

# Tayloring Inter-Organizational Tele-cooperation A Case Study in the German Steel Industry

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## ABSTRACT

Most Participatory Design has been applied for single organizations. The case study described in this paper reports the experience of the OrgTech project dedicated to a participatory tailoring of groupware in a inter-organizational network.

## INTRODUCTION

The case study described in this paper reports the experience of the OrgTech project (*Organizational and Technical Development in the Context of the Introduction of a Tele-cooperation System in Small and Medium-Sized Engineering Companies*) where groupware and 3D-CAD are to be introduced, among others, in two small engineering companies (in this text named **Techno** and **Doku**) and their major client: a steel mill (here addressed as **MeltIt**). The project aims at supporting the work processes within and between engineering firms and their clients by an evolutionary and participatory integration of organization and technology development of the inter-organizational cooperation.

Knowledge in the project is seen as informations combined with experiences, contexts, interpretations, and reflections (see Ciborra 1996 p.20). Participation means integration of future end users into the selection, tailoring and implementation of their cooperation technology (Floyd, 1989). At the same time, for the project participation also means a restructuration of the business processes based on the negociations of the people involved in the given inter-organizational cooperation (Wulf & Rohde, 1995). In this context, it is the aim of the project to contribute to a cooperation system supporting the experts' knowledge of the employee instead of replacing it.

The paper starts with the description of the given inter-organizational cooperation starting with the mill as a strong

client, then describing the two engineering firms. The description of the strategies adopted to implement improvements of the inter-organizational cooperation is followed by an analysis of their failures referring to the underlying interests. The paper finishes with some general conclusions.

## THE GIVEN COOPERATION

### MeltIt

Techno and Doku, two engineering firms, take on sub-contractual work for MeltIt, a large steel mill in the German Ruhr area, e.g. the construction and documentation of steel furnace components. The Construction Department of the mill coordinates the contact with the external offices. The steel mill is owned by two big enterprises of the German economy. MeltIt has until now been the most cost efficient mill in Germany and sells the products to both mother enterprises. One of the two enterprises owns another steel mill which is beginning to be competitive. MeltIt is therefore trying to achieve some more cost reductions (60 Millions DM per year) primarily in the maintenance.

A consulting firm is taking decision with the management about the future of the Construction Department, and about the mechanical workshop. The discussion includes the possibility of outsourcing these two departments. Therefore, the Construction Department is not inclined to commission new constructions. The two departments are not sure about their future existence and would like to use the project to secure it. On the other hand, the Construction Department is not disposed to release construction commissions to Techno or Doku.

We interview the Construction Department (managing the outsourcing of the construction design), the Work Planning Department (planning the production), the Mechanical Workshop (producing mechanical pieces, tubes etc. for the maintainance of the mill), and the Systems and Methods Department (managing the electronic archive of the drawings used by all departments). If an operator of a production facility requires a repair service or a new part s/he contacts the Construction Department which is responsible for the maintainance in the mill. This department decides who will carry out the design and drawing, co-ordinates the process of

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design, and when the drawing is finished decides whether the internal workshop or an external enterprise will manufacture the part.

A typical task of the Construction Department is to supply the external engineering offices with documentations and drawings, and to discuss the design with them. From the commission of the order until the final acceptance, the external engineer may meet quite frequently with the Construction Department. Sometimes an on-the-spot visit at the plant with the operator is needed, but most of the meetings take place at the Construction Department to discuss the drawings of the external offices.

The information infrastructure allows all the departments mentioned and the operators to access the central electronic archive of more than 100,000 drawings through a FDDI ring (100 megabit/s). The archive system allows for searching, viewing and ordering of drawings. The system supports multiple users simultaneously opening the same drawing in read-only mode. A technician from the Construction Department and one from the Work Planning uses this viewing functionality to discuss design or manufacturing problems by telephone.

Three-dimensional CAD is not used at the moment but is regarded to be useful by a technician to communicate better with the workshop. The workers sometimes having problems reading 2D drawings, an implementation of 3D is seen to improve the quality of the construction design by eliminating errors and automatically creating parts lists. The Work Planning complains that often the drawings are not ready for the workshop and some changes have to be done. Moreover, the Work Planning ("Work Preparation") and the Production Department are not involved in the construction process of the mill which often leads to problems during the production process.

A relevant problem of the steel mill is the drawing archive. Problems are caused by the sheer number of drawings, the organization of the archive, the complexity of the construction process and communication problems (cf. Iacucci et al. 1998). The archive presents for each drawing only the latest version. If a part is altered and the new drawing has been saved, it is no longer possible to obtain the older versions of the drawings for the remaining parts of the same type. Furthermore, the number that allows for searching the electronic archive is too unspecific. This incurs high search efforts. The external offices, therefore, complain about the specification of the construction orders being too vague. Because of this, several meetings have to take place for any planning order.

#### **Techno**

The engineering office Techno offering services for planning, execution, change, or capacity increase of conveying systems in heavy industry possesses various patents in this area. The office employs about a dozen engineers and has a Novell network with 12 CAD workstations. One of the workstations

has an ISDN connection and is used to exchange files with the steel mill.

The typical design project starts with first retrieving the drawings and documentation about the actual state. This need for drawings and documentation remains during the whole order cycle. The drawings are mostly ordered by fax from the Construction Department. After being printing the drawings are piled up at MeltIt waiting to be collected. Normally every day someone from the office drives to MeltIt (a 30 minutes drive) and checks if there are drawings to be collected. However, drawings can take up to one week from the day the fax order was sent.

When the construction drawing is finished, it is delivered to the steel mill on a disk in a CAD file and in an image file, ready to be saved in the archive. Sending the files via ISDN could do this, but at the construction department at MeltIt only one of the managers has a PC which supports ISDN connections and the recipient of the files is usually someone else.

Techno has rather intense contacts with the Construction Department while the engineers meet only on few occasions the plant operators. The high level of expertise of the Construction Department is appreciated. However, the manager and owner of Techno is convinced that the plant operators are the real knowledge carriers and should be more directly involved in the construction process.

#### **Doku**

The engineering office Doku, offering planning and documentation within the area of pipe lines and plant construction, has a dozen employees and one manager who is also the owner. They have a network with 10 CAD workstations. One PC has an ISDN connection and is used to interchange files with MeltIt. The office supplies the steel mill mostly with plant documentation. The documentation is necessary in case of failure or breakdown, but in the daily work the plant operator and the construction department of MeltIt do not care much about it. Doku has informal meetings with the operators more frequently than Techno, and often starts the job before the commission of the Construction Department takes place.

The employees of Doku were rather skeptical regarding the possibilities to introduce videoconferencing. One of the technicians explained that visiting the factory is necessary and tele-cooperation would not improve the situation, because most of his communication partners on the shop floor would probably not take the time to apply the new technology. Moreover, these people would need extensive explanation to be able to understand the 2D drawings. Another problem mentioned at Doku was the difficulty to meet contact persons at MeltIt.

Both engineering offices would like to have permission to search and download drawings from the steel mill's archive via ISDN. On the other hand, MeltIt does not want to grant

such permission for security reasons.

### **REFLECTING THE COOPERATION**

We start our project with a Kick-Off workshop involving people from all firms and departments mentioned above. On this workshop we explain that we see our aim in helping to implement an improvement of the given inter-organizational cooperation in an evolutionary manner on the basis of the participation of all people involved. This being generally accepted, we discuss with the workshop participants about our ideas how to proceed: interviewing people and studying their work on their workplaces, organizing group discussions, analyzing processes, structures and documents of the given division of labor, etc.

The Kick-Off workshop agrees upon our proposals and provides us with relevant additional information. We thus, in a way, have become agents of an inter-organizational meeting. We organize a technical demonstration at the Fraunhofer Institute in Darmstadt for all interested persons. A following workshop decides, due to timing arguments, to split into two sections: one for 3D-CAD and *Design for Manufacturing*, the other for the improvement of the cooperation processes in the supplier-client relationship of the participant organizations. Each of the workgroups consists of five to seven members representing each of the three organizations.

The engineering firms participate in the workshops only with one representative because of their limited human resources. In Techno, the system administrator is an engineer who participates in the workgroups and represents the enterprise (the manager participated only at the beginning). Because the engineer has no decision making power, the absence of the manager weakens the decision-making capability of the workshop. Doku is always represented by the manager. The employee taking care of information and communication is rarely present.

Workshops are organized at MeltIt. Project members moderate both workgroups and facilitate their work (e.g.: protocolling, information gathering). The project team participates in both groups and can call (such as any participant) for plenary meetings, if decisions of one team might influence the other. Other persons may also participate in both groups, but only few do. When special contributions are required to proceed with the workshops, it is not difficult to organize for the contributors to report during the day. On the other hand, it is hard to get the simultaneous participation of all the parties in the mill.

The first workgroup agrees upon the scope to introduce tools for real time CMC (Computer Mediated Communication) like conferencing applications and of communication infrastructure, to analyze requirements, and design a workflow system for managing the construction drawings for all the organizations.

As on-site meetings generally involve more than two participants and have as point of interest several drawings

hanging on the wall or laying on the table, tele-conferencing is not desired to substitute these face-to-face interaction completely, but to strengthen its efficiency by giving access to documents and information sources other than the drawings on the walls. A meaningful introduction scenario is also the cooperation between Techno and MeltIt. In particular we find a young engineer who is interested in trying these new technology to avoid travelling.

Although we find relevant applications for tele-cooperation in the field and much interest, only more or less isolated pilot installations and processes can be implemented in the field. A mayor reason for this contrast between the promising project start and the poor outcome is the frustration especially of the engineering firms about the fast changing and inconsistent policies of the mill. In particular, its incapacity to adapt a consistent data management strategy, besides the intransparent ongoing outsourcing debate, is seen as an obstacle to any sensible organizational development.

### **OBSTACLES TO IMPROVE THE INTER-ORGANIZATIONAL COOPERATION**

Cooperation generally involves multi-perspectivity (Floyd, 1989). In inter-organizational engineering processes in particular, there are very different perspectives on how to define the relevant business processes and how to define quality measures. For instance, from the perspective of the external engineering offices their business process finishes when delivering the final drawings. Thus, there has been little awareness concerning the production processes and their specific requirements. The engineering firms learn about such problems during the project, but all their proposals to solve it are restricted by the mill.

It is unclear to the external offices, which are the relevant quality measures for their services, because competencies in the steel mill are unclear. For instance, concerning the layout of the final drawings the Construction Department focuses on DIN and company standards while the plant operators focus on understandability. Differences in perspective have to be understood and the problems involved have to be tackled commonly when trying to improve inter-organizational business processes (see: Wulf et al. 1999). But the mill does not agree on any consistent solution.

Furthermore, in the case of more than one organization not only the common level of sophistication of information technology is relevant, but also the security policies. The two possible security solutions also have different advantages and disadvantages for MeltIt and the two small companies: the IS department of MeltIt, for example, is following a firewall security policy prescribing that all connection with external nets should go through the firewall (the ISDN solution we installed is just allowed as a research project). Techno and Doku are more confident with the Remote Access Service solution and ISDN for their only temporary access to the Internet through a provider and their lack of any firewall. Doku having purchased a 3D-CAD system different from

the one chosen within the project, additional problems of standards are arising.

Conflicts arising at an inter-corporate level are of different nature compared to those within one enterprise. However, strong conflicts influencing the project and the inter-organizational cooperation have become clear between the departments of MeltIt. For example, the Construction Department fears the involvement of the plant operators in the project because the outsourcing debate is on the agenda: strengthening the role of external engineering firms could weaken the position of the mill's Construction Department. Due to its resistance, the plant operators could not be integrated in the project during its first year in spite of their importance for the construction. For Participatory Design, conflicts and different power resources have been found since its early days (see Schmidt, 1991). Participatory Design tries to assure that decision making remains transparent, reliable, and accepted. However, due to the possibility to externalize internal conflicts, in inter-organizational networks this is even more important (but also more complicated !) than in a normal enterprise.

#### CONCLUSION

Investigations into the given inter-organizational cooperation as undertaken in the OrgTech project are good means to reflect the multi-perspectivity of perceptions and interests in an given inter-organizational cooperation. In inter-organizational cooperation different interests are not only within the organizations involved, but also between these organizations. This produces benefits and problems.

Inter-organizational cooperation provides new potentials for future win-win situations and mutual learning. Participatory Design can outline the new opportunities for better quality management, new products and new services as arguments for realistic benefits of common efforts. Thus the anticipation of new opportunities can become a shared vision and orientation for all people involved (see Kensing, 1987).

However, if the restructuring of the cooperation is only felt as a mere cost reduction strategy of a too powerful client seeming independent from the future development of his partners and unwilling to any change in his organization, the inter-organizational conflicts do not allow much confidence to grow in the engineering enterprises. In such a situation

between the organizations, there is only limited space for Participatory Design.

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