

Integrated Organization and Technology Development (OTD):

A critical evaluation

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INTRODUCTION

The domain of work has developed a myriad of social practices which are often shaped by ICT infrastructures. The introduction of additional IT artefacts, of course, affects these practices and the related patterns of communication. While management and IT specialists plan for certain effects of a system's introduction, unintended use of the system can play a central role (Orlikowski 1997; Pipek and Wulf 1999 and 2009). Therefore, the (unanticipated) appropriation of IT artefacts by its users is an important phenomenon (cf. Pipek 2005a, 2005b; Stevens and Pipek, in this volume). Given the existence of IT related organizational change and adjustments related to the appropriation of software, the development of IT in organizations faces an iterative challenge:

- the existence of IT artefacts allows for new work practices and
- these practices raise new requirements for technological support.

This phenomenon causes a significant degree of difficulty in software engineering projects (cf. Rönkkö et al. 2005).

With regard to the design of IT infrastructures in support of cooperative work, a dialogue between designers and users is required. The “Participatory Design (PD)” community (e.g., Greenbaum/Kyng 1991, Ehn 1993, Kensing/Blomberg 1998, Wagner, in this volume) has developed over time, using a variety of different techniques for user participation in (iterative) design processes. However, the PD community, we feel, tends to underestimate the relevance of non-anticipated use and design-relevant outcomes of IT appropriation over longer periods of time.

To cope with the intertwined complexity of individual, social, and technological change, we have developed over time a practice-based research perspective. As a first step we proposed a process-oriented framework for the design and introduction of IT artefacts into organizational practice. Integrated Organization and Technology Development (OTD) tackles problems in organizational practice to which the appropriation of properly designed IT artefacts could be an element in the solution space. The framework suggests that the design of new IT functionality and the tailoring of existing ones should be conducted in association with attention to activities of organizational and personal development (Wulf and Rohde 1995).

In parallel with our work, related approaches to analysing, reflecting and developing work practices emerged. Focusing on the development of work systems, Kuutti proposes an approach called formative experiment or developmental work research methodology, based on action research methods (Kuutti 1991, 540ff). This approach includes four methodological phases: analysis, formation of instruments, application of these instruments, and evaluation of effects. A different school of thinking preferred ethnographic approaches for technology development (cf. Blomberg et al. 1992). Ethnographic methods concentrate for the most part on different forms of observation, interviews, and video analyses. In this context the relevance

of participation (of some kind) is considered to be a crucial characteristic of the ethnographic approach (Blomberg et al. 1992: 139f).

With its emphasis on the integrative aspects of technological and social systems, STS can be seen as a disciplinary area which had theoretical interests in what we can gloss here as the ‘socio-technical’, and which preceded later approaches such as the Scandinavian participatory design method, MUST (Kensing et al. 1996, Kensing et al. 1998, Kensing/Blomberg 1998, Bødker et al. 2005) or the OTD framework presented here. More recently, Fischer and Ostwald, in the early 2000s, introduced their participatory design method and process model SER (Seeding – Evolutionary Growth – Reseeding), which is based on a concept of “informed participation” (Fischer/Ostwald 2002) and following the meta-design approach (Fischer 2003). In the IS community, Peter Checkland’s soft systems methodology did similar work (see e.g. Checkland 1989). It should perhaps be pointed out that only later did Checkland focus more explicitly on IT (see Checkland and Howell 1997). In this context, the OTD framework offers one mindset for orientation to groupware development projects which sits besides other alternative approaches.

In the following, we want to present the framework of Integrated Organization and Technology Development (OTD) and describe its application in a series of research projects in practice.

THE FRAMEWORK OF INTEGRATED ORGANIZATION AND TECHNOLOGY DEVELOPMENT

First published in the middle of the 1990’s, OTD was applied as a framework for research projects developing and introducing groupware into organizations. Our thinking in the early 1990s was influenced by different intellectual traditions and normative positions emerging from the German discourse on “Computers and Society”.

Traditional computer science approaches seemed not to take the social embeddedness of ICT sufficiently into account which also meant that normative concerns were not seen to be a relevant issue and hence were seldom dealt with. Criticizing the mainstream in Software Engineering, Floyd et al. (1989) had proposed STEPS – an evolutionary and participative process framework to build software for and with users. Their work was grounded in the kind of analysis associated with the Scandinavian School of Participatory Design (PD) (Floyd et al. 1987). Coy (1989), similarly, had asked for an extension of the theoretical foundation of computer science beyond purely formal conceptions.

Work psychological research in the tradition of Leontjew’s activity theory argued, at roughly the same time, that the human quality of (computer supported) work was importantly determined by organizational factors such as the overall task of an organization and the division of labor among its workers (Hacker 1987). Discourses in management science indicated major problems with Tayloristic principles of organizational design as they were not able to deal with the increasing differentiation and dynamics of market needs (Brödner 1985; Womack et al. 1990; Hammer and Champy 1993). Overcoming Taylorism seemed desirable as well from a normative perspective, grounded in work psychological findings about work satisfaction, motivation and so on (Brödner 1985; Hacker 1987). At the same time it became obvious that post-Tayloristic concepts of work would require different approaches for IT support (Brödner 1985, Schmidt and Bannon 1991, Wulf 1992). Organization and technology development seemed to be related to each other in very significant ways.

To overcome this gap in the state of the art we suggested the process framework of Integrated Organization and Technology Development (OTD) to facilitate change in organizational structures and cultures with their supporting IT-infrastructure.

Integrated Organization and Technology Development (OTD) is defined as "the process of change of an organization in which an organization and technology are designed and developed in a task- and needs-oriented fashion by the members affected through integrated means: the organization members affected consider the existing problems, search and evaluate the problems' causes, and negotiate a process of problem solving. OTD only takes place if the members affected are willing and able to define contents and course of the OTD-process, and are immediately taking part. (...)" (Hartmann 1994, 311, translation by the authors).

The OTD-process is characterized by a parallel development of workplace, the organizational and technical systems, the management of (existing) conflicts by discursive and negotiative means, and the immediate participation of the organizational members affected (cf. Hartmann and Rohde 1993). OTD is based on the assumption that there exist several ways of designing organizational structures and processes instead of "the one-best-way". So the division of labor, the distribution of tasks among different organizational sub-units, the specific design of workflows, individual degrees of freedom, the role and conditions of ICT use in the work process, and the design of technical support are to be negotiated in a participatory manner.

Three elements were central to this framework:

(1) *Integration of individual, organizational and technological change*: The process was thought to be intentionally set up in reaction to a problem perceived in daily work practice. After setting up the change process, the given situation had to be analyzed with regard to organizational, professional/role and technological dimensions. Based on such integrated analysis, alternatives for interventions were to be suggested and discussed. Based on the outcome of these discussions, interventions with regard to technology, formal and informal aspects of an organization and the qualification of its members were suggested to be planned and finally implemented.

(2) The change process was expected to happen in a *participatory manner*: A problem perceived by practitioners was seen as a starting point of the change process. From the initiation of the process suggested, it was to be driven by practitioners' needs and their direct involvement in the analysis, planning and implementation of interventions. (External) Change agents, such as researchers, could also get involved in support of the change process. Where there was a lack of expertise in the change management process among participants, a typical problem of highly Tayloristic organizations, it was expected that specific training (qualification for participation) would compensate.

(3) The process framework was conceptualized in an *iterative and evolutionary way*: Due to the fact that the organizations' environments are constantly changing and an integrated development of practices requires an equally dynamic exploration of ideas, evolutionary cycles were envisioned on three levels:

- within individual process steps, e.g. by prototyping technical artifacts,
- through iterations within the integrated change process, e.g. by reiterating the planning phase when certain interventions did not work as planned before,
- between different instances of the change process, e.g. where, after a change was implemented, it turned out that a new problem occurred which necessitated the redevelopment of appropriate practices.

The OTD framework distinguishes between the primary task of an organization (establishment of an appropriate work system in the organizational practice to fulfill the organization's aims) and the secondary task (to develop, adapt, and – if necessary – reorganize the "work system", consisting of organizational structures, cultures, practices, technical systems and tools, and human resources and competencies).

Both tasks are understood as analysis - development - evaluation - adaptation/reorganization cycles. Within the primary task, the existing work system is evaluated and designated as in need of adaptation or reorganization if problems occur. The development (and the adaptation/reorganization) of the work system is another cycle in itself: the definition of a problem within the work system of an organization leads to the establishment of a reorganization process that consists of an analysis, the creation of options, planning of interventions, the realization of these interventions (for organizational development, tailoring and re-design of technical systems, and measures for qualification), and the re-analysis of the new system. Being a participatory process, this second task cycle should be accompanied by appropriate measures for qualification for the participation of organization members.

After a new modified work system has been developed, this system is again implemented and evaluated in terms of new organizational practice. Within this organizational practice, the work system is administrated, appropriated, and adapted on the different organizational, technical, and qualifying levels, according to the requirements of the organization's primary task.

While the early OTD concept focused on the "work system" (e.g. human work design, workplace studies etc.) as the central development task, Rohde (2007) analyzed five longitudinal case studies - applying the framework to different organizational settings over one decade - and pointed out that groupware support would be probably not be limited to work systems but might focus on (collaborative) learning systems and community-building as well. Furthermore, Rohde (2007) came up with some reformulation, esp. with regard to some theoretical limitations of the original OTD model. The empirical insights showed some indication of relevant socio-cultural processes which had not been considered in the original OTD framework. This was elaborated especially with regard to the design and introduction of groupware applications for informal and virtual (respectively hybrid) organizations, (social) networks, and communities. Therefore, Rohde (2007) added socio-constructivist and socio-cultural theories to OTD in order to analyze their implications for the understanding of processes of social identification (Tajfel 1982, Tajfel and Turner 1986), trust-building and social capital (Bourdieu 1984, Cohen and Prusak 2001, Huysman and Wulf 2004), and community learning (Lave and Wenger 1991) within OTD projects.

The reconstituted OTD framework provides a combination of theoretical concepts for the orientation of research projects regarding the introduction and adaptation of groupware systems into organizational practices by mainly applying ethnographic, qualitative and participatory methods:

- qualitative interviews,
- participant observation,
- scenario-based methods,
- different kind of workshops concerning data collection, process and requirements analysis,
- participatory design of technical prototypes, and
- trainings measures for qualification of project participants, organization members and technology users.

Rather than a well-defined plan for ICT design projects, the presented framework describes an ideal typical process of OTD, which is intended to help researchers and participants for orientation in their respective projects.

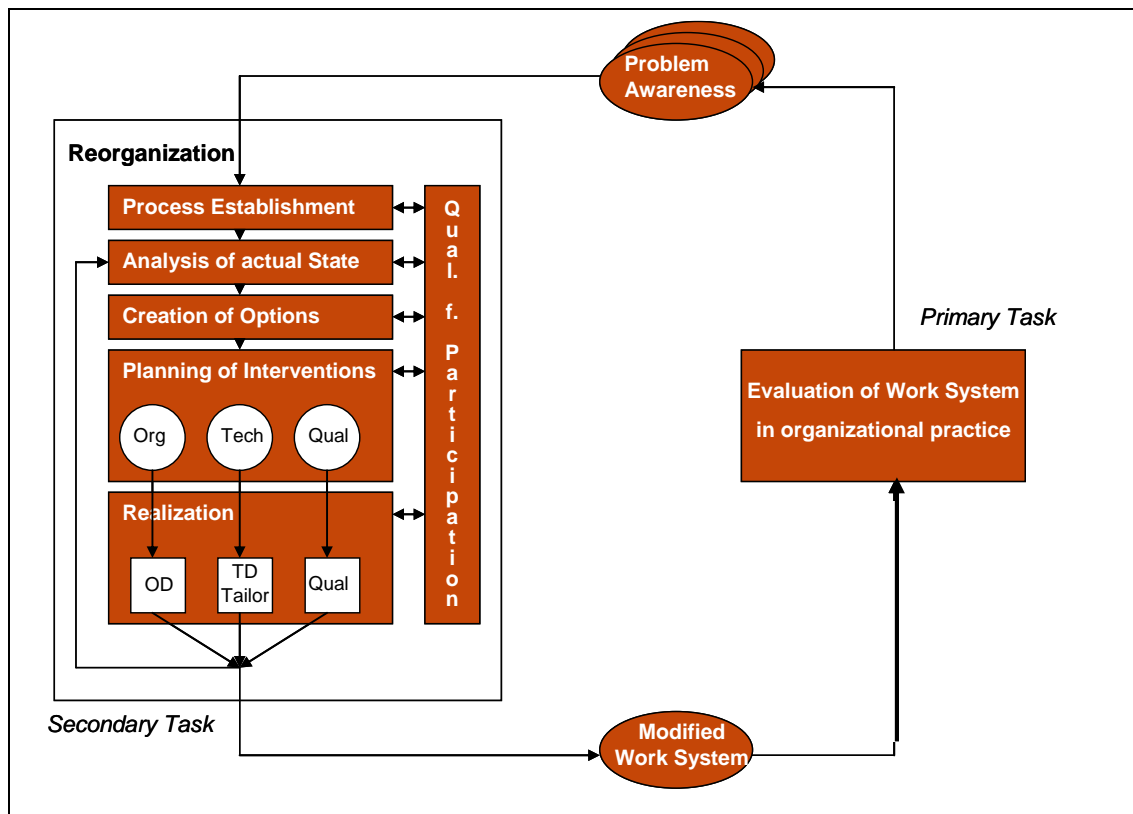


Figure 1: Orientation framework „Integrated Organization and Technology Development“ (OTD)

In the first step of the change process, the actual state has to be analyzed with respect to organizational structure, technology, and qualification. According to the knowledge of the organizational subunit's problems and goals, there are different methods for such an analysis. This analysis can consist merely of a group discussion of the organizations' members to develop a common understanding of the problem. Such a discussion can be prepared by change agents using open interviews or different (work) psychological instruments for task and work analysis.

Having clarified the situation with regard to organizational problems, it seems important to generate alternative approaches regarding solutions. These alternatives may include different combinations of organization, technology, or qualification development. Thus, the members of the organization can discuss and find a general consensus regarding an appropriate solution. These options can be created by the members of the organization themselves, or by change agents. The agents' job is to propose alternatives that are agreeable to all parties involved. Thus, it may be helpful to present work situations with the help of textual or graphical scenarios or organizational or technological prototypes to facilitate mutual understanding.

Based on this discussion, the members of the organizational unit have to decide on interventions in organizational, technological, and personal dimensions in order to realize the development options chosen. A certain approach for these interventions has been proposed by Fuchs and Hartmann (1993), and Hartmann et al. (1994). They describe software development as an iterative problem solving process which should be characterized by the participation of end users. The scientific knowledge of external change agents, the needs and demands of users, and the interests of system designers have to be integrated within this process (cf. Fuchs/Hartmann 1993, 361). In consequence, therefore, they developed a scheme for problem

solving, integrating problem analysis, definition of goals, choice of adequate problem solving operators, and evaluation. This problem solving scheme is combined with corresponding phases of software development and a qualification program for user participation (Fuchs/Hartmann 1993, 365). This approach is based on both the inductive and deductive derivation of goals and problem solving operators. Thus, their main interest in developing user qualification is directed towards the development of analytical, synthetical, and dialectical skills for problem solving and conflict management. These are developed in and through methods such as group discussion, group training, communication training methods, or theme-centered interaction.

In relation to the design and introduction of groupware, the original OTD framework does not differ explicitly between the development of new IT systems “from scratch” and the re-design of existing groupware systems. Empirical evidence, however, has shown the relevance of processes of re-design, tailoring, and adaptation of existing systems. Therefore, groupware design and introduction projects, it was felt, should include extremely generic and flexible groupware systems which allow for appropriation practices, participatory tailoring and adaptation (cf. chapter 2, Stevens and Pipek in this volume).

Evaluating our approaches to integrated organization and technology development, the framework requires some conceptual refinement. We understood changes in work practices to be the result of planned interventions at the time of their (evolutionary) implementation. However, empirical studies published in the late 1990s, showed that organizational change following the introduction of groupware can also happen in an opportunistic manner, and a long time after its implementation (Orlikowski 1996; Pipek and Wulf 1999).

Similarly, learning was originally conceptualized as happening in a planned manner during the change process. While formal learning in the sense of qualifying is important to enable change, the informal mode of learning is also important; both in making sense of IT artifact as also in developing work practices (e.g. Wulf, 2000; Twidale, 2006; Lave and Wenger, 1991.)

To cope with these insights the integrated change process has to be understood as, in principle, ongoing.

The interventions depicted on the left side of the process framework may contribute to informal learning and emergent changes in work practice. When discussing extensions of the STEPS process model we had already suggested that the IT artifacts should be tailorable by the users (Wulf 1994, Wulf et al 2008) To overcome the conceptual shortcomings, the right side of the framework needs to be further elaborated. It should be understood as a complex, self-organized and partially discontinuous long-term alignment between organizational and technological learning and change. Understanding and supporting these activities requires further research. A new development cycle starts in the case where a formal change process is set-up again.

Applying the framework in Practice

While the OTD framework has influenced our thinking ever since, in only few of our projects was there the mandate to tackle organizational change related to the introduction of IT explicitly. Here we want to focus on experiences gained in two projects: OrgTech (Stiemerling et al. 1998; Iaccuci et al. 1998; Wulf et al. 1999) and Iran NGO-CS (Rohde 2004).

OrgTech: Supporting Maintenance work in a steel mill

The Case

Being responsible for the maintenance of a steel mill, a group of middle managers agreed to work with a consortium of two research institutions (Fraunhofer Institute for Graphical Data Processing (FhG-IGD) and our group, at that time at the University of Bonn) as well as a business consultancy which specialized in facilitating organizational development processes following a post-Tayloristic paradigm. The project aimed at exploring the opportunities of, at that time, innovative IT applications such as video conferencing, application sharing and 3D CAD in order to overcome the rather formal division of labor in the steel mill's maintenance department. Additionally, the managers wanted to investigate how to better integrate external engineering firms into their internal maintenance engineering-, work planning- and manufacturing processes. While the external engineers worked mainly with their internal engineering correspondents, both of these sets of actors had little contact with the work planning and manufacturing units. The maintenance of the steel mill additionally suffered from conflicts between the centrally responsible unit and local acting plant operators who carried out modifications at their plants without central involvement.

The project was funded by the EU and the State of North Rhine Westphalia within a funding scheme for structural adjustment. The project was established, on the steel mill's side, by the heads of the maintenance department and the head of the construction department. Both of them were in charge of central organizational units which were in competition with the different plant operators. They also asked two external engineering offices to participate in the project – these offices supplied services to the maintenance engineering department. At least one of them followed the steel mill's managers' invitation to the project with some reservations and some suspicion.

The link to the steel mill's middle managers was built by a department head of our partners from FhG-IGD – a research institute with a high technical reputation. He had known these managers for some time. The middle managers, both owning a phd in mechanical engineering, seemed to be driven by a certain curiosity to explore what type of insights a research-based project team could achieve in their field of operation and which type of change processes would emerge. However, later on in the project we learned that the manager responsible for the maintenance department had hired, in parallel, a professional consultancy to reorganize his manufacturing unit.

We started the project with a kick-off workshop in which we asked the participants from the different organizations to point us to given problems related to technological, organizational, and qualification issues. Based on the results of the workshop, we conducted an extensive interview study in different organizational units of the steel mill and in the two engineering offices (Nett et al. 2000; Wulf et al. 1999). Based on these results, a workshop was conducted at FhG-IGD to present ten different IT applications which offered some potential for overcoming identified problems. In a second workshop, the results of the pre-study were presented to members of the maintenance department and to the participating engineering offices. As the result of the discussion in the workshop, two work groups were formed, deliberately focusing on the exploration of the potential of a certain type of IT artefact as well as on problems in existing work practices. A first work group focused on synchronous tele-cooperation and conventions for the storage of drawings as it was understood that the discussion on current projects would require references to archived drawings. The second work group dealt with the introduction of 3D-CAD and, at the same time, with production-oriented methods of construction. The first work group started by introducing a video conferencing and application sharing tool among internal and external maintenance engineers, and derived concepts to extend the functionality of the application (e.g. Jaccuci et al. 1998). Members of the second work group explored 3D-CAD but, at the same time, engineers of one of the external engineering offices visited the steel mill's production planning and production

department. They found the video conference system to be suitable for a better understanding of certain aspects of the production facilities in an ad hoc manner.

While the project advanced, after 18 months, half of the envisioned run time of the project, the top management of the steel mill decided to stop outsourcing maintenance engineering work to external offices. The decision seemed to be intended to save costs during a cyclic down turn of the steel market. However, this decision impacted the institutional context of our project in such a way that the change process came to a halt.

With reduced motivation and participation of the organizations involved, we expanded our initial analysis with regard to the knowledge sharing practices in maintenance engineering (Hinrichs et al. 2005; Pipek and Wulf 2003). Since the central drawing archive played a particular role in maintaining the steel mill, we were able to involve its administrators in the prototyping of an innovative access control mechanism (Stevens and Wulf 2002 and 2009).

Reflections

We began with the supposition that an integrated approach to organizational change while exploring opportunities of innovative IT applications was both feasible and desirable. However, when it came to the planning of the different interventions, the different work groups had specific motivations to either start from IT opportunities or from specific organizational problems. It turned out to be easier to start exploring the potential of already existing IT artefacts, e.g. video conferencing and application sharing, than achieving changes in complex and distributed engineering practices, e.g. a better alignment between construction and manufacturing in maintenance engineering. The roll-out of video conferencing and application sharing was perceived by the participants to offer new opportunities for external engineers to come into contact with the internal production department.

The broader goals of the project were defined by two middle managers of the steel mill's central maintenance units, who got the research institutes involved and also selected the external engineering offices. However, the analysis and planning for intervention phases was set up in a manner such that these managers had relatively little impact on progress. The organizational culture of the steel mill itself allowed for such an approach but, on the side of the engineering offices, the company owners expected to have considerable involvement in the operative project activities.

This case study gave us some important insights into the importance of institutional conditions when putting the OTD framework into practice. Large organizations, specifically the managers initiating such a project, need to be motivated, tolerant and aware of the fundamental purposes of such interventions, if they are to work. This, in and of itself, implicates the notion of 'trust' in project work, and the way in which it does, or does not, emerge. In the case of the steel mill the establishment of the project was facilitated by their earlier linkage with FhG-IGD. Moreover, the culture of the organization seemed to be open enough to experiment with academics on real- world organization development processes. Additionally, we understood that the middle managers in charge, both still on an upwards career trajectory inside the mill, liked to be associated with this type of innovative project. However, they also limited their risk by restricting our project to a focus on the engineering work – and by asking another consultancy to reorganize the manufacturing department. However, from an organization development perspective this split in responsibilities was not too helpful.

The external engineering offices were, at least in the beginning, reluctant to let empirical research which was, in their eyes, defined by one of their core clients, happen. However, they accepted the investigation on condition that the steel mill was seen as an important client.

OTD always becomes part of the organizational micro-politics. The resulting changes in work practice may produce winners and losers. The internal actors who have initiated and promoted an OTD project may (implicitly) demand a certain loyalty to their interests. Such an alignment may limit the sphere of potential interventions and become a problem for gaining academic insights. So, a careful and self-reflective analysis of the restrictions resulting from the micro-political environment is required.

Finally, the sudden end of the originally envisioned OTD process due to a top management decision makes clear how fragile these project settings can be in practice. This fundamental change in the organizational environment disrupted the main line of our research. Given the still existing project funding, we reacted by changing our focus of investigation towards the role of the central archive in the steel mill's maintenance engineering practices. This shift turned out to be academically interesting – but required a certain flexibility and creativity with regard to the originally envisioned research design.

Iran NGO-CS: Development of a Community System for Iranian Non Governmental Organizations

The Case

During the late 1990s and the early 2000s (under president Chatami), there seemed to be a historic window of opportunity for democratic reform programs in the Islamic Republic of Iran and a possible political opening for Iranian-Western collaboration. This window was closed in 2003, perhaps as a result of US president G.W. Bush's "axis of evil" rhetoric (2002), the second gulf war (2003), and the presidential election of Mahmud Ahmadinedschad (in 2005). However, the project we describe was conducted during this very short period of hope and democratic openness in Iranian society between 2000 and 2003.

In the beginning of 2000 a study on Iranian NGOs funded by the Ford Foundation and the Iranian Population Council analyzed the situation of Iranian Non-Governmental Organizations as characterized by two broad kinds of problem: (i) conflicts between rural NGOs and urban organizations which were mostly located in Teheran and the (provincial) capitals and (ii) significant differences between so called "new" NGOs and traditional community based organizations of the third sector which mainly focused on relief work (cf. Namazi 2000). In 1997 and 2001 two national conferences of Iranian Non-Governmental Organizations (NGOs) took place in the cities of Busher and Mashad, in which more than 120 participants from NGOs, scientists, government delegates, and representatives of the UN were engaged (cf. Hamyaran 2001). The meetings were organized by the Hamyaran Iran NGO Resource Center in Teheran, which, at that time, was coordinating the ongoing networking process of Iranian Non-Governmental Organizations. As one result, Hamyaran decided to find experts to help Iranian NGOs establish a better networked community and develop an appropriate IT support for this NGO community. In 2002 the "International Institute for Socio-Informatics" (IISI) concluded a contract with the Department for International Cooperation of the "Friedrich-Ebert-Stiftung" (a foundation aligned with the German Social Democratic Party (SPD)) on a research and development project which aimed at the support of community building and networking among Iranian NGOs.

The Iranian NGO Community project started with a pre-study which aimed at the analysis of the specific requirements of Iranian NGOs. This analysis was conducted in spring 2002 by means of a detailed questionnaire to be answered by Iranian scientists and NGO experts. This questionnaire included questions concerning the nature of the different Iranian NGOs involved, their ICT infrastructure and internet connectivity, computer and language skills, requirements concerning technical support and trainings, state of the art with regard to socio-

organizational networking, constraints and limitations concerning a potential change process. Based on this analysis, a project plan was set up following the OTD framework.

In 2002, IISI provided the cooperation platform “Basic Support for Cooperative Work (BSCW)” which was developed by Fraunhofer FIT (cf. Bentley et al. 1997) to Iranian NGOs in order to support their networking processes by technical means. BSCW offers shared workspace functionality via a web-browser interface. IISI organized the introduction of BSCW to the Iranian NGO network and realized a train-the-trainer program for members of Iranian NGOs, which not only focused on technical training but was also directed towards community building, cooperation training and project development, as well. The project started in March 2002, included a delegation visit of leading Iranian NGO members and civil society experts in Germany in December 2002 and ended with a final visit to Iran in September 2003.

The process of socio-organizational networking by and for Iranian NGOs had already been running for several years before our project started. Thus, the planning for NGO-CS (community system) did not start in a social or organizational vacuum but had to cope with requirements which had been articulated before and during the ongoing NGO networking. According to these preconditions, the following strategy for the project was chosen:

Requirement analysis: Based on process documents written by the Iranian NGOs and a pre-study in which Iranian NGO experts were involved, the requirements of the Iranian civil society organizations concerning technological support were analyzed.

System introduction: In a first expert visit to Teheran, the technical platform BSCW was introduced to a group of leading Iranian NGO members.

System adaptation: Together with Iranian NGO practitioners a structure for the Iran NGO-CS was developed, BSCW was adapted to the NGOs’ needs, and the first content was loaded up to the system. This system was aimed at support for the already running and ongoing socio-organizational process of NGO networking. A special focus was to bring together people and organizations in the different Iranian provinces, regardless of time and location.

Qualification measures and trainings: In several training measures, Iranian NGO members were trained to use the system and to train other Iranian civil society practitioners by cascading.

Socio-organizational interventions: In several meetings and workshops the establishment of a common practice was supported by initializing collaborative projects. Therefore, tools for proposal writing and for project management were offered.

Evaluation and redesign: Each measure and intervention was evaluated with questionnaires and expert interviews. Furthermore, the system’s usage was also evaluated by means of anonymous log files. During two follow-up visits in Iran, additional training and workshop meetings were conducted in Iranian provinces outside Teheran and the system was redesigned for further use.

International networking: In addition, it was decided to support the international networking of Iranian NGOs by fostering international exchange of experiences, mutual visits, and common research projects.

During the project all the above mentioned technical and socio-organizational measures were carried out in three Iranian provinces besides Teheran itself. The evaluation of all of our activities, which was based on questionnaires and interviews with stakeholders, was positive, participants rating the measures to be quite important and helpful. Most stakeholders expected that the established processes of networking, training and cooperation support would continue and grow throughout the whole of Iranian civil society. Nevertheless, in September 2003 the

introduced BSCW community system had only 280 registered users - instead of potentially several thousand, as was originally envisaged. Furthermore, at the project's end there were only a few cooperative project proposals underway. Finally, within a year after the end of the official project in September 2003 the usage of BSCW and the visible cooperation processes among Iranian NGOs significantly descended and nearly completely ended. So, the project ultimately failed in achieving a critical mass of participants and thus in being sustainable.

Reflection

Although our project activities have been evaluated positively, the OTD project as a whole failed with regard to the defined aims and its sustainability. This failure is mainly due to specific political conditions, organizational structures of NGO networks, and the lack of trust within Iranian civil society.

Our project was planned during a stage of political liberalization in Iran, initiated by the Chatami regime in the late 1990s. Part of this political liberalization was Chatami's support for Iranian civil society as a necessary precondition for our project. In the wake of this liberalized, domestic policy the Iranian society seemed to open up for more international cooperation – even the highly conflictual relations between Iran and the United States seemed to be a little less so around the year 2000. However, in January 2002 US president G.W. Bush held a speech in which he defined Iran (besides Iraq and North-Corea) as the “axis of evil”, blazing the trail for new international rhetoric against Iran. In March 2003 the Second Gulf War started with the US invasion in Iraq. As a consequence conservative politicians regained influence in Iran, domestic liberalization stopped and the Iranian regime and society closed up once more against international influences. These political developments were hard to foresee at the start of the project, we were too optimistic in our assumption with regard to the development of the civil society inside Iran.

Another unforeseen internal political issue was the critical relation between Governmental and Non-Governmental Organizations: While our project started as a close cooperation between international experts and the Hamyaran Iran NGO Resource Center in Teheran, in May 2002 another organization was established: The new Iranian Civil Society Organizations Resource Center (ICSORC) started with strong support of the Iranian Government; it was somehow unclear, and not only to us, whether ICSORC was a real NGO or a sort of government-initiated non-governmental organization (so called GINGO). Nevertheless, despite the fact that there was a cooperation between this new organization and our project, based on an agreement that we should not hamper each other's activities, there was a direct competition between Hamyaran and ICSORC regarding the support mission for the Iranian civil society. Although ICSORC officials were invited and indeed participated in our activities, they started to develop their own technical infrastructure for Iranian NGOs, their own training facilities etc. Therefore, in contrast to what was planned, our project activities failed to reach the whole of Iranian civil society but was mainly restricted to the NGOs which were organized around Hamyaran, and not the ones which were otherwise addressed by ICSORC.

One main mechanism we based our approach on was the targeted “snowball effect” by train-the-trainer measures: First a defined group of facilitators within the NGO network was enabled to (tele-) cooperate with each other. During the next steps these facilitators had to be trained in order to work as trainers themselves for their colleagues and other NGO members. However, we had to learn that building of social ties in a community and a successful “snowball effect” heavily depend on mutual trustful relations that were rarely freely given in Iranian society. Given the authoritarian nature of (some parts of) society in the post-revolutionary Islamic Republic of Iran, most of the participants in our project had experienced oppression themselves or at least through affected relatives, friends and neighbors. More than

two decades of oppression and strong governmental surveillance undermined trustful relations in the Iranian society to a large extent. When setting up our project, we underestimated this widespread lack of trust, a lack that (besides the political conditions mentioned above) hindered the success of our project.

According to the application of our original OTD framework in this particular setting, we see at least the following differences:

- (1) In contrast to our OTD focus, in the Iranian case study we did not deal with an already existing, traditional organization but with a newly emerging network/community structure. Organization Development focuses on organizational change of established organizational structures and processes. In this case study we faced the challenge of organization development in terms of community-building, therefore, fostering and supporting the emergent and participatory creation of completely new organizational structures and processes. Civil society networks might be characterized by completely different requirements and constraints than formal organizations – with regard of group dynamics, membership, ingroup/outgroup mechanisms, motivation, rules and regulations, etc.
- (2) Distinct from the “work system” focus for business organizations in the original OTD, the main goal in this case study was the establishment of community learning and collaboration structures within and between very diverse groups, networks and organizations. Instead of intervening in a more or less well-defined work system of co-workers cooperating on common tasks, the focus in Iran was rather more diffuse, making it difficult to identify common goals and interests, establish shared practices, plan cooperation projects etc. Such projects clearly have to start from a different place. There are few clearly articulated goals at anything other than a political level, the heterogeneous nature of the participating organizations needs to be understood, as does the wider political context. That is, addressing a whole collaboration infrastructure is necessary. The value of understanding infrastructure as a socio-technical phenomenon was made very clear to us here.
- (3) While the original OTD framework incorporated awareness of micro-political impacts and conflicts on organizational levels, our Iranian case study confronted us with much stronger macro-political conflicts/developments and historical contingencies than can hardly be foreseen, let alone controlled in the process. As mentioned above, OTD projects need a mandate to be conducted. In a traditional business organization the agreement or *votum* of management (and hopefully) a workers’ council might do the job – at least until the management changes. Concerning macro-political structures, there are a multiple players involved, governmental organizations (of different countries/states), political parties, voters, secret services, public administration etc. In our project we had the mandate for the support of socio-technical and organizational change by merely two institutions (FES tolerated by German government and Hamyaran tolerated by Iranian government). That proved to be not enough.

Discussion

More than 20 years have passed since the first publication of our OTD framework. The integrated perspective on socio-technical, organizational and qualification aspects in practice-oriented ICT design projects has informed our research in many R&D projects, but OTD was very rarely applied in these projects to its full extent. It rather has been something of a general conceptual backdrop to implementations that have been realized in various groupware design processes. One needs a fairly broad/general mandate to implement such a complex, integrated program. In industrial projects this general mandate is often lacking, due to micro-political

decisions and, maybe sometimes, to limited trust in external scientific consultants or resources. A limited mandate for smaller, more clearly defined interventions (e.g., on the technological level, on personal qualification measures or controllable managerial changes etc.) in our experience, is more likely to be successful. We have chosen two cases of OTD application to be analyzed in this chapter. Looking at the two exemplary cases, we sum up our findings with regard to the core concepts of OTD in the following.

The original conception of OTD offered a framework to allow actors to tackle problems in their social practices, linking technological and organizational change. To establish such an ongoing improvement process, corresponding qualifications, resources, and experiences are required – which again can be built and refined during such a self-reflective change process. In both of the cases observed, we were in a situation to start implementing OTD in fields of applications which had no prior experience with this process model before and were characterized by rather different traditions of cooperative work and experiences with organizational change.

While maintenance in the steel mill was fragmented by structural divides, the mill had a tradition of workers' participation. This tradition helped setting up the initial steps towards an OTD process. In the case of the Iranian NGOs only very few prior experiences with collaborative practices across and within institutions existed; instead a culture of mistrust and suspicion was dominant. Nevertheless, the participating organizations and individuals were quite motivated and hopeful that they might overcome these difficulties and engage in a nation-wide civil society community-building process.

In both cases OTD was initiated by actors exercising a specific position in the social texture of the fields of application: middle managers in the case of the steel mill and a government supported resource center in case of the Iranian NGOs. These actors defined, at least, an initial problem description and project vision. OTD was introduced in the context of an externally funded project, in the steel mill case by a state government's innovation program in the case of the Iranian NGO by a foreign foundation. In these constellations, outside academics became the facilitators of integrated change processes. The change processes were enabled in principle but also depended in practice on the availability of external resources. When trying to reach out further with the OTD approach, we found it difficult to convince organizations to start such a process relying solely on their own resources.

On an institutional level, it turned out to be difficult to find organizations (especially middle and top managers) which were willing to partner with an academic institution to pursue integrated and organization change processes. From our experience it is much easier to involve them in a research agenda which presumes the exploration of the potential of innovative technologies but little else. While the appropriation of the resulting artifacts typically leads to changes in practice – a fact of which decision makers are typically aware - they are unwilling to factor this explicitly into their plans. A focus on technology development in the project set-up avoids addressing conflicts which may otherwise be evident immediately. A focus on the development of technology in practice emphasizes the exploratory aspect of these projects and makes them appear, at least, in the initialization phase, to be reversible in their effects on the organization. Less dangerous, as it were. Indeed, we experienced a few cases in which our newly developed IT artifacts were removed from the organization – typically after the funding phase of the research project expired. Finally, overcoming Tayloristic structures has become less of a concern in the recent managerial literature. From the perspective of academic qualification and career-building it turned out to be difficult to find an interested audience and as a consequence to position the resulting findings appropriately.

The following reflections on OTD are mainly (but not only) based on the experiences from the two reported case studies which are by now quite distant from our accumulated experiences in a wide range of technology-related projects.

Vis Inertiae: OTD processes potentially impact work/collaborative practices in a profound manner. While the changes are grounded on the operational level, they are often interwoven and interfere with a strategic level. Most organizations (business companies and social networks/communities) tend to stick to established routines, historically acquired rules and regulations, micro-/macro-politically negotiated strategies etc. When asking for a general mandate for OTD understood as organization-wide, socio-technical change management, many organizations tend to opt for small, easily controllable changes which have no fundamental impact on organizational structure, strategy and culture. This tendency towards organizational continuity and a stable identity is quite understandable but hinders holistic socio-technical development programs and leads to half-hearted, insufficient solutions. We have, without doubt, underestimated these needs for stability and identity and the potential resistance to deeper organizational changes in our early conceptions of what OTD might offer.

Micro-politics: In traditional, formal organizations operational affairs are mainly separated from technical, personnel, organization developmental matters etc. - in different departments, with their own heads and responsibilities. Although we observed many organizational (middle) managers who are aware of the fact that these different organizational levels are inseparably interdependent, they do not have the organizational mandate to decide on a more general level. Organizational division of labor/ division of management decisions and differentiated department structures hinder a more global, general mandate for change processes on an integrated, supra-department level. (Expected) impacts of OTD projects affect different departments, heads etc. and lead to respective challenges and conflicts. If not overruled by the top management, these interdepartmental conflicts of interest make OTD programs nearly impossible. Even with the mandate of the top management, the aforementioned micro-political conflicts have a massive impact on integrated OTD projects. Moreover, the participatory OTD approach needs agreement, consent and commitment from members of all organizational levels. The top/middle management mandates are necessary but not sufficient conditions for OTD. It needs commitment from members at all organizational levels (but this is true for other OD projects as well). In this sense, Integrated OTD is a fairly ambitious framework.

Macro-politics: OTD did not take macro-political issues into account. Corporate mergers & acquisitions activities, political/governmental changes, societal developments, legal reforms etc. were not planned for in the original framework. We underestimated micro-politics but we completely ignored macro-politics. The truth is that the direction of the both the projects described was seriously impacted by political and economic developments clearly outside the operational scope of the projects (on micro- and macro-political level).

Conclusion

Besides the aforementioned lessons we learnt from the two projects presented, there are some more abstract conceptual considerations with regard to the application of OTD in practice. In the following we reflect on some potential structural shortcomings of our original framework not on a primarily empirical basis but rather on more general insights.

Design vs. development dilemma: In general, the integrated OTD framework followed a socio-technical understanding, taking technical design processes as well as socio-organizational development into account. One conceptual misunderstanding of the early work

ends in a “design vs. development dilemma”: if dealing with socio-technical systems, one could probably intentionally design the technical part, but not the social/organizational one – this latter socio-organizational part of the system might be influenced by design, but it develops (mainly) by itself. Development of social systems is emergent, self-organized, contingent – not intentional, controlled, deterministic. The original OTD framework showed some awareness of this dilemma but conceptually underestimated its pragmatic significance. While design interventions might be efficient/sufficient in ICT design projects (and even this assumption is critical, cf. chapter on Grounded Design, Stevens et al. in this volume), socio-organizational change might be (positively or negatively) influenced by design interventions but cannot be controlled by designers’ aims and intentions. Although this central “design vs. development dilemma” was already embedded in the original socio-technical foundation of OTD, its consequences for practical OTD projects have not been elaborated explicitly.

Asynchronicity: OTD conceptualizes organizational, technical and qualification measures as parallel processes. In practice these interwoven processes follow different timelines. While a technical design cycle might last for a specific time t_1 (e.g., 6-8 months), the related socio-organizational process might last significantly longer (t_2 , e.g., 16-24 months). In modification of the original OTD framework publication, this asynchronicity should be taken into account. In practice, OTD projects face the challenge of concurrent but mostly asynchronous development/design processes. Awareness and expectation of this asynchronicity influences planning of OTD projects and probably the decisions of managers to give a mandate for such integrated development processes.

Deepness of intervention: Our OTD framework plans for technical and socio-organizational changes and developments. Both are interventions into the social practices of organization members affected. Our original framework does not distinguish between the depth of intervention in respect of technical vs. socio-organizational measures. Based on our empirical experiences, technical vs. socio-organizational development cycles might not only rely on different run durations but might imply a different level of depth of engagement as well. While the implementation of a technical prototype during a pilot study might influence the organizational practice temporarily (and maybe in the first instance) and on a fairly superficial level (and could be extracted if unsuccessful), a socio-organizational intervention (training, business process changes, structural/strategic changes etc.) could be far more persistent (and not easily rolled back). OTD does not differentiate between any potential consequences of different measures on technical vs. socio-organizational levels. Nevertheless, this different depth of intervention might prove to be an obstacle for the establishment of integrated OTD projects.

Output guarantee: Organization managers usually expect some form of guarantee for development project outcomes. With regard to technical design solutions this guarantee could be a contractual matter according to design requirements and technical specifications that have to be met. With respect to socio-organizational changes the requirements to be met are rather more difficult to define. Given the “design vs. development-dilemma” mentioned above, it might be much easier to guarantee the success of design products or artifacts (at least to convince managers with putative guarantees) than the results of emergent and contingent socio-organizational development processes. With respect to OTD, managers might be

reluctant to give a mandate for integrated technical design, organizational development and personnel qualification without being guaranteed the output of the whole process. When cooperating with a middle-sized German health insurance company, for example, the management agreed upon our statement that the design of a new e-learning platform would necessarily affect the education and trainings practices of the company. However, we were only given the limited mandate to design and introduce the new e-learning technology but not the broader mandate to re-organize organizational learning programs. One reason for this limited mandate was – so we were told by some middle managers – that the impact of a new technology would be much easier to foresee and observe than the effects of much more advanced re-organization.

OTD was not published as a recipe or checklist for groupware projects (to fulfill each and every step one by one) but as an orientation framework for action researchers and practitioners, just to provide a practice-oriented framework for groupware introduction in organizational settings. Given that the Socio-Technical Systems approach has been in the public purview for five decades, at the time being there is still no a comprehensive approach to the integration of organization development and technology development at hand – this gap is meant to be bridged by the OTD framework.

In the early days of our research endeavors the development and exploration of (innovative) IT artifacts in relation to organizational practice was not yet widely accepted. It found a more receptive audience in the CSCW and PD communities, and recently also in the CHI community. Finally, there are very few public funding bodies which offer support for research into integrated organization and technology development processes. In the current research environment it is obvious that research agendas promising societal innovation by means of technological progress are much more generously funded than those directed towards the solution of problems in workplace practices – at least in a first step – to be found in individual organizations.

As pointed out above, most organization (mainly company) managers indeed agree in principle on the perception of interwoven technical and socio-organizational aspects with regard to the design of socio-technical work systems, but many of them avoid giving a general mandate for a full comprehensive OTD project, perhaps because there are problems of accountability. They prefer a more controllable, smaller scope approach to socio-technical change.

Public discourse (and funding) focus merely on social innovation as a result of technology development, pushing for an IT design-oriented research approach. Many managers/ organizations do not see the linkage between technical and organizational development, or are very careful to provide a general mandate (maybe specifically in the case of universities). On the other hand, OTD is looking very much at a planned and facilitated change process. However, IT appropriation and changing practices result often without external facilitation in an emerging manner. Therefore – and based on our empirical experiences so far - we developed ‘Grounded Design’, a more IT design-oriented approach to organizational change (Rohde et al 2016; Stevens et al. in this volume).

This approach, based upon design case studies (DCS, Wulf et al. 2011 and 2015), offers a more technology- and design-oriented perspective, breaking down theoretically derived principles to some more pragmatic methodological issues, and thus, conceptualizing one development cycle as involving a more manageable range of interventions. One could say that this paradigm emerged from the OTD framework by a conventional evolutionary process which led to a better environmental fit. However there are also considerable differences in the two research paradigms. Typically, OTD processes start from an identified problem with practice. Practitioners, typically supported by certain actors from the organization's hierarchy, assume that the application of innovative technologies could contribute to its solution (without other interventions). In contrast, a design case study starts typically from the idea of exploring the potential of certain technologies or algorithms for social practice, not necessarily with an initial focus on given 'problems'. It is rather defined by the relationship between a certain technology and the social practice within a specific field of application.

The change process in organizations is typically driven by application-oriented IT professionals. OTD set out, rather ambitiously, to deal with the evident fact that such change is inevitably a socio-technical matter. We continue to have that view. While the main result of a process of OTD is the solution of a real world problem, however, the result of a design case study is the design of an IT artifact together with an investigation of its appropriation in practice. Pipek (2006) and Stevens (2009) elaborated on the appropriation of IT artifacts, to the effect that we cannot understand their use as if it depended entirely on the intentions of designers and, moreover, that potential uses will emerge over time (Stevens and Pipek, in this volume). Appropriation, understood as a long-term phenomenon, had not previously, we suggest, been sufficiently investigated empirically. Their implications for (re-) design were not yet thought out. Design case studies suggest designing innovative IT artifacts in a participatory and evolutionary manner. They allow analyzing changes in practices and organizations in a long-term perspective, comparing the results of the pre-study with those of study an artifact's appropriation. Design case studies do not suggest the initial setting up of a planned process of organization and qualification development, integrated with technology emergence.

These differences in goals have consequences for development methods. As with the OTD framework, after the set-up of activities, a pre-study of the given work practices is conducted. However, with design case studies these empirical investigations are conducted by external actors, such as ethnographers or IT designers. The focus of this analysis is twofold: (1) gaining new insights about the diversity of given practices, relative to state of the art (2) grounding the design of innovative IT artefacts in this setting, . Such an analysis should describe given practices with focus on those (problematic) aspects which could be improved by means of the IT artifact.

Grounded in the results of the empirical pre-study, evolutionary and participatory design activities are set up under the design case study agenda with at least one field of application – typically with those having participated in the pre-study. The resulting IT artifacts are, in a third step, rolled out in at least one of the fields of application. Changes in practice related to their appropriation are empirically investigated over a longer period of time (Wulf et al. 2011 and 2015). While the OTD framework explicitly suggests planned measures of personal and

organizational development to elaborate on given practices, our understanding of the term appropriation is rather unspecific on whether specific measures should be planned and how the organizational learning should be supported (see Stevens and Pipek, in this volume).

OTD offered an open framework for orientation in socio-technical change projects, integrating technical design aspects, socio-organizational development and qualification issues. Although the basic assumption of interwoven design/development problems on different levels is quite broadly accepted, OTD nevertheless proved to be quite ambitious, complex and not easily manageable. This complexity lead to acceptance problems in practice.

Therefore, we elaborated on design case studies as a more modest instance of OTD philosophy– with a primary focus on technically induced dimensions of change opportunities and a more limited scope. In this way, design case studies could be understood as more technically-driven, design-oriented element in a longer term OTD engagement. They integrate a strong emphasis on appropriation practices, but may imply less intervention into organizational practices.

On a fundamental level, our formulation of Grounded Design as a conceptually derived approach for design science provides a basic theoretical reference frame for OTD, design case studies and appropriation research (cf. chapters 2 and 4, Stevens and Pipek and Stevens et al. in this volume). This chorus of theoretical approaches, methodological frameworks, and analytical concepts can be seen as an ensemble geared to enhancing research and development projects in practice-oriented computing – and in what we call socio-informatics.

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