Using Models of Work Practice as Reflective and Communicative Devices:

Two Cases from the Norwegian Offshore Industry

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ABSTRACT
PAR and PD are similar traditions, the major difference is the technology aspect that has been largely missing in the PAR-tradition. Two examples from the Norwegian offshore industry are used to describe how models can be used as reflective and communicative devices. Simple models can be used in a constructivistic manner to bring forth local knowledge and the voices of local realities in the organization. A distinction is made between expert and participative modelling with the use of various forms of artifacts, urging PAR to be more attentive to the way it uses technological artifacts in organizational development processes.

Keywords
Action research, empowerment, participation, representations, work mapping, models

INTRODUCTION
Action research consists of a number of traditions where Participatory design is the most prominent within IT development. Participatory design and participatory action research (PAR) [20,9] are traditions that have very much in common, but up to now have mainly existed as separate traditions. The authors represent the PAR-tradition. For us action research is collaboratively carried out by professional social researchers and local participants in a community or organization under study. Research agenda is collaboratively set, local people are trained in social research and act on the results. Action research aims to create unlikely but liberating social outcomes [9].

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The research agenda of PAR is based on similar principles as that of participatory design: Empowerment, democratization, participation in design, grasping local knowledge, reflection and communication related to local practice [3,7,15]. The major difference has been the use of artifacts. While PAR has focused on reflection and not on information technology, PD has used technological artifacts (mock-ups, prototypes) as the key to enable organizational reflection and user involvement. PAR's contribution is most relevant when it comes to issues and roles of participation [10], and organizational reflection and change in general [8], and not to systems development more in particular (even though these exist [6,11]). The use of models has been different in two traditions. PAR has used models as communicative and reflective devices in organizational development processes [8], as will be presented in two cases from the Norwegian offshore industry. This has been possible since the main agenda in PAR has not been to describe the details of everyday interaction and collaboration, which is more important when developing a collaborative IT-system. PD has been sceptical with regard to the deployment of models [1,16], mainly because objectivistic models are unable to describe the rich situations of everyday life. However, in the two cases here, engineers, welders and technicians were used to think in terms of models and flow charts. The question was not to use models or not, but how models could be used to enable reflection, organizational learning and change.

In an attempt to pin-point key lessons from these projects, we want to argue, in spite of the critique from PD [1,16], that simple models have a mission when used in a constructivistic manner. Contructivistic models can make it easier to portray local knowledge and the many local realities of the organization. Taking a pragmatic position, the models can be used to erase the distinction between experts and employees. This makes it possible to combine local interpretations of BPR and enterprise modelling. In

the cases, the modelling process ended up in restructuring old practice and gave new roles and responsibilities to people in the two organizations. For the two organizations new practices were the obvious results and the models were helpful in these processes. Constructivistic models in both cases improved the potential for organizational learning in the companies and developed new powerful images of the business.

One present trend in WWW-based IT design is that design tends to be more to combine already existing WWW-based components on an intermediate level to enable access to corporate databases of several kinds. It could mean that more efforts can be placed in organizational development and prototyping, while IT design might become more to adapt and customize standardized WEB based "LEGO-bricks". Based on these lessons we try to develop distinctions that take advantage of both the local reality of the individual and the organizational reality of the organization. A distinction is made between expert and participative modelling with the use of various forms of artifacts that to a less or larger degree will lead to organizational closure. We place PAR, PD and BPR in different parts of this division and urge PAR to be more attentive to the use of technological artifacts in organizational development processes since both organizations presented here are building digital models of their operations.

CASE 1: THE NEW NORNE INSTALLATION

Norne is a new oil production ship put into operations by Statoil[1] in 1997. This new installation is different from former permanent concrete and steel constructed giants that up to now have inhabited the Norwegian Continental Shelf. Norne has a very lean organization, about 1/3 compared to its older counterparts. Still, it performs the same functions (production of oil) and these must be more efficient in Norne. Norne has developed new work practice, not only on the boat itself, but also with regard to onshore-offshore co-operation inside Statoil and through vendor co-operation outside Statoil.

Most of the work in this participative project was done in 1996 in Nornes preparations for operations but with additional intensive working weeks in March-May 1998. The scope was to help Norne develop their most important work processes in operations, by acting as facilitators in the Norne organization, i.e. providing a method for describing work processes and perform process support during an organizational development process. With Nornes challenges the issue was to make them identify their most important work processes. This work is described in detail elsewhere [11].

Norne personnel developed 16 main work processes. For each of these work processes Norne personnel were chosen as process owners. The role of a Norne process owner was to involve other people in the Norne organization in order to describe the defined process. Employees that were chosen came from different levels in the organization, from supervisors to operators and technicians. The typical process owner was a person that would be working with the process in operations, who knew the activities and who had basic communication and facilitator skills. These persons were trained by the researchers in the process of establishing a facilitator role for their process: Learn basic facilitator skills, problem solving techniques including our methodology, and PAR-thinking [20] more in general.

Application of the model: Norne maintenance

The methodology is very simple. The arrow box (figure 1) signifies the activities within a process (e.g. within maintenance to create a work order). There are products associated with the processes. For maintenance the end product is technical condition re-established, while an intermediate product can be a created work order. Linked to products and processes you have information requirements, e.g. to the sub process create work order one information requirement is access to the plant management system. Finally, there are also dependencies between processes and products on different scales that can be addressed by using arrows between the objects.

These simple symbols were applied in describing i.e. maintenance (figure 2). The first sketches were made on paper in groups. The typical situation was that the process owner gathered 5-6 of his or her colleagues in a full day workshop to design the overall maintenance process.

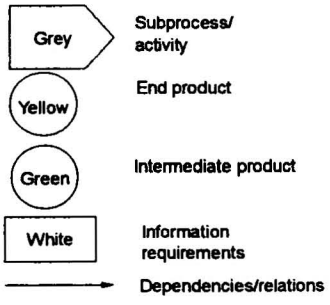

Figure 1: Norne flow chart symbols

[1] Statoil is the state oil company of Norway. Primary activities are exploration of new oil and gas fields, operation and maintenance of a number of offshore oil and gas production installations, operation and maintenance of refineries, transportation, marketing and distribution of intermediate and end products.

Here they would discuss activities, roles, products and dependencies using the simple symbols. Researchers participated as facilitators and assisted when needed in their processes and workshops. Before the project started we discussed some overall requirements with Norne management and operators/technicians. We agreed to stick to the following premises and address these issues continually throughout the process if and when they were broken: 1. Norne wants to remove as many of the detailed procedures as possible. 2. Norne have competent personnel on all levels that are eager to take responsibility, supervision is not an issue. 3. We will not tell competent people how to do the work they are skilled to do. As a consequence, we make aggregated descriptions of work practice, and do not go into details. 4. Automation no, quality of working life yes....

The method resembles that of a collective reflective practice[8]. An overall operational strategy developed by management gave functional requirements to the organizational design of the future installation (e.g. number of people onboard, equipment installed, espoused values and overall objectives). This strategy was of a general nature and the challenge was to put the content into concrete terms to meet the strategic objectives. The people taking part were divided up in multiskilled groups, with one process owner as facilitator/leader. The groups interviewed experienced operational people, read about and discussed best practice from other Statoil operated installations. The interpretations of interviews and best practice were kept in mind when developing their own work processes using the flow chart methodology.

When each group were developing their work processes in roundtable discussions, the following reflection took place: Roles became discussed, clarified, demands and requirements both internally and externally between the groups became apparant. Once objectified via flow charts discrepancies in expectations, perceptions within and between groups and work processes were found. It was a bargaining and mobilization process in the sense that each group had to argue for their ideas, give and take perspectives depending on the situation and domain. Groups had to reach an agreement themselves without appealing to management (which would have meant loss of face). The flowchart methodology then became the catalyst, in the form of a language that enabled a diverse discussion on operational practice. A result of this reflection is the maintenance process in Norne.

The traditional way of describing maintenance in the oil industry is to write a procedure that regulates activities, and many of these activities must be based on strict procedures because accidents can have disastrous effects on people on board the installation and on the environment. Described in figure 2 are different roles in the Norne organization that take part in the maintenance process, from the different levels offshore to technical support onshore. The more the arrows and the sub processes passes over the lines, the more coordination intensive the process becomes. In order to avoid bureaucracy in the maintenance process, Norne decided that most of the maintenance should be done by the shift teams and operation/maintenance teams, with minimum interference from others. In the maintenance process, to write, wait and approve work orders requires considerable time. This has to do with the health hazard, since you must control what kind of work is conducted at different locations on the installation. However, Norne has taken measures to reduce their maintenance work orders by 75%, by differentiating between different kinds of work orders. Up to now they have succeeded in this effort.

Much of the maintenance work is rather simple (with no potential hazard) and can be done by the teams without work orders. To be able to do so they designed teams with system responsibilities that could self-organize, instead of having a traditional disciplinary responsibility. Specific technicians were given the responsibility to both operate and maintain their defined technical systems and within that area they have large autonomy. When given the power to describe their own work they also took more responsibility themselves eliminating much of the control of middle management. The flowcharts were meant as resources for future situated actions in operations, a general reference for orientation purposes and self organization. In order to open the "black boxes" like in figure 2, we stressed other aspects through our participation as mediators and helpers in the process description workshops, via informal discussions with groups and members during our fieldwork days in the Norne organization.

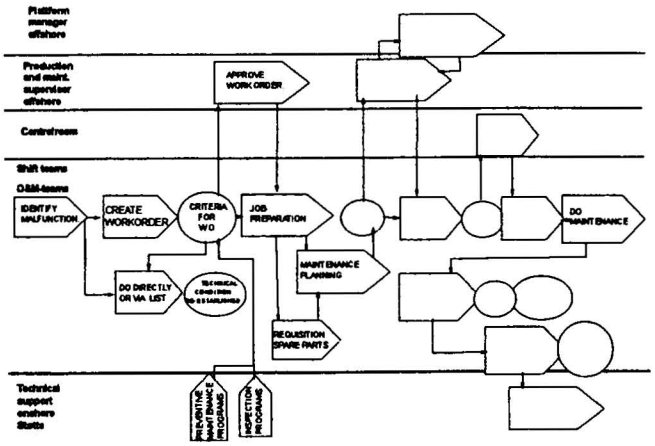

Figure 2: Norne maintenance process (principal sketch simplified)

An example of this can be that one of us asks what does this box contain, like the box "create work order" in figure

2. The context is an informal discussion with the PAR-anthropologist, a Norne process owner, and four of his helpers. The start of a dialogue on this issue went like this:

Excerpt 1

Anthropologist: "Take a look at the "create work order" sub-process. I know from past fieldworks I have conducted that the "bureaucracy" with work orders take considerable time. You have said that Norne will try to reduce the number of work orders with 75%. How do you plan to do this when you are in operation, since both you and me know that it is easy to fall back on old practice?"

Process owner: "You have seen our criteria to differentiate between work orders, they are fairly clear. However, I do agree that we have to do something more than just define these criteria, these things will not happen by themselves."

Anthropologist: "How do you plan to do this?"

Process owner: "Good question! We have already taken measures to present this way of thinking during our presentation to newly recruited Norne people. Another idea is to live by and learn from the usage of these principles during our commissioning phase. I think this is the only way we can make Norne personnel understand what this really is about."

Process owner: (Addressing his four colleagues) "I want you to help me plan how we can take steps to live by these principles before we come into operations."

It took many months to develop the maintenance process since participation, empowerment and ownership were key issues. The process owner and 5-7 Norne people had the mandate to describe the overall process and mobilized a participative process to receive feedback from the rest of operations, including management and employees. The proposed maintenance process and the other 15 work processes were not overruled by management and were implemented in a LOTUS NOTES release 4 database and made clickable with hyperlinks (see [11] for further details).

CASE 2: AKER VERDAL

Aker Verdal is a construction yard for offshore installations. Its main products are jackets (steel foundations for oil platforms, used on depths down to approximately 250 meters) and various production modules. The yard is dominant in the Norwegian sector of the North Sea when it comes to jackets. Currently, they have 1060 employees (1998). Aker Verdal is part of the Aker Maritime group, which also includes other yards, suppliers and an engineering company. Aker Verdal was established in 1970, and has been reasonably successful in the market. However, they have so far not been able to stabilize themselves as a profit-making company. In 1996, a change program named "Aker Verdal towards year 2000" (AV 2000) was initiated.

At the core of the program is a research project, created in cooperation between Aker Verdal and SINTEF Industrial Management, entitled "Enterprise Modelling". The project is funded by the national Norwegian research foundation (NFR), who insisted that the project needed to be cross-disciplinary, i.e. include both engineers and social scientists. Enterprise Modelling at Aker Verdal can be traced back to 1994, when the yard ran a total quality program. In an effort to document their work processes, cross-functional teams in the entire organization drew process charts at a very operative level. The hope was that they would be able to link these process charts together in one major work flow, which then could be used as a basis for improvement and redesign efforts. Due to the complexity, this attempt (predictably) failed. What remained was however an organizational knowledge about modelling, and an interest in understanding work processes.

The spool manufacturing process

AV 2000 has a vision of Aker Verdal as a "process oriented" yard in year 2000. To them, this means to define the core manufacturing and support processes, redesign them in the most productive manner, and then organize according to these processes. Eleven such core processes have currently been identified, and six of these are now being redesigned.

The spool manufacturing process, which has as its product structural tubes used in jackets, is the one that has been developed the most. The redesign of this process actually started some time before all the processes were identified. When the AV 2000 project started, we wanted to create a pilot in manufacturing in order to demonstrate what might be possible, using process thinking and information technology. The process of cutting "stubs", short tubes, was chosen. The engineer in charge of this process had an idea that if the workers themselves were able to plan their own work, they could easily cut down radically the time used for transportation and handling. He created a group consisting of people from the entire process: Engineering, planning, work management, and machine operations. Through presenting a simple drawing of the process (figure 3), and what might be possible if the operators "harvested" information from a small spreadsheet application on the shop floor, they reached an understanding about a redesigned work flow. This new work process was implemented, and gave immediate results when it came to productivity and the removal of bottlenecks in manufacturing. However, there were problems regarding the implementation earlier in the process.

To understand and evaluate the work so far, the researchers in AV 2000 interviewed all people that had

been involved in the process (11 in total.) Among the results were a clear lack of participation in the design and decision process from the ones that were most negatively affected, the planners and the supervisors. This was taken into consideration in the next step of the process redesign: The entire spool process.

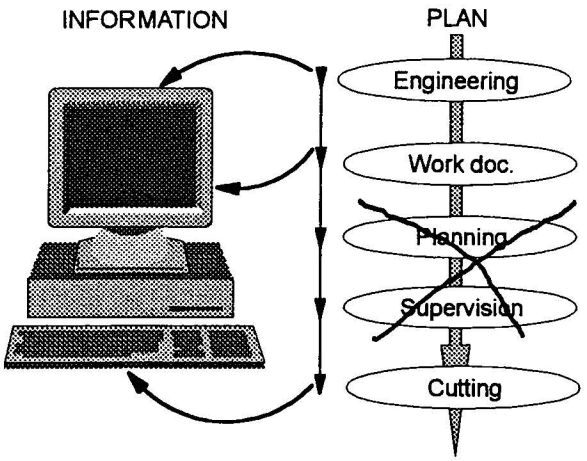

Figure 3: The cutting of stubs at Aker Verdal

The same engineer that had initiated the redesign of cutting of stubs, was also in charge of the modelling of the spool manufacturing process. A team was put together which included people from the entire process, from construction to manufacturing[2]. The modelling was assisted by an internal facilitator. In this model they used very simple tools: Post-it stickers of various colors on a large sheet of paper represented the activities in the process, and lines and arrows represented input and output. This was the same technique that was familiar from the total quality project earlier. The researchers introduced elements from the IDEF 0[3] standard: Control and mechanism were added to the sub-processes and activities, so that for instance the quality system and drawings (control) and tools (mechanism) could be included in the model. In order to increase participation, people from various parts of the process were invited to validate the process, and to brainstorm on improvement potentials. As the redesigned process was close to completion, they also conducted a "simulation" or role-play, where the people involved in activities actually lined up according to work flow, in order to reflect on whether the model in a sufficient way described necessary inputs, outputs, controls and mechanisms.

The reflections made in these discussions, as well as in similar discussions in other processes, are often based on the discovery of relationships and dependencies. Those working in processes usually optimize their own activities and functions, but have neither the tools nor the knowledge to see what is going on earlier or later in the process. When they for instance discover that certain quality problems that they found insignificant in their own job causes major problems for the person sitting next to them in the discussion, a different work reality for the individual is constructed in the reflection and learning process. On several occasions this has lead to a change of priorities, the cutting out of certain work operations, or a re-ordering of the sequence of activites.

There seems to be an agreement among the participants and other people related to the manufacturing of spools that the redesigned process in a good way describes a desirable way to perform this manufacturing. Implementation of the new process has however been difficult in many different ways. The new process requires new cross-disciplinary competencies among many of the people involved, which is difficult to find time and resources to acquire. Power relationships between managers in the new process oriented organization and the old functionally oriented organization are difficult. The existing measurement, accounting and control systems are not suited for process organizations. Some of the redesign requires physical relocation of people and machines (in the offshore industry, there is some pretty heavy-weight equipment.

These difficulties illustrate how very different it is to model and redesign work processes in a large and mature organization, as compared to a smaller one being constructed from nothing. The non-existence of a technological infrastructure (a network, for instance intranet) made it very difficult to integrate the process in the organization, that is to implement it as a computer interface/information model. If we had been able to do this, it would probably have been easier to help the participants move from modelling to implementation, to introduce new support and control systems for the new ways of working, and to train people in the required competencies as they were performing the work. It would also have facilitated broad participation in continuous improvement of the process. This technological infrastructure, an intranet, is now being implemented, and will become important in the further work on process orientation at Aker Verdal.

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[2] The redesign focused on Aker Verdal, even though the process of producing spools really starts with the engineering done by the engineering company.

[3] IDEF is a standard diagramming method used to describe systems, developed by ICAM (Integrated Computer Aided Manufacturing). IDEF 0 is for process modelling. See for instance Federal Information Processing Standards (FIPS) Publication (PUBS) for IDEF. IDEF0 - FIPS PUB 183, 1993.

DISCUSSION ON KEY FINDINGS

Norne and Aker Verdal are very different organizations. Norne is a fresh starter with little history, Aker Verdal has a long tradition. This diversity in organizational maturity will create a space of a constructible organization. Norne is a process plant going over into stabile operations. Aker Verdal is working under tougher market conditions and must adapt to these conditions continually. Norne has an offshore organization of around 100 working in three shifts and Aker Verdal has around 1000 employees. Both projects were conducted in comparatively small organizations restricted to a few locations. Both size and location made it possible to run a participatory project. Even though the unions were not involved in both cases[4], the working conditions between management and employees were based on openness and trust.

A simple method

In Norwegian work research, work mapping and representations of work practice have been used in different forms since the late 1960's [17]. With the growth of BPR and enterprise modelling, work mapping became hype again. There are however considerable differences in how work mapping is conducted.

Within the paradigm of enterprise modelling [14], the focus on ontologies is considerable. An ontology in enterprise modelling tries to define elements of a generic enterprise: Reuse of enterprise models, translation of semantics between various lexicons, elimination of redundancies and resolving unnecessary or missing content. [5,19]. They assume general validity and relevance of their concepts, indifferent of the reality construction process of the modelling organization. The language for developing models is the most important, but the degree of formality and the notations used for modelling are accessible to specialists only. The language in the model is not suitable for organizational sense making since it is not understandable to none experts and restricts access to the modelling process. In Norne simplified flowcharts were developed to give everybody access to the modelling process, enabling the employees to use their own professional language to a larger degree. Aker Verdal started up with using IDEF 0, but found out that they needed simpler symbols. Behind these two PAR-cases lies a constructivistic point of view, very different from the previous objectivistic perspective [5,19]. In PAR, models are not defined with precise and unambiguous definitions. It is seen in relation to sense making, reflection, interpretation and discussion in order to reach a common understanding. Model creation and model interpretation as we see it is a matter of involving actors with their local realities. Both our cases used simple models with few elements and few language concepts that were more or less intuitively understood by the actors. The simpler the model the less model power and advantages were given to managers, experts and professionals.

Model power [4], is a situation where two people (A and B) try to communicate, and one of them (A) has a much stronger and more developed model of the subject matter than the other person (B). The person holding the weaker model (B) will try to learn and adopt this model (because without a common point of reference communication is impossible). This means that the more successful B is in adopting A's model, which is developed on the basis of A's world view, the more B is being controlled by A. When the employees themselves create or restructure the workplace, as in Norne and at Aker Verdal, they need a simple method. The flowchart with its weaknesses enables them to talk about organizational problems, roles, responsibilities, apparently irrational phenomena, relations between phenoma, and discuss what measures can be taken to improve the situation. This use of "black boxes" becomes useful. It is not necessary to know the exact content of a black box to have a pragmatic discussion of relations of "black boxes" at a more aggregated level. Even though people interpret the "black boxes" differently, this is less of a problem when people come from a relatively joint Statoil and Aker culture and have been working in the same environment for years. A constructivistic approach with a simple method, focusing on the modelling process were important both in Norne and at Aker Verdal. Neither syntax nor semantics were formally defined and agreed upon in detail. This fact did not have a large effect on the meaning associated with the models, since models both in Norne and at Aker Verdal were designed for human interpretation.

Pragmatism

The idea was to take the advantage of the local reality of the employees at both locations by applying a simple method. This meant using the employees own local theories in the modelling process. Some local theories could be interpretations of BPR, TQM, Scandinavian perspectives on union-management collaboration, to name a few. These concepts might seem contradictory, but could be applied down to a certain level of aggregation. PAR is multidisciplinary in nature and believes in combining different perspectives from anthropology to engineering to grasp the overall picture [20]. Concepts from the dying BPR-tradition were used in defining the value adding processes of Norne and Aker Verdal.

In the world of engineers and technicians

[4] At Aker Verdal, the Unions sit on the project board, and have clear intentions and interests in the total project. There are however not Union representatives in each subproject.

flowcharts are a well-known technique to describe "system" phenomena and dependencies. In the local reality of the employees in these two cases, this was a fruitful method to understand the composition and decomposition of technical systems. There are a number of problems associated with using this machine like metaphor to understand organizational phenomena. Flowchart representations can be used to pinpoint important issues, but other aspects must be brought forward in the process of reflection and fieldwork to cover other issues that this rationale does not envision.

Seeing the phenomena from different perspectives will improve the understanding of the whole [12]. A structural and rationalistic perspective will give a partial but important picture, and human resource, political and cultural perspectives make it possible to understand the setting as a social system, with communities of practice, local knowledge and inevitable power struggles. Organizations not only consist of identifiable system relations, objects that can be decomposed or substituted, logistic systems and work flow. There is a possibility that too much focus on these issues will set frames for a "machine"-like perspective on the world, where the latest fashion depicts the enterprise as a computer like construction. The social system tends to become a "remaining factor". It views the social aspects as "what is left", that could be put on top of the rational process in terms of "criteria for success", when all the formal objectives, roles and responsibilities have been settled. As a consequence, it does not show vital social processes in the organization, like informal networks, team building processes, local knowledge, intuition, knowledge creation, learning, communities of practice and motivational processes. It is also more applicable in traditional production industries and not as applicable in knowledge intensive businesses. In order to question BPR as a systematic solution to business problems, it was coupled with ethnographic descriptions and a participatory action research design [9].

The model as a communicative and reflective device

The method used in Norne and at Aker Verdal has two phases, that of development and dissemination of a model [18]. Development is a process of creating or changing a model, including sense making, representation, manifestation and distribution. It implies building a number of intermediate artifacts like flowcharts, explanations to the charts, narratives, metaphors, definitions and examples. These are the products of the modelling process. These artifacts describe a domain like maintenance in Norne and the spool manufacturing process at Aker Verdal. Artifacts have an expression and impression according to a participant. The expression is manifested in some medium, i.e. paper or a digital presentation on a screen. An impression can be described in terms of elements and structure. Model development correspond to perspective making within a community of knowing. Dissemination is the process of model deployment. It also includes sense making, representation, manifestation and distribution, run in a parallel phase with development. Dissemination is an opportunity for perspective taking and implies; making artifacts available to other actors, making intermediate artifacts become exposed artifacts, create ownership, participation, commitment and empowerment, and give the original creators of the model feedback. Both development and dissemination are essentially communication processes that can utilize a number of different forums and media each with particular properties and approaches for development and dissemination purposes [18]. The combined focus on formalism and dialogue in the two phases uses a double level language [13]. There was a restrictive formalism in flowcharts. Understanding, interpretations and changing items at the formal level were mediated by conversations on a cultural level, giving power and meaning to the formal representations [13].

The Model as an integrated part of the organization

In both cases the modelling processes ended up in restructuring old practice and gave new roles and responsibilities to people in the two organizations. This was the major effort to institutionalize new practice and the final judgment of the models' applicability. We have focused on communication and reflection and little on models in themselves. A consequence of our perspective is that the modelling process is the most important and hence the social construction process of sense making, interpretations and development of shared meanings is the most critical. There are many ways of creating this shared understanding. Norne used a double level language to develop their work processes. They run a participative process to create ownership and spread the thinking to the rest of the organization. In addition to this Norne made a digital model of the work process flowcharts. They called this an operative enterprise model, enabling employees to have easy access to information they needed in their daily operations. This information superstructure or reference guide gives descriptions of important work processes in Norne. Some killer functionality was implemented in the operative model to secure use. This was the ideal Norne operational model and employees could give improvement comments via the LOTUS NOTES-application facilitating a continuous improvement process as well. The model then became operational as the key NOTES database of Norne. Aker Verdal also has plans for doing the same when they get their intranet up and running. Both cases show that the model must be a part of the organizational setting unless it will disappear.

Statoil is working further with developing digital models as the Norne model in the form of WWW-based navigation structures on top of existing IT infrastructures. WWW-based components (i.e. Java and applets) function as components that retrieve information from old databases whether these are NOTES or legacy systems. Old databases can also be edited from the web interface, employing more customized interfaces for ordinary users. For PAR and perhaps also for PD there is already a situation where more and more effort can be employed in developing these overall navigation structures based on local individual and organizational needs. Then the IT development will be more related to setting up or combining already existing Web based components on an intermediate level to enable access to corporate databases of several kinds. As PAR-researchers we interpret this to be a challenge: It means that more efforts can be placed in organizational development and prototyping, while a collaborative IT-design might become more to adapt and customize standardized WWW-based "LEGO-bricks".

BPR, PAR AND PD IN MODEL BUILDING: A PROCESS OF ORGANIZATIONAL REFLECTION AND CLOSURE

Figure 4 shows two dimensions of model building in organizations. On the vertical axis, we distinguish between participatory and expert approaches to the change process.

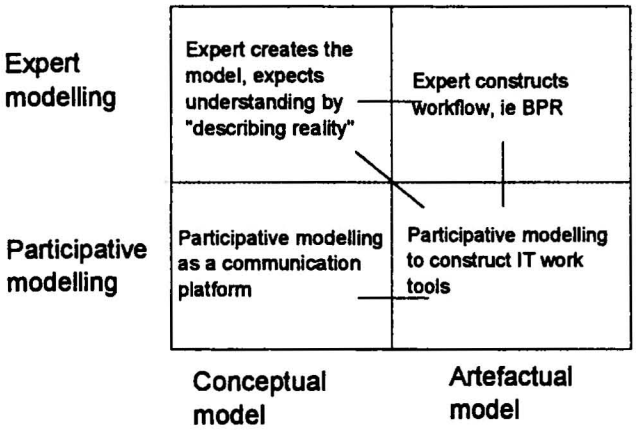

Figure 4: The relation between different modelling modes and forms of representation

On the horizontal axis, we distinguish between conceptual and artifactual models, and thus between models created for the purpose of being a basis for common understanding of the organization being modelled, and models that are implemented as work tools in the organization. Moving along this axis is a process of giving representations a more concrete form in the shape of artifacts. These artifacts can be oral or metaphoric descriptions in one end, via flow charts, to mock-ups and digital models in the shape of prototypes and IT systems in the other end. We argue that the various traditions of modelling and participatory change and development can typically be classified according to this table. We also argue that the table may show how the traditions of PAR and PD may find common ground within the area of constructivistic enterprise modelling.

Business Process Reengineering has typically been a tradition in which experts have created process models. The intention of the models has been to focus on and simplify the core processes of the organization. The level of detail ranges from strategic to detailed operative. Work flow systems are a tradition often related to BPR, also dominated by experts who model and simplify processes. This tradition has however been more occupied with the technological implementation of these processes, as they create computer based systems to control, monitor and facilitate the work processes. These two traditions are clearly both on the expert end of the vertical axis, but differs on the conceptual/artefactual dimension.

Participatory action research (PAR) has, as described earlier, a focus on creating arenas for dialogue in order to produce liberating and unlikely social outcomes. The models that are created through PAR processes are not necessarily what we would call "enterprise models", but they are still new and common understandings of the organizational and local realities of the participants in the organization, very often on a strategic or "core process" level. We argue that the PAR tradition, more often than not, belongs in the lower left corner of our model: Participatory and conceptual. Participatory design has a focus on participation, IT-design and technological implementation. The outcomes are different from PAR, as the tradition focuses on the work processes and design issues more than the strategic and organizational issues.

We place PD in the lower right corner of the model: Participatory and artifactual. We argue that both traditions could benefit from integrating the conceptual and artifactual aspects, and thus learn from each other. PAR in many cases needs to take its participative processes further, and create a more concrete and closed organizational reality than the conceptual models. This would increase the permanency of the social outcomes created, something which is clearly lacking in many cases of PAR. PD could benefit from the well-developed concepts of participation created within the PAR tradition, and especially from integrating the more organizational participatory processes. These could also be used to increase the reflection and communication around the use and reconstruction of the artifacts created in the design processes. Enterprise modelling the way it has been described above in the two cases, is a way to move along the entire horizontal axis of our model, from strategic and organizational concepts to the operative artifacts. To us, it is a way to integrate the already very similar traditions of

PAR and PD.

An enterprise model is a powerful part of organizational reality[5], and has the potential of dominating the local reality of individuals and groups in the organization. The challenge is to facilitate processes in which all the local realities can be seen as valid and useful in the construction of the enterprise model, and where the enterprise model does not create an organizational closure in which the diversity of local models is unreasonably limited. This can be illustrated as in figure 5. These two situations may be called two archetypes of organizational closure. The dotted circle illustrates how the enterprise model dominates the possibility of developing local understandings of the work and the organization. This is a situation that may limit creativity and improvements, as this often has as its source the very existence of diverse local realities. The inner circle illustrates how organizational reality, in the shape of the enterprise model, is much smaller. This nurtures a diverse organization, in which individuals and groups are given the possibility to develop local views of their work and the organization. This has been called a large "space of possibility" [6].

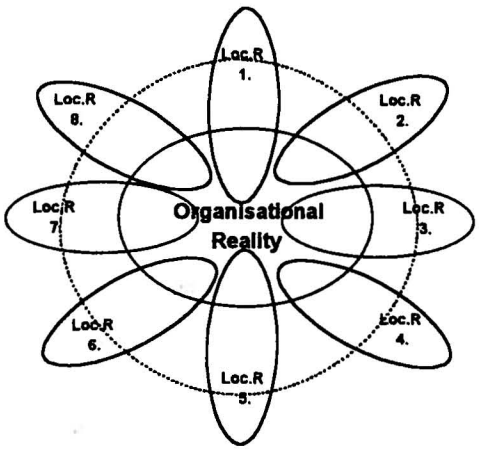

Figure 5: Local realities and organizational reality, a small (dotted) and a large space of possibilities

Organizational closure is however necessary in order to be able to perform work. As long as organizational reality is such that nobody needs to take it into consideration in their actual work, it becomes very easy to move away from the description of reality agreed upon through the participatory process. This balancing of concepts and artifacts in the participatory processes is what may be developed through an integration of the PAR and PD traditions. We have earlier argued that the transformation from conceptual model to artifacts is becoming increasingly easy through the construction of WWW-technology. This makes it even more necessary to have well developed concepts of participation. Firstly, because these transformation processes will be more common. Secondly, because it will become more necessary to reopen the artifactual "black boxes" that are the results of organizational closure. This calls for clear ideas about how to facilitate reflection and communication around models, both conceptual and artifactual.

[5] Organizational reality and local reality have the same meaning as Peter Berger's and Thomas Luckman's terms objective and subjective reality[2].

CONCLUSIONS

PAR and PD are similar traditions, the major difference is the role of information technology that has been largely missing in the PAR-tradition. The two cases in this paper are aimed at showing that models in spite of their weaknesses might be used as reflective and communicative devices in organizational development, as long as they are used in a constructivistic manner. The distinction between participatory v.s expert modelling and deployment of artifacts have been used to place PAR, PD and BPR. We have urged PAR to be more attentive to the use of technological artifacts in their development processes, whereas PD can develop more advanced concepts of organizational participation and reflection in their design processes. We are of the opinion that PAR and PD can benefit from each others perspectives.

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