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Towards an Integrated Organization and Technology Development

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ABSTRACT

Nowadays organizations are seen as self-organizing social systems. To cope with dynamics of a continuously changing environment they have to be able to react flexibly. To support organizational change we will work out the concept of integrated organization and technology development. This approach offers a framework to deal with organizational and technological change jointly in an evolutionary and participative way. We will investigate on methods to organization development, work psychological guide-lines, approaches to software development and tailoring in use. Based on these results we will develop an integrated approach to organization and technology development.

KEYWORDS: Organisation development, work psychology, software development, tailoring in use

1. INTRODUCTION

Nowadays organizations face increasing complexity and dynamics of their environment. On the one hand large scale markets for mass production are disappearing in northern economies because of a high level of satisfaction of customers' basic needs. Customers' needs have to be satisfied more individually. Thus, markets are getting more segmented and dynamic. To be able to survive in these markets, organizations have to be able to cope with this increased complexity of customers' demands and to react quickly to changing requirements of their customers.

Moreover, in several markets international competition is increasing because of liberalization in trade regulations and easier physical access due to an improved transportation and telecommunication infrastructure.

To cope with these demands organizational structures have to be rethought. In this context the concept of self-organization is nowadays widely discussed in management science. Although approaches like "lean production" (Womack et al. 1990), "virtual organization" (cf. Davidow and Malone 1993), "semi-autonomous workgroups" (cf. Brödner 1993), "business reengineering" (cf. Hammer and Champy 1993) and "fractal factory" (cf. Warnecke 1993) differ considerably in their point of emphasis, they have a common foundation. Contrary to a tayloristic approach where organizations were perceived as social units which could be controlled mechanically from the top, the concept of self-organization is based on the idea that social units are networks of autonomous self-regulating subunits whose behaviour cannot be controlled easily from the outside. To be able to exploit the benefits of self-organizing systems organizational structures have to be renewed: the divison of labour among the subunits has to be changed, the hierarchies have to be flattened while self-coordination by non hierarchical communication among the subunits has to play a more important role.

Within this process of reorganization information systems are of importance. New modes of division of labour within an organization or between organizations can be supported by groupware which supports interindividual, intergroup or interorganizational (tele-)cooperation (cf. Hammer and Champy 1993, 83; Schmidt 1994, 101). Furthermore, synchronous and asynchronous communication systems and coordination-tools can facilitate the self-coordination

among subunits which will replace coordination by formalized rules and hierarchical decision making. However, these systems do not only offer opportunities for organizational changes but also their design has to respond to changing requirements from

their fields of application. Thus, the relationship between the technical and the organizational changes is characterized by reciprocity and interdependence. To handle the reciprocity and interdependence we propose to handle organization and software development integratedly. Therefore, we will work out the concept of integrated organization and technology development. The given dynamics of the environment force organizations to react permanently. This requires an iterative approach to change. Once an intervention has been performed within this development process its effects have to be reconsidered whether they led to the intended result. According to the paradigma of self-organization it cannot be predicted from the outside in which way organizations as a whole and single subunits will react to changing environmental conditions. Thus, a process of integrated organization and technology development depends on the active participation of the single subunits affected.

We will look at participation not only for functional reasons but also for normative considerations because it should lead to more democratic participation of the organization's members. Thus, we have to consider how participation is established and who participates in the single phases of the process. Moreover, we consider normative criteria to be very important within a process of change. They allow to evaluate different design alternatives. Though a normative base cannot determine the outcome of an evolutionary process, nevertheless it gives orientation for the actors within this process.

To work out the concept of integrated organization and technology development we will first take a look at process-oriented approaches to organizational and technological change. Furthermore, we will consider normative bases to evaluate the steps of such a process. Therefore, we will investigate on methods to organization development, work psychological guide-lines, approaches to software development and tailoring in use. These concepts will be evaluated answering the question whether they allow for an integrated evolutionary and participative approach to change. Based on these results we will develop a concept of integrated organization and technology development.

2. Organization Development

Management science has not yet agreed on a common definition for the term organization development. Pieper (1988, 56) suggests that organization development can be understood as a continuously initiated, long-term organization-wide change in the behaviour, attitudes and abilities of its members as well as in its structures and its processes. The organization development process can be characterized by the four steps of diagnosis (analysis of the actual state and feedback), intervention planning, application of interventions and evaluation (of work system) (cf. figure 1). The process is focused on the interaction between organization and organizational context, on intergroup relations within an organization and on relations between individual and organizational needs (Pieper 1988, 74). Thus, one can distinguish two major approaches to organization development. On the one hand changes can be directed towards attitudes and abilites of individual members of an organization (cooperation facilities, teamworking, conflict handling abilities). On the other hand changes can concern certain aspects of an organization as a social entity like division of labour or mechanisms of coordination and conflict management.

To support organizational changes methods and instruments of applied social science such as theory of personality, social psychology, group dynamics and organization theory are applied (cf. Huse 1980; French and Bell 1990). Methods and instruments are developed since the middle of this century when group dynamics as a new research field was established. Group dynamics is based on the fact that changes in attitudes and behaviour can be reached more easily through group-discussion than by lectures or teaching to individuals.

The following interventions were chosen to promote changes (cf. French and Bell 1990, 137):

- feedback
- changes of rules and values
- increase in communication and interaction
- confrontation with mediation and negotiation
- qualification by teaching:
    - new knowledge
    - new abilities

Single methods of organization development like survey feedback, training laboratories, encounter groups, transaction analysis, intergroup intervention and team development combined these interventions with several social scientific techniques to collect data about the actual state of an organisation in a specific way (Pieper 1988, 67). Other methods like managerial grid or management by objectives are conceptualized for use by and training of the management staff only. The appropriate method is chosen often by the change agent, an outsider who is responsible for the moderation of such a process of change. Organization development is based on an evolutionary approach. Assuming that changing requirements will be a permanent feature of an organization's environment and that the effects of these interventions cannot be clearly predicted, there is a general agreement that organization development has to be seen as a long-term process (cf. French and Bell 1990, 66).

Organization development is based on a method called *action research*, which describes an iteration of data

collection, feedback, intervention and new data collection (French and Bell 1990, 112). This procedure is performed in a cyclic process of analyzing the organization and its problems, presenting and discussing these data within the organization, planning of interventions to overcome the problem and performing the intervention within the organization. Afterwards the same steps are reiterated: data about remaining problems are collected and so on (cf. figure 1).

It is interesting to see that there is a considerable gap between the normative background of organization development and its practical implementation. Organization development is based on a normative-reeducational approach: precondition for organizational developments is the change of individual and collective values and rules (cf. French and Bell 1990, 73ff). Organization development processes were originally guided by the ideas of *democratization* of organizations and *personal growth* of its members (ibidem, 98ff; Pieper 1988, 91). Nevertheless, these norms are rarely met in practice. Organization development processes are established by the management that defines the problems to be tackled and the aims to be followed (cf. French and Bell 1973, 184; Pieper 1988, 54). External change agents control the process of change according

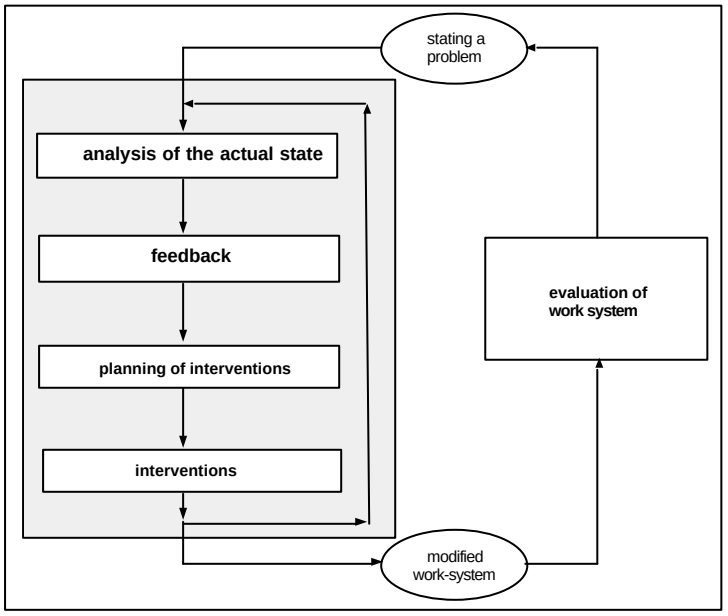

Figure 1: Process modell of traditional approaches to organisation development

to these given facts. Thus, the participation of ordinary members of an organization can be extremely limited. Therefore, Pieper (1988, 112) calls organization development a social technology being at hand of the management and just providing pseudo-participation to ordinary members of an organization.

It seems doubtful whether such a restriction of the participation of the organization's members can work out well in self-organizing units. On the one hand it is questionable whether aims pointed out by the management will be adequate for specific problems of certain subunits. On the other hand it seems unlikely that external experts are able to control a process of change within an organizational subunit. Thus, for functional considerations as well as for normative reasons participation of members of an organization has to be increased. Pieper (1988) has proposed to modify the traditional approaches of organization development towards a discursive one which offers a wide extend of participation to all members of an organization. To define problems and to choose an intervention to their solution there should be an open discussion within an organization. Such a process would increase the democracy within an organization.

Organization development is rather a label of different methods to promote organizational change than a homogenous concept with a theoretical foundation (cf. Sievers 1975, 29). Therefore, organization development merely means a bundle of intervention strategies, which could be successful in reaching the promised aim of democratization and promotion of personal gowth within the process as well as in the process results. Although, the approach does not offer any criteria for the evaluation of these process characteristics. Organization development suffers from the lack of theoretical assumptions about why changes occur and how they can be guided by interventions in a certain direction (cf. Pieper 1988, 82). Therefore, it is neither possible to evaluate the normative demands. Nevertheless, there exists a big repertoire of practical experiences with these methods which makes it attractive to consider them for an integrated approach. Furthermore the strong emphasis on a cyclic approach makes these methods interesting for further considerations.

3. WORK PSYCHOLOGICAL ANALYSIS

To find evaluation criteria for the outcomes of organization development processes we want to look on the findings of work psychological research, which offers several criteria for *quality of working life*. The work psychological approach like the organization development is based on the normative demand for *personal growth*.. In the following we describe the basics of Leontjews *activity theory* and the *Handlungsregulationstheorie* (action regulation theory; cf. Hacker 1986), which offer a theoretical foundation of several evaluation criteria for human-centered work systems.

To investigate on human actions, the soviet union psychologist Leontjew developed the activity theory, which allows analyses of human behaviour from both kind of perspectives: from the individual and the social one. The activity theory does neither take an individual's nor a group's standpoint but is focussing on the analytical unit *activity*, which includes not only individuals' actions but the social context, too. Leontjew critisizes the traditional behavioristic stimulus-response scheme, because it ignores the embedment of individual activities in the social context and therefore in a world of real objects, towards which human activities are directed on (Leontjew 1974, 6). *Object-type activity*, as Leontjew called it, is a human's activity and its corresponding conditions, goals, and means. It can not be seen as a socially isolated event, but must be considered as embedded in a social context. Human activities constituate individuals' mental models of the world, their perception of social environments and the objects, to which their activities are directed. Leontjew states that "society produces the activity that shapes its individuals" (Leontjew 1974, 11) and that the analysis of human activity is an analysis of different activity levels: *activities* are directed to objects and driven by desires or motives, *actions* can be seen as actualizations of activities, directed to and structured by goals, and *operations*, as realizations of actions, are determined by the certain conditions of the goal's achievement, that means a specific *task* (ibidem, 26f).

This differentiation in activity, action, and operation was taken up by the german work psychologist called Hacker. The *Handlungsregulationstheorie* (action regulation theory) has differentiated further *activities* which are driven by motives and directed to superposed goals, *actions* which are directed to certain subordinated goals, *operations* which correspond with partial goals and concrete conditions, *movements* which are single operation units, and, on the lowest level, *sensumotorical phenomena* (eg muscle contractions) (cf. Hacker 1986, 73ff). In work psychological theory development, the german dominated discussion has concentrated on the *individual aspects* of human action. The theory focus on individual psychological aspects of sensumotorical, cognitive, intellectual, and psychological regulation of human work. Psychological work analysis here is defined as "the analysis of the process, the psychological structure, and the regulation of human working activities related to their conditions and consequences (...)" (cf. Frei 1981, 12, translated by the authors).

On the basis of this theoretical approach four work psychological criteria for task analysis and job evaluation are derived: the *possibility to perform the task* (Ausführbarkeit), the *harmlessness* (Schädigungslosigkeit), the *avoidance of imnparements or interferences* (Beeinträchtigungsfreiheit), and the *promotion for development of personality including social skills and capabilities* (Persönlichkeitsförderlichkeit) (cf. Hacker and Richter 1980, see also Ulich 1984).

Concerning single workplaces several procedures for work and task analysis are available which are grounded on these findings (TBS, Hacker and Richter 1980; VERA, Volpert et al. 1983, Oesterreich and Volpert 1991; STA, Ulich 1983; RHIA, Leitner et al. 1987; TBS-GA, Rudolph et al. 1987; KABA, Dunckel et al. 1993). These procedures cover a single person´s workplace and on *individual* cognitive psychology. Thus, work psychological research offers criteria mainly for an evaluation of quality of working life guided by the idea of individual´s personal growth. Social context, interpersonal relationships, group dynamics, and intergroup behavior are neglected to a great extent.

Furthermore, they are developed for the analysis of actual work conditions and the evaluation of real work situations. They does not offer criteria for the evaluation of development processes but of their outcomes only. Nevertheless, work psychology seems to offer the only theoretically derived criteria for the evaluation of human work at all. With increasing complexity of organizational work conditions, self-organizing working units, and development processes the work psychological evaluation criteria have to be enriched with social psychological findings and process orientated aspects.

Therefore, we propose to apply the existing work psychological evaluation instruments within organizational restructuring processes especially in the phases of analysis of the actual state and evaluation of the restructured work system (cf. figure 3). They could bridge the gap between the normative self-understanding of the organization development approach and its lack of adequate evaluation criteria for its results.

4. SOFTWARE DEVELOPMENT AND TAILORING IN USE

Contrary to the approaches of organization development software development originally has been seen as a well predictable activity. Therefore, as a main approach to overcome the software crisis one has developed methods and tools to formalize the process of software development. According to the waterfall-model an application is realized top down from its specification to the program code and its final tests (cf. Boehm 1976). Thus, one assumed that the requirements for a system would be explicable in the beginning of a project and stable for a longer period of time.

These assumptions have been questioned for years. Boehm (1988) has proposed to develop software according to a spiral model. By several cycles each containing an evaluation of a preliminary product, changed requirements and misunderstandings about the

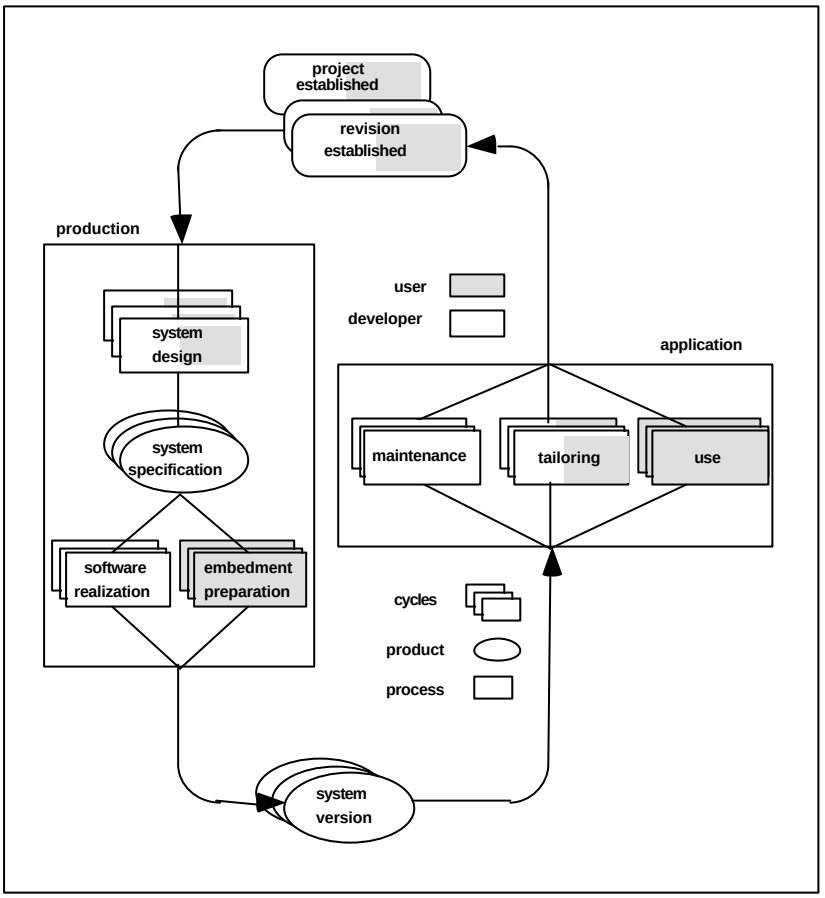

Figure 2: Extended process model integrating software development and tailoring in use (cf. Floyd et al. 1989, p. 57; Wulf 1994, p. 43)

specification can be reduced. To support a cyclic procedure, methods for object oriented analysis, design and implementation have been proposed. Thus, Henderson-Sellers and Edwards (1990) propose a fountain model for object oriented software development. Breaking the system up into modules which are meaningful to users facilitates to react on changing requirements during the development process. It is no longer necessary to follow a top-down sequence of activities. Thus, it is possible to change between the activities of requirement analysis, design and implementation on the level of the whole application or on the level of single modules. This allows for the flexible reactions towards changing requirements.

These approaches deal with the production of an artefact and flexibilize the process of software development. They do not focus on software redesign due to changed requirements during its application. Furthermore they do not discuss which role end users should play within this development process and how to get them involved.

Contrary to these approaches the STEPS-method is based on an active participation of end-users (cf. Floyd, Reisin, Schmidt 1989). Software development takes place as a process of cooperation among software developers and users. This is due to the fact that only a process of initual learning between developers and users can bring together sufficient competence to reach end-users' quality demands (ibidem, 53). Therefore, the process model of software development describes activities to be done by developers and users seperately and others which have to be done together. As software development is seen as a part of the design of users' work system, the STEPS-model is more comprehensive than other approaches. Especially the use of a system in a context of application with its evaluation for redesign are important aspects of this approach. Therefore, this method does not only ask for cycles of analysis, synthesis and revision during the design of a single system version but it is evolutionary in a broader sense. In order to keep pace with environmental changes it assigns an iterative development process establishing a revision as soon as the system's functions do not match anymore with the requirements of the users. Thus, the STEPS model offers an evolutionary and participative framework which is well adapted to develop software for organizational environments which can be described according to the paradigm of self-organization (cf. Floyd 1994).

Nevertheless, in a very quick changing environment this approach will cause quite some overhead if all adaptions of the software lead to the establishment of a revision. In this case system developers have to get involved. Therefore, evolutionary and participative software development has to be supplemented by activities performed by end users or local experts of the application environment (cf. Wulf 1994).

Approaches of end users' modification of a system version have been discussed under different labels (Trigg, Moran and Halasz 1987; Fischer and Girgensohn 1990; Henderson and Kyng 1991; Nardi 1993; Oberquelle 1994). Based on Henderson and Kyng (1991) we want to sum up these activities under the label of tailoring. Contrary to the development of a new system version the existing version is adapted to changing requirement during its use. Thus, during system design aspects of the functionality which should be tailorable have to be selected and tools have to be developed that support the adaption of these features. Tailoring allows for adaptation to changed environment just as far as these

needs have been anticipated during system design. If there are requirements for adaption which have not been anticipated it is necessary to redesign the system.

Tailoring can be distinguished from system redesign by looking at the actors who perform the modification. End users, a group of end users or local experts of the application environment are the actors of tailoring while during redesign system developers always get involved. Tailoring can be distinguished from the ordinary usage of a system by looking at the activities performed. Tailoring means the manipulation of system features which are stable during the normal usage. These modifications are valid for a certain period of time up to the next cycles of tailoring (cf. Henderson and Kyng 1991).

Thus, tailoring is always participative as it is initiated by users and often even performed by them. Tailorability offers a technical option to adapt a system evolutionary within its context of application. Therefore, the activity of tailoring can become part of an evolutionary approach to software development and usage. Within a design cycles as it is proposed by the STEPS process model, tailoring takes place during the application of a system (cf. Dzida 1994). As long as users´ requirements can be handled locally during usage, there is no need to establish a revision of the system. As far as changing requirement can be anticipated, tailorability offers the chance to avoid too frequent redesigns of an application. Thus, it can play an important role in enabling an organization to react to changing environment (cf. Wulf 1994).

Figure 2 gives an overview of the STEPS process modell which has been extended by tailoring activities during a system´s application.

5. INTEGRATED PROCESS OF ORGANIZATION AND TECHNOLOGY DEVELOPMENT

Summing up we have seen that in management science as well as in computer science there are evolutionary and participative approaches for the design of work systems. Nevertheless, they are not yet integrated. Methods of organization development - if they deal with technological aspects at all - take software rather as a static artefact which might be introduced within the framework of an intervention. On the other hand software development traditionally does not deal with organizational changes due to its application.

STEPS overcomes this restricted perspective. It mentions embedment-preparation as an important activity of users during the period of a system´s production. Furthermore, Floyd et al (1989) assume that organizational change can be a reason to establish a revision. Nevertheless, STEPS focuses on software development. The evolutionary development of a software artefact is the intended aim of this approach. But within the process of organizational change it may not always be necessary to develop a new artefact or to revise a system version.

A first approach to integrate STEPS into the process of organization development has been worked out by Falck (1991). Within the IMPACT framework she has used an open questionnaire to collect data about problems of an organization. Based on the results of this diagnosis the members of an organization decide participativly on objectives for software development and for organizational change. Both processes are supposed to happen at the same time.

In the literature tailoring is rarely connected to evolutionary approaches of software development or organizational change. As these approaches are based on a linear model of system development it is assumed that the system itself and the tools for tailoring do not change during a system's use. Therefore, Henderson and Kyng (1991) integrate the redesign of an application done by software developers into the concept of tailorability under the condition that it has been initiated by end users.

Empirical studies on the use of tools for tailoring have stressed the importance of collaboration among end users (cf. Nardi 1993) because single users will have different skills in performing these technical interventions. Therefore, Henderson and Kyng (1991) ask for a tailoring culture within an organization to facilitate systems' adaptation. Recent empirical studies on tailoring within an organization state an increased structuring and bureaucratization of these tailoring activities (cf. Trigg and Bødker 1994, 50). Nevertheless, there are few propositions on how to encourage such a process by means of group dynamics. There are not any propositions on how to integrate tailorability into a process of organization development.

In the following we will try to integrate the approaches discussed so far into an evolutionary and participative process model of integrated organization and technology development. We will work out a concept proposed by Hartmann (1994). Integrated organization and technology development is defined as "the process of change of an organization in which organization and technology are designed and developed jointly in a task- and need-oriented way by the members affected: the organization members affected consider the existing problems, search and evaluate the problems´ causes, and consider measures to solve the problems. (...)" (Hartmann 1994, 311, translation by the authors). The organization and technology development process is characterized by a parallel development of workplace, organizational and technical systems, the management of (existing) conflicts by discoursive and negotiative means, and on immediate participation of the organization members affected.

Establishing the process – A process of integrated organization and technology development starts with the perception of a problem in the daily work of an organizational unit. If a member of the organization finds that certain organizational aspects are preventing an efficient performance of his actual tasks, he should have the chance to articulate problems. Based on this perception, the members of an organization who are affected by the problem should discuss whether there is a need for an integrated process of change.

If they opt for the establishment of a process of organizational or technological change, objectives and measures have to be specified. It has to be decided whether and how to involve external change agents within this process. Furthermore, one has to find an agreement how to get personal and financial resources necessary for the process.

Analysis of the actual state – At first, the actual state has to be analysed with respect to organizational structure, technology and qualification. The results of this analysis have to be discussed. According to the knowledge of the organizational unit about the problem and its objectives there are different methods for an analysis. This analysis can consist just out 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 such as the methods described in chapter 3 (TBS, Hacker and Richter 1980; VERA, Volpert et al. 1983, Oesterreich and Volpert 1991; STA, Ulich 1983; RHIA, Leitner et al. 1987; TBS-GA, Rudolph et al. 1987; KABA, Dunckel et al. 1993).

Creation of alternative options – Having clarified the actual state with its problems, it seems important to generate alternative approaches to its solution. These alternatives may include different combinations of organization, technology or qualification measures. Based on this alternatives, the members of the organization discuss and find a consentanous solution. To judge the human centred potential of the different options, these alternatives can be evaluated with work psychological methods.

The alternative options can be created by the members of the organization themselves or by change agents. Especially, if these alternatives are proposed by change agents they should be presented as understandable as possible to all members 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. While software prototypes have been used in software development for some time to facilitate communication between users and developers (cf. Floyd 1984) there is only few research on how to present modified organizational structures in a way that their implications can be perceived easily.

Planning of the interventions – After choosing a development option the members of the organizational unit have to decide on interventions in organizational, technological, and qualificatory dimensions. If software has to be (re)implemented the establishment of the software development project happens in this phase.

Interventions – Interventions derived from organization development play a central role within the wider process of integrated organization and technology development. Their main issue is the change of formal and informal aspects of an organization. Concerning the structures and processes of an organization, decentralization and new forms of division of labour may have to be introduced. Decentralized and cooperative structures are realized by formation of workgroups. Workgroup structures could be guided by concepts like semi-autonomous workgroups or linking pin systems (cf. Likert 1961). Methods to introduce work group structures are group dynamic techniques like training laboratories or team development.

According to software interventions one can distinguish between tailoring and redesign as a result of changed requirements. Depending on the changes which are necessary one will try to solve the problem by tailoring the application. As the goals for the tailoring process have been set participatively by the members involved, we assume that their realization will happen cooperatively among them. Tailoring is facilitated by such a cooperative procedure (cf. chapter 4). Nevertheless, it might be necessary that change agents support tailoring. If the software changes cannot be performed by tailoring, a redesign-cycle has to be initiated. In this case one has to involve software developers to communicate the requirements. A revised version of the software has to be produced cooperatively. During the period of redesign one has to consider potential changes in requirements which make an evolutionary approach necessary.

Moreover, there might be an organizational restructuring necessary which cannot be supported even by a revised software version. For instance, production planning systems (PPS) which have been designed for tayloristic organizational structures are no more adequate if workgroups with high authonomy are introduced. In this case the software has to be removed. A software which has been used for long time is often interwoven with work practice in many ways. Therefore, it is important to analyse this interdependency thoroughly before removing the system.

Within the process of integrated organization and technology development two different requirements for qualification have to be considered: special professional qualifications and social competences as preconditions for participation. Task specific knowledge of organizations' members has to be actualized if

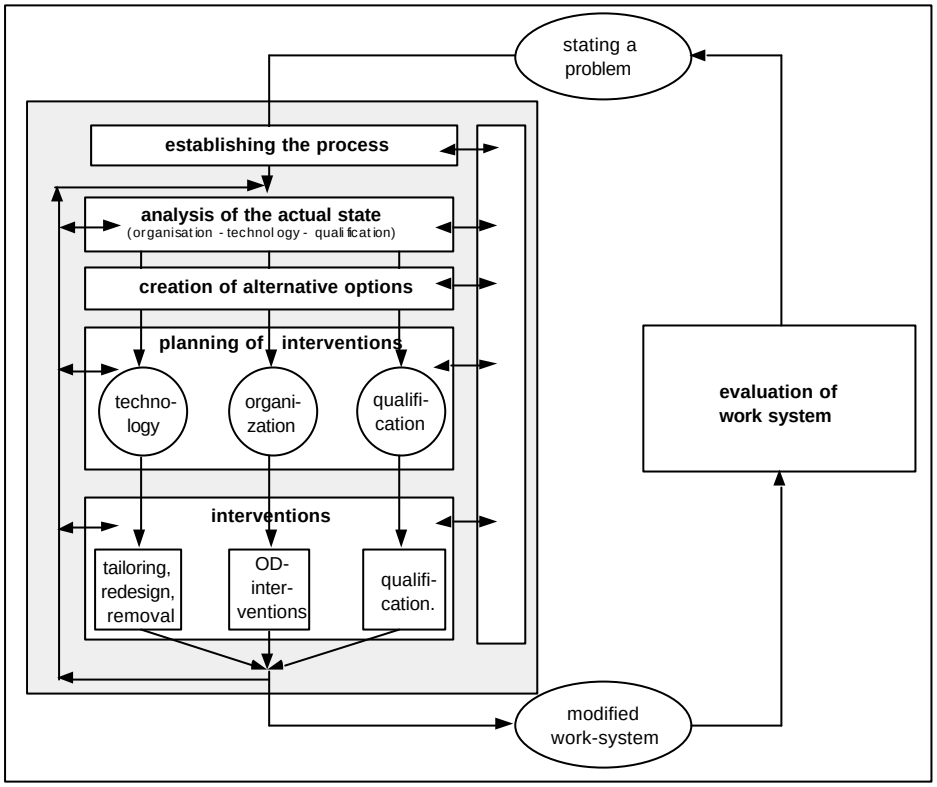

Figure 3: Process of integrated organization and technology development

organizational development leads to new task profiles for individuals or if the introduction of new technologies requires new skills. The organizational restructuring leads to increased autonomy for individuals concerning decisions on goals, procedures and schedule of their work. To deal with this authonomy requires new skills.

Qualification for participation – Furthermore, the individuals involved in organization and technology development must be enabled to participate in the process adequately. Therefore, the *social competences* of the participants have to be promoted. Social competences in this context are communicative and cooperative abilities as preconditions for an involvement in discoursive development. To take part in this process, an adequate capability for conflict management is necessary, too. These social competences can be trained by encounter group method, team development, training laboratories, transaction analysis, or group intervention. During the integrated process of organization and technology development there should be performed workshops for the promotion of social competences continuously.

A comprehensive approach for participation has been proposed by Sell and Fuchs-Frohnhofen (1994). They regard a process of change as an iterative problem solving activity. Thus, they develop a modular qualification program which stresses analytic, synthetic, and dialectic abilities for problem solving and conflict management. These skills are trained using methods like group discussion, group training and communication training.

Though we have presented the different steps of the integrated approach to organization and technology development sequentially, it should be possible to reiterate certain steps according to the necessities of the process.

6. CONCLUSION

The understanding of modern organizations as self-organizing socio-technical systems leads to new approaches to organizational change and techical innovation processes. Increasing environmental dynamics and complexity require flexibility of organizational units as well as of technical systems. Today the idea of participation and cyclic-evolutionary approaches for both technical and organizational development processes are widely accepted but suffer from a lack of theoretical foundation as well as of methodological concepts. The organization development approach ignores technical innovation processes and does not offer adequate criteria for the evaluation of its results. Psychological research proposes a theory of human work and derives normative criteria for human centred design of work systems. It is limited to individual needs and does not offer methods of intervention. Software-engineering approaches ignore (interconnected) organizational changes. Therefore, we proposed a participative and evolutionary approach to integrated organization and technology development supported by work psychological evaluation criteria. Organizational and technological realities are understood as an interrelated work system. This work system should be modified in an iterative process which is oriented to the needs of all participants affected.

The framework we have proposed combines different instruments to promote organizational change. Single instruments have been applied and tested in practice. The integrative use of these instruments has not yet been practically evaluated. Nevertheless, it will be necassary to collect practical experiences. We have just started a research project to encourage cooperation within a ministerial administration. To overcome spatial barriers between certain subunits an initial version of a groupware system will be applied. Due to its

introduction the division of labour among and within organizational subunits is questioned. The system has to be tailored to meet organizational demands and it is already predictable that the requirements of the users will demand for a reimplementation of certain functions. Within this process there will be several workshops for qualification. The whole process will be guided by researchers who play the role of change agents. Beyond this we need additional case studies in different organizations to be able to judge whether this approach is a reasonable way to cope with increasing dynamics of the environment.

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