for the initial engagement and further support of the implementation process. Comparing views from users and the implementation and support groups on the same or similar incidents allowed us to understand the mutual influences these groups have on each other and the overall implementation success. Observations and documents were used to provide background information and validation for the interview data.

3 Results

Based on the interviews, eight general factors were found that influenced individuals' perceptions, attitudes, and behaviors during the implementation process. These eight factors again fell into two bigger categories: a) design factors and b) process factors. *Design factors* refer to the layout of the Collaborative Environments in terms of technology, physical space, and organizational structure (i.e., team composition or staffing). *Process factors* in contrast refer to the way the design factors are introduced and supported. Process factors include the general engagement process, the preparation and training of personnel, inclusion of offshore personnel, inclusion of management, and the post-implementation evaluation process (see Table 2). Our data indicate that individual design factors vary in their degree of impact or relevance at different stages of the diffusion process. We further found, that the emphasis on which groups need to be involved as 'targets' or 'providers' of information, resources, or actions changes over the duration of the process. In the following a number of concrete examples are presented to illustrate major issues at different stages of the process.

A) Design Factors

1. Technology design and implementation:
Type of technical capabilities compared to existing technologies; quality of IT support; timing, pace, and process of deployment

2. Design of the physical environment:
Layout and setup of the physical environments and integration of CEs in the overall physical layout of the organization; degree of change of the work place compared to the former situation

3. Staffing:
Team composition; placement of offshore personnel onshore; level and consistency of staffing; transparency of staffing decisions

B) Process Factors

4. General engagement process:
Activities and efforts that lead to the knowledge about and appreciation of the CE concept by individuals and groups

5. Preparation and training:
Activities to get individuals acquainted with the new CE environment and its capabilities and to give users the knowledge and confidence in how to use or adapt the CE for their specific personal and job requirements

6. Inclusion of offshore personnel:
Engagement and inclusion of offshore personnel in the planning process; pacing of offshore deployment

7. Inclusion of management:
Engagement and inclusion of management in the planning and engagement process; clarification of their dual role in the engagement phase and long-term support

8. Post-implementation evaluation process:
Evaluation procedures to capture immediate and long-term effects (e.g., type and frequency of measures, intrusiveness, personnel included/excluded the process, perceived veracity and balance of reports)

3.1 The early stages: Interlinking organizational and individual adoption

Organizational decisions on what technology to adopt are an important step for innovation as well as implementation effectiveness. Since CEs are a relatively new type of environment not many experiences exist on what technological capabilities are needed or appropriate for users or how they tie in with existing capabilities. This leads to the question of how organizations can guarantee they not only adopt the right technologies for their business purposes, but also enhance the probability of adoption by all core groups. Our study showed that it is best to interlink organizational and individual adoption processes early on allowing participation of core groups in the *define, select, and execute stages* of organizational adoptions. There are, however, pros and cons to the way and extent of participation that should be considered before starting the process.

3.1.1 User participation as change vehicle – Pros and cons

Participation of users in the define and selection stages of organizational adoption of CEs has many benefits. It usually results in a better fit between technology and tasks, higher commitment to the chosen alternative, higher acceptance of the concept, and often creates the necessary change dynamics within the organization. In our study, location 1 decided on very extensive user participation following a *self-design learning model* (Mohrman & Cummings, 1989) in which several assets conducted pilots on the design of the technology and physical space (see Example 1). Results in the pilots were then fed back into the planning of CEs leading to a continuous cycle of improvements. Location 2, in contrast, decided on a more standardized top-down driven implementation strategy over all assets.

EXAMPLE 1: Technology and physical design pilots in location 1

Extensive pilots to trial furniture and technology in Location 1 gave users the opportunity for immediate feedback on the feasibility of possible design solutions. The final design is based on the experiences gathered during this period. The pilots set out to guarantee user satisfaction and best support for day-to-day work processes, but as a side-effect also created curiosity within the rest of the organization and increased the dynamic for the change towards CE. Here the organizational adoption process was well interlinked with the individual process, which increased the willingness for adoption by users.

Examples of engagement presentations on furniture trials

Overall, it seemed that users in both locations were generally satisfied with the process and provided solutions, but that the two approaches let to a different set of benefits and challenges.

High-participation schemes: Benefits and challenges

Users in location 1 were highly satisfied with the degree of influence they were granted and developed a feeling of ownership to the process; on the downside this meant the creation of high expectations in users for the constant availability of support and resources, a very high work-load for implementation and IT-support groups due to low standardization and constant demand of changes, and possible disappointments in users once a standard CE solution will be chosen and the individual pilots dissolved. Organizational restrictions that counteract the participation scheme can discredit efforts by the implementation group and create resentment by users (see Example 2).

EXAMPLE 2: Organizational restrictions to user participation

"And they were going on like, 'Ok, we can't do this, but let's look how we are going to design [a CE]. So what's the point in looking at what we want if they can't deliver it?" (CE personnel, location 1, pre-implementation)

Even more problematic for the high-participation scheme chosen in location 1 was to ensure equal participation of all user groups affected by the CE implementation. The engagement and inclusion of offshore personnel as well as the actual technology deployment offshore is considerably more difficult than on the onshore site. A general tendency therefore was to concentrate efforts on the most readily accessible group (i.e., onshore personnel) and to develop and deploy CEs primarily based on the requirements and possibilities of onshore personnel. With the pace of the implementation largely determined by onshore, the CE initiative was often seen as primarily an onshore solution forced upon offshore instead of a collaborative

effort. The under-representation of offshore views not only bears the danger of overlooking specific requirements and needs of offshore personnel, but has also been shown to alienate offshore to the concept of CEs. Equal participation and input as well as equal pacing of the process for all groups seem not only desirable, but necessary to avoid resistance in non-participating groups.

Low participation schemes: Benefits and challenges
Compared to high-participation schemes tangible benefits of a low participation scheme are lower time, costs, and personnel resources involved in planning, deploying, and supporting Collaborative Environments. In general, it seemed that users in location 2 were well satisfied with their CE solution, but often had greater difficulty in accepting certain aspects than their counterparts in location 1. The standardized solution, for instance, did not take into account specific requirements for individual job functions such as the use of big drawings or privacy for HR-related conversations. Some questions also arose whether the concept was transferable to all assets in the same way (e.g., "In applying what they were thinking to [name of asset] I can see was just fitting the mold"; manager, location 2).

In summary, user participation is a valuable tool to enhance commitment to the change process, but only if

- equal participation of different user groups (e.g., onshore/offshore) can be guaranteed,
- implementation and support groups are given sufficient resources to handle the extra demands,
- the organizational framework actually allows the necessary leeway to act on user expectations,
- organizational restrictions in terms of degree and areas of user participation are clarified beforehand and communicated clearly to users at the beginning of the general engagement process.

If these requirements cannot be met, it is likely that it will be difficult to keep the promises of user participation. In such cases, it may be more appropriate to adopt a low participation approach and communicate the strategic intentions clearly and consistently to all future users. It is then the responsibility of those implementing CEs to analyse user needs and ensure adequate task-technology/environment fit for all job functions.

3.1.2 Interdependencies between core groups

CE implementations involve a number of different groups with different roles and requirements throughout the process. In our study we identified five such core groups: CE personnel, second tier personnel, management, IT-support, and implementation group. The management of interdependencies between these groups can be difficult, especially if a high participation approach is chosen. The implementation group in location 1, for instance, was very successful in gathering input from users and managers into the design of the CE pilots. Numerous workshops were held to clarify expectations and develop requirements for the individual pilot teams and newsletters, flyers, as well as visits offshore ensured that personnel were informed about the CE initiative. Problematic for the later stages of the process proved to be that the IT-support group was initially not part of this process. Solutions were initially planned without sufficient involvement of the IT support group and requirements, timelines, and commitments were agreed with users and management without further consultation, so that expectations for users were set very high without checking the feasibility or deliverability by IT (Example 3).

EXAMPLE 3: Inclusion of IT-support group

"One of the major issues that we had was that the consultants were developing requirements, but they weren't fully documented in the way that they should have been. […] they weren't concise and detailed enough to say what they really wanted or how they were using it, which meant a lot of guessing about what they really wanted and a lot of discussions in like sort of a week, two weeks before." (IT-support, location 1)

EXAMPLE 4: Experiences by IT-personnel

"[The users] started getting a little bit 'sharpy', because they thought that everything was going to work and the fact that we were always there and it's a small area." (IT-support, location 1)

At the beginning this led to high additional strain for IT personnel which impacted on other projects and tasks as well as caused negative user reactions, because technical solutions were new and often could not be tested properly before they were installed in the CE areas (Example 4). After this initial period IT was integrated in the process and the problems largely subsided.

Interdependencies and the need for coordination are present at all stages of the diffusion process and between all groups. For a smooth process it is therefore necessary to:

- identify all groups involved and affected by the change and identify which are the core groups at specific stages of the diffusion process prior to the implementation,
- map out and agree on requirements, roles, and interdependencies for each group covering the process from start into routinization, as requirements and interdependencies will change throughout the implementation process.

3.2 The critical stages: Influencing decision and implementation

The decision whether to try and then continue working with CEs was driven primarily by their additional benefit compared to what is already available, adequate preparation and training, adequate knowledge about the concept, and the perceived attitude by the organization towards the concept (see Examples 5-9).

EXAMPLE 5: Technology design and task-technology fit

"They improved the technology, but […] the service company that provides the ROV actually has a better system." (CE personnel, location 1)

EXAMPLE 6: Preparation and training

"There was virtually no instruction on using the new technology, however once we figured this out, there were many benefits and it has been a brilliant tool." (CE personnel, location 1)

EXAMPLE 7: Knowledge of roles, responsibilities and overall purpose

"Well, the reason I personally don't use the [CE] is because there's not any defined process of what do they do." (second tier personnel, location 1)

EXAMPLE 8: Technology deployment and early realization of benefits

"The [CE] has taken a while to become fully functional due to its installation with inherent 'teething troubles'. These problems often took a considerable time to fix, leaving us with our hands tied a little bit." (CE personnel, location 1)

"We are discussing the [CE] facility but aren't fully set up yet (offshore). For my function, I am still using net meeting, spider phone, etc., as opposed to plasma screens, so don't see full benefit of [the] system." (CE personnel, location 1)

EXAMPLE 9: Underuse due to lack of staff

"Today was the first day I've seen anybody in four months time probably. Again, it speaks to the value of the environment, right? Apparently it says it's not really necessary." (second tier personnel, location 2)

As these examples demonstrate decisions and problems in early stages of the diffusion process (e.g., knowledge acquisition in Example 7) or the organizational adoption process (e.g., technology selection in Example 5) can have an impact on individuals' decision to use Collaborative Environments. Initially positive attitudes can become negative due to a perceived mismatch between official attitudes and actions (Example 9) or a perceived lack of support by the organization (Example 6). But these examples also demonstrate that individuals are not just passive observers of the process. They will not only try to make sense of what they perceive (e.g., in Example 9), but also put their own efforts into overcoming challenges and mastering the system (e.g., Example 6). Supporting users in these efforts and giving them the time and freedom to test and adjust the new system can considerably speed up the implementation. Based on the feedback provided by users, location 1, for instance, continuously made efforts to improve the environment and technological solutions. Asset teams were given complete freedom in deciding how to use the environment and how to incorporate them into their existing routines. And despite initial problems most teams perceived considerable benefits early in the process.

The early realization of benefits is crucial for developing a positive attitude towards new technologies and the intention to keep using it in the future, since users will often give up an otherwise valuable tool after their first two or three unsatisfying

encounters. In the case of Collaborative Environments, especially big time lags in the onshore and offshore deployment of technology or immature technology can prevent users from receiving or recognizing benefits of Collaborative Environments (Example 8).

Based on these observations, main recommendations for facilitating the decision and implementation stages are:

- Training for new technology is given to onshore and especially offshore personnel directly after deployment and re-training is available for people moving into CEs after the initial deployment.
- Clarification of roles and responsibilities of CEs early in the process for all personnel also with respect to other parts of the organization.
- Parallel deployment or offshore deployment first to reduce impression of onshore/management driven agenda.
- Sufficient resources for manning and supporting CEs and clear communication of reasons for delays/problems to avoid impression of lacking organizational support.

3.3 The final stages: Facilitating or undermining long-term commitment

Long-term commitment requires that all groups and especially users continue to feel positively about their decision to accept and adopt the innovation. This confirmation comes primarily from first-hand experiences of benefits, a positive attitude by the surrounding organization, and support by management. Observations in our study show, however, that the organization can do much to actively facilitate – or undermine – the development of long-term commitment. One such area is the post-implementation evaluation process; another is the development of a long-term perspective for CE personnel.

3.3.1 The challenge of post-implementation evaluations

Evaluations of the implementation success are an integral part of the overall process. Yet, as our participants showed, the way such evaluations are conducted can increase or decrease positive attitudes, even after the implementation has officially ended. Of particular relevance in this respect were the frequency and timing of evaluations (Example 9), the perceived truthfulness and balance of official reports, agreement between perceptions of personnel and official reports, and the credibility of evaluators and processes (Example 10).

EXAMPLES 9 and 10: Evaluation process and communication of results

"A disproportionate amount of time is spent communicating with MANY different interested parties, in particular the companies involved in the [CE] instigation. I often feel that we are expected to spend a lot of our time filling questionnaires, being interviewed for press releases, chairing feedback meetings, and hosting every visitor in [company] who wants to see how a [CE] is used. If I had known that so much of our time would be expected to be given for, what sometimes feels, like it is a PR exercise for the [CE] consultants, I would have had serious reservations about being included in the [CE] team." (CE personnel, location 1)

"We have a test system for our process control systems here, so […] we do all our software mods to the control systems here in the office and usually push the mods over the satellite without sending anybody offshore to do it, which is a big work saver. Now the people who run [the CE program] take all the credit for that." (manager, location 2)

Based on these and other statements, the following suggestions for the organization of the post-implementation evaluation process can be provided:

- The existence of an evaluation process and the steps and instruments involved need to be communicated before starting the change process.
- The number of people conducting evaluations should be kept consistent and minimal and CE personnel should be allowed to judge the appropriateness of the timing of evaluations.
- If information gathered in the evaluation goes public it has to be balanced and truthful, i.e., also represent negative or critical voices to indicate the organization is honest about a people-driven change process.
- Feedback and suggestions need to be acted on quickly to avoid devaluation of the feedback process.
- Evaluations should start early in the implementation process (persuasion and decision stages) and kept as an ongoing cycle with higher frequency at the beginning; after the implementation and an overall positive confirmation has been reached the evaluation process should lead into a permanent option for feedback and suggestions with the normal support groups.
- All groups involved in the implementation process also need to take part in the evaluation process.

3.3.2 Providing developmental perspectives for CE personnel

During the implementation, new CE personnel have to go through a very stressful period with considerable changes in their work environment, adjustments to new technologies and/or new team members. After a couple of months, however, Collaborative Environments tend to become a normal part of the work environment and a routine setting for the organization. CE personnel often perceive the move into CEs as a possibility for personal development (e.g., "So yes, it was a part of a career change, plus maybe diversifying into something else", CE personnel, location 1). Comments by CE personnel one year after the initial roll-out of CEs indicate that these expectations are not always followed up by the organization (see Example 11). There is therefore a danger that individuals loose the sense of direction and purpose if not given a long-term developmental perspective.

EXAMPLE 11: Career development and long-term perspectives

"You're sitting with people that are at the same stage of 'I don't know what's happening'. […] We're not learning from anybody. We're not getting developed by anybody." (CE personnel, location 1)

Recommendations therefore are:

- to clearly communicate from the outset whether or what long-term career/developmental benefits are associated with moving into CEs;
- to develop a clear long-term perspective for the future use and purpose of CEs within the organization and communicate it to all groups early in the implementation process.

4 Conclusion

The findings from this ongoing research into the implementation of Collaborative Environments showed that even for a strong and convincing concept, it takes time and stamina to achieve the intended benefits. The implementation of Collaborative Environments is a complex and intricate process that does not end with the provision of the physical space or the deployment of the technology. Its success stands and falls with users' willingness to adopt and integrate Collaborative Environments into their normal work routines. Changing or enforcing existing attitudes and behaviors of users is only possible if we are aware of the human factors involved in the diffusion of CEs. Our study identified eight general factors that impact attitudes and behaviors of individuals in varying stages of the diffusion process. Based on our experiences and encounters with the individuals directly involved in the process we further developed first recommendations to counteract common pitfalls. Further research will look more closely into the specific requirements for offshore personnel and the factors involved in the routinization of CE use.

5 Acknowledgements

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