Global Co-Operation in the New Millennium
The 9th European Conference on Information Systems
Bled, Slovenia, June 27-29, 2001

COMMITMENTS ENABLING CO-OPERATION IN DISTRIBUTED INFORMATION SYSTEMS DEVELOPMENT

Ralf Klischewski

University of Hamburg, Department for Informatics/Software Engineering, Vogt-Koelln-Strasse 30, D-22527 Hamburg
Tel.: ++49 40 42883 2299, Fax: ++49 40 42883 2303
klischewski@informatik.uni-hamburg.de

ABSTRACT

Information systems development is regarded as a series of distributed activities aiming at allocating resources in order to promote the development and use of computer-based systems. Co-operation means to interrelate those activities and to create a network of human and nonhuman actors to eventually support the use of the system. Applying concepts and terminology of actor-network theory, circulating and (black)boxing commitments of the actors involved are identified as recurrent activities essential to enabling co-operation and to achieving progress in systems development projects, i.e. to encouraging actors to contribute the required resources in due time and place. This framing of ISD is applied to examine co-operation in a case of the implementation of computerised support for the examination administration of a large university. Summing up, the potentials of approaching systems development as networking are evaluated to provide guidelines for co-operation and management in distributed ISD projects.

1. THE CHALLENGE: CO-OPERATION IN DISTRIBUTED DEVELOPMENT ENVIRONMENTS

As computer-based networks extend the boundaries of information system applications, the various actors developing and using the system are often separated by organisational boundaries, linked rather by some co-operative arrangement than by effect of some hierarchical power structure. Instead of one social actor being able to execute power over all other actors, *development and use take place in distributed environments* which are not organised nor controllable as a whole, i.e. each organisational unit involved is capable of independent decision making. Thus, communication and co-operation within the IS project and with users and/or other stakeholders, sharing views and perspectives, clarifying conflicts, achieving consensus, and adapting to an evolving correspondence between actors become even more critical success factors.

In practice, much of the work in information systems development is still organised in projects, but the actors involved find themselves in an *unstable* organisational environment for the time of project duration. New challenges for project management include coping *dynamically* with basic questions of co-operation, e.g.: Who is to be regarded as a project member? What are the common project aims and tasks? Who to contract with, and when, inside and outside the project, and what for? How to plan and evaluate progress?

To answer these and other questions, scientific observation and reflection need a framing for the duration of inquiry. Here, the notion of information systems development (ISD) shall comprise all activities to get a computer-based information system "up and running" (Kling and Lamb 1999), which is also the ultimate goal of co-operation within ISD. But (unlike CSCW research) ISD research has not yet spent much effort on reflecting the notion of co-operation in systems development. In Software Engineering, co-operation among developers is mainly discussed within Software Process Modelling and Software Process Improvement. In ISD research, a broader view is usually adopted to relate the developer's action to other actors and to the organisational environment (such as in Participatory Design). Conceptualisations of ISD that provide starting points for the inquiry into co-operation comprise

- process models, which attempt to relate subsequent events (e.g. "encounters" linked by three kind of "episodes;" Newman and Robey 1992, Robey and Newman 1996)
- stage models, which provide a rich picture of the process as a whole (e.g. Floyd et al. 1989, Damsgaard and Scheepers 1999, Atkinson 2000)
- role models and actor mapping (e.g. Gärtner and Wagner 1996)

However, all these approaches must prescribe or assume stability for what are process elements and their relations, what is the overall course of the development process, or what is the set of roles and/or actors involved. These basic assumptions no longer hold because systems development and use is increasingly taking place in distributed environments where central monitoring and control (alone) is not a suitable option for project management. During the last years, ISD research has also focussed on networks, mainly drawing on actor network theory since it (in contrast to the above) aims at explaining the growth of networks by relating all kinds of elements without making a statement on how to frame the relation of social actors and information technology. To investigate and reflect the distributed and dynamic aspects of co-operation in today's ISD, it is suggested to regard systems development as 'networking' (Klischewski 2000), which means to ask: How do system developers recruit and mobilise (enough) allies to forge a network which will bring out and support the use of „the system"? Following this question, it is possible to provide new frames for conceptualising and managing the phenomena related especially to distributed and dynamic development environments.

In this paper, it is argued that co-operation in ISD is enabled by commitments, thus aligning social actors and their resources in a network. In the following, it is explained how actor network theory supports this kind of research. Based on this theoretical approach, ISD is conceptualised as networking with (black)boxed commitments. This framing of ISD is applied to examine co-operation in a case of the implementation of computerised support for the examination administration of a large university. Summing up, potentials of approaching systems development as networking are related to co-operation and management in distributed ISD projects.

2. ACTOR NETWORK THEORY FOR ISD RESEARCH

Reconstructing the 'success' of science and technology as the extension of networks enrolling human and nonhuman resources, Latour (1987) suggests to "arrive before the facts and machines are blackboxed or [to] follow the controversies that reopen them" (first "rule of method", ibid., p. 258). What is often called actor network theory (ANT) originates in social anthropology and the sociology of science, to "denote an emerging set of ideas about networks of association, in which groups of heterogeneous allies, by virtue of the strengths of their aligned interests, create those black-boxes that eventually come to be seen and accepted as the facts of everyday life" (McMaster et al. 1999, 345). Within ANT (cf. Law 1997) a 'network' is much like a structure, except there is no assumption that specific links or nodes in the network are guaranteed. Networks may be imagined as scripts, which means that one may read a script from, for instance, a machine which tells or prescribes the roles that it, the machine, expects other elements in the network to play. And, building and maintaining networks is an uphill battle, the links and nodes in the network do not last all by themselves but instead need constant maintenance work, the support of other links and nodes. Thus,

networks are processes or achievements rather than given relations or structures. 'Actors' (or 'actants') to become associated and enrolled in those heterogeneous networks may be both human and nonhuman, i.e. the various elements of the heterogeneous network are all equally able to act upon one another.

During the last decade, the work of Bruno Latour and others referring to ANT (meanwhile "recalled" by Latour himself, cf. Latour 1997) has inspired a number of ISD researches to reflect project experiences and to conceptualise the interrelation of actors in the socio-technical contexts of systems development. Framing systems development as networking 'enrols' the following claims relating ISD and ANT as results of past research:

- *ANT as practical research method:* it provides concepts (theory) as ways of viewing elements and suggests to trace these elements in empirical work (methodology), and people and artefacts (e.g. organisational members and computer-based systems) may be analysed with the same conceptual apparatus (Walsham 1997).
- *IT as subject for blackboxing:* analysing a case, Vidgen and Master (1996) show how IT implementations "become blackboxes as a result of dissemination through time and space".
- *Translation of success factors:* Gasson (1999) suggests that „the success of a design initiative is dependent upon the ‚translation' of the interests of influential actors" and therefore „design goal definition must proceed recursively through the processes of design, which require new approaches to the design and development of organisational information systems".
- *Beyond strong symmetry of humans and nonhumans:* Jones (1999) argues that interpretation is central to the process of information systems design, implementation, and use. In between structuration theory and ANT he calls for a "relaxation of the assumptions of strong symmetry between human and material agency": Since intentionality is a specifically human characteristic, "human agents seek to channel material agency to shape actions of other human agents".
- *Towards process management:* as McMaster et al. (1999) seek to "understand adequately the process through which stabilised networks form" they suggest two models (courtroom and a parliamentary democracy) of a "due process" to enable an ongoing procedure of inclusion and exclusion of humans and nonhumans in ISD.
- *Methods as actants:* Atkinson (2000) employs ANT to explain the use of a given ISD method (i.e. SISTeM) and the resulting interventions in organisational problem situations. He introduces the method as a "mutable mobile" being enacted, enrolled and translated in actor-networks and, at the same time, as an actant contributing to the change of existing networks at organisational work settings.

ISD research related to ANT has provided a rich body of valuable insights. However, ANT-based framings of ISD elaborated so far have not led to applicable guidelines and methods for IS practitioners (compared to approaches based on systems theory, e.g. Soft Systems Methodology, there are more difficulties since ANT does not permit abstracting stable structures for methods and practical guidance). To proceed in this direction, the notion of networking is used here to conceptualise systems development 'in-the-making' with the key research question: How do systems developers recruit and mobilise (enough) allies to forge a network which will bring out and support the use of „the system"? There might be many answers to this question, depending on how the network relations are explored in detail. As we are interested in what actually enables co-operation, we focus in more detail on (1) what contributes to the dynamics, i.e. to the growth of the network, (2) what provides the "glue" for relating the distributed network elements (social actors and their resources), and (3) what the social actors involved (can) work on during the course of co-operation. We will investigate these issues by following commitments in the course of ISD.

3. CREATING NETWORKS BY BOXING AND CIRCULATING COMMITMENTS

In this paper, the following hypothesis drawing on ANT is argued as answering the key research question above – it will be used to trace project co-operation and eventually to provide practical guidance:

> Systems development, aiming at establishing an information system based on computer networks, must also establish a network of commitments by all actors whose consent and effort are necessary to make use of computer systems' potentials by putting these commitments in a '(black) box' and circulating them among those actors.

A commitment is a form of social contract. Here, within ISD, the notion of commitment refers to an agreement that something within a social actor's realm may be moved around, transformed, and allocated for the purpose of systems development and use. 'Something' could be physical or abstract objects (software, computer, financial asset), personal opinions now standing out in public (judgement, decision, consent), certain tasks to fulfil or activities to do in the future (work effort, availability), professional knowledge (e.g. about work processes), or anything else which might be a resource for effective system use.

To get a computer-based system in an organisation "up and running" it needs subsequent promotion and support by a number of social actors. Each commitment for promotion and support might be essential and a prerequisite for further steps in development and implementation. It might even require complex social activities to achieve a single commitment (e.g. resolving conflicts). But as soon as it is 'there' the following activities just 'draw' on this commitment, i.e. further steps in development and implementation align all past commitments to establish the flow and allocation of resources in due time. In this view, commitments are to reduce complexity and to channel and transform the *input*, i.e. the resources committed by a social actor, towards an *output*, i.e. the function of those resources required for effective use of the computer-based system (e.g. exploitable expertise, continuous service, process patterns, application procedures, work organisation, system components).

Commitments are a success factor in every development process. However, in a distributed and unstable organisational environment for ISD projects, commitments do not have a "natural" frame of reference, i.e. a stable social setting where social actors negotiate and maintain their mutual agreements and expectations. To work with commitments in such project management environments, they must be *boxed*, i.e. one must draw a line around them, take them away from the actor who made the commitment, circulate and make them a function or eventually a brick in building the system. Being boxed, commitments are (immutable) mobile plans for allocating resources.

In each situated development and implementation process, a unique wrapping of commitment boxes is needed to create a network relating actors' resources to places and transforming those resources into a function for effective system use. In principal, those boxes could be anything as long as they are mobile and serve to circulate commitments on allocating resources – typical examples found in projects are public opinions, common beliefs, role assignments, documents (reports, contracts), budgets, accepted work routines, a variety of technical devices. These boxes become *black* as soon as they are referred to only in their input and output, as they are part of other boxes, being transformed, without making visible the social process in which they have been established or which could lead to a withdrawal of the commitment.

Whereas 'blackbox' and 'immutable mobiles' are prominent terms within ANT, 'commitment' is not. This notion refers to the intentionality of humans in difference to nonhumans. This is an a priori assumption for the duration of inquiry in order to provide an operational framing for ISD research to follow systems developers through their projects. The following case study tries to point out the role of commitments circulated: their origin in the social actors involved, their 'acting upon' other elements in the network and during the course of project co-operation, and their contribution to the growth of the network.

4. CASE STUDY: COMPUTER SUPPORT FOR AN EXAMINATION ADMINISTRATION

A large German university is employer to 3.300 people (not including the university hospital), providing education for about 40.000 enrolled students (1998/99). The organisation is structured into 19 more or less independent departments as well as some functional units (such as the central computing centre). In 1996, the university established and institutionalised a task force for its own organisational development (*P*roject

*U*niversity *D*evelopment) with one subproject focussing on the examination administration. There, the need for a computer-based system was triggered by significantly increasing examination requirements due to the modularization of curricula as well as the university management's interest in decentralising the examination administration (i.e. dissolve central examination offices). The project planning and the effort to enrol a number of actors to support the project started in 1997. The project is still ongoing. The introduction of a computerised information system mainly affects the few dozen persons who handle the administration procedures. But with a secure infrastructure every staff member and every student could become user of the system (in order to avoid double work in recording and communicating relevant data).

The author plays an active role in the reported case. Being a teacher, researcher, and IS expert at the same time, there is not always a clear distinction between the roles of IT user, scientific observer, and member of the developing team. In the following, 'IS expert team' refers to the author and his colleague as well as three students who each assisted the developing work for a limited time. Further technical development is carried out by the selected software producer and the university's central computing centre.

The material presented here is based on electronic and printed project documents collected from the very beginning, including invitations to meetings, public statements of opinions, official minutes as well as internal diary entries by project members. In April 1999 the IS expert team issued a report on the case analysis as a basis for introducing a computerised system to support the examination administration. The report included the following stakeholder map (figure 1; translated from German) to depict the relevant actors as potential users at that time (who also had access to the report, except for the general public):

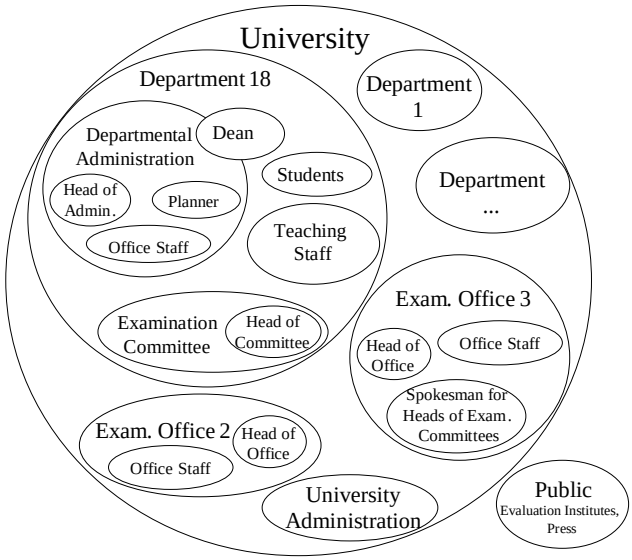

Figure 1: *Stakeholder map of social actors concerned with the use of an IS for examination administration*

Throughout the course of the project several stakeholder maps have been used. Variations of the above include/exclude individuals and professional groups, specific departments, examination offices, staff representatives, data protection officers, development actors (software vendors(s), computing centre(s) within the university, IS expert team). Since 1997 many commitments (or the lack of them) have influenced the course of the IS development. A number of them have been regarded as critical for the progress, in retrospect we have identified those as milestones. The table of commitments below (table 1) represents one way to tell the project story, including the kind of boxing by which the commitments were circulated as well as necessary resources related to the project by making the commitments (see Klischewski 2000 for more details). Each of these commitments is related to a series of events with certain actors involved, each has been differently wrapped up in a box, and each box has been more or less circulated, used and translated to get on with the project. None of these commitments are independent, all of them are drawing on commitments circulated before.

Commitment as Milestones (month/year)	**Boxing for Circulation**	**Related Resources**
signing up of IS expert team for system development (7/97, contracts: 3/98, 10/98, 10/99)	meeting notes, role: expert, (later: contracts/budget)	work effort, professional expertise, availability
"Buy! Don't make!" – decision of major stakeholders to use an existing software and to call for customisation and additional development if necessary (5/98)	public opinion, common understanding	opinion, consent
agreement of administrative staff to share work expertise in detail (11/98)	report on workplace analysis	consent, professional expertise
co-operation agreement between university and software producer (2/99, contract: 7/99)	tender, contract, software	consent, financial asset, software
IT experts within the university subscribe to observing privacy regulations (2/99)	public opinion, system specification	consent, professional expertise
administration and pilot departments agree to formal involvement of the staff representatives and their participation on a regular basis (10/99)	public opinion, contract	consent, work effort
departments (informatics & economics), PUD, univ. administration and central computing centre agree on co-operation during implementation (11/99)	signed document ("goal agreement")	roles, responsibilities
departmental staff shifts daily agenda to concentrate on the introduction of the system (11/99)	roles, tasks, schedules	work effort, availability, professional expertise
"We run the system!" – the commitment of the informatics department to server hosting (12/99)	running system, assignment, role	professional expertise, work effort, availability, IT devices
decision to put the system in productive mode (i.e. some portions of examination administration now rely on the established computer support) (3/00)	formal decision, roles, tasks, schedules	consent, work effort, availability, professional knowledge

Table 1: *Commitments as project milestones*

To examine project co-operation in more detail, we reopen the box of the milestone commitment "We run the system!" (made by the informatics department by the end of 1999) and examine it more thoroughly as an extension of the network 'in-the-making' to support the use of the system. The following series of commitments interrelating social actors and resources necessary for the project represents the history of this commitment and, at the same time, the fragile structure of previous commitments supporting it. The actor network in figure 2 depicts the origin of these circulated commitments by the social actors involved, their 'acting upon' other network elements, and their contribution to the growth of the network during project co-operation.

IS for Decentralised Examination Administration!

In 1997, the manager (not an IS expert) of the *PUD*-subproject (on reorganisation of the examination administration) circulated a study on the history and past organisational development of the examination administration at this university, which calls for a decentralisation policy. Both the informatics and the economics department subscribe to this policy as they agree to participate in the pilot project (1998). In addition to the outspoken and circulated opinion the commitment is further boxed and sustained by signing a "goal agreement" between the departments, PUD and the university administration in 1999.

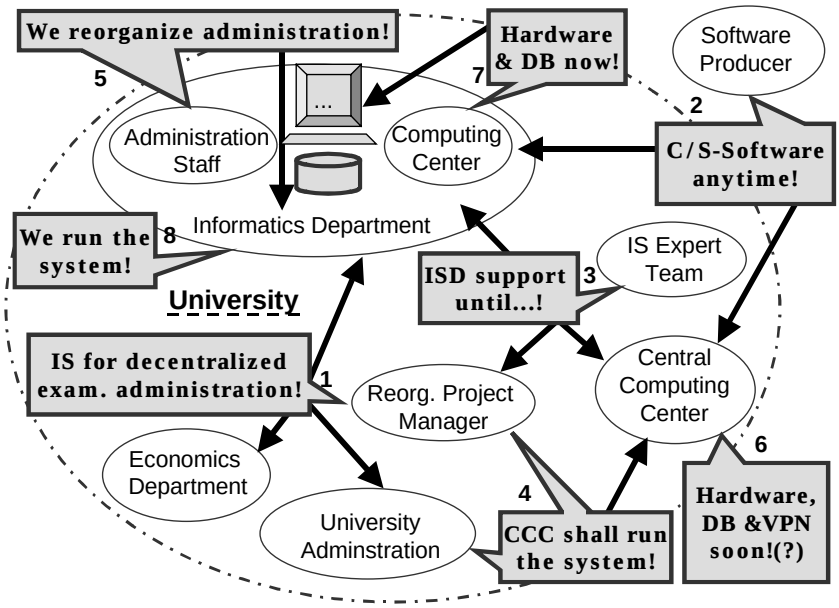

Figure 2: *Actor-network supporting the commitment "We run the system!" focussing on social actors and commitments for allocating resources*

Client-Server-Software Anytime!

The agreement between the university and the software producer (reached in early 1999) includes that the university may draw on the latest release as well as operational support as soon as it is ready for deployment. This commitment was boxed in a contract in 7/1999. In addition, an employee of the software producer sets up a test installation at the informatics department (4/99).

ISD Expertise and Support Limited until Year 2000!

The involvement of the IS expert team had been based on (or boxed by) four single contracts with *PUD* (altogether 17 months within 1998 – 2000) with resources for only part-time work to advise and partly to manage/carry out the development and implementation under the formal guidance of *PUD*. For various reasons (unsatisfactory financial basis, lack of commitments, project delays, short term contract offers only) the IS expert team made clear (at project meetings, in a letter circulated to social actors involved) that its expertise and support would not be available beyond the year 2000.

The Central Computing Centre shall Run the System!

Although the central computing centre had offered to run the system (i.e. to host the server and to provide a secure network for client access as well as user support) since 1998, it refused to engage seriously in the project (i.e. to allocate any resources) before the university administration and PUD decided that the central computing centre should operate this service and would therefore receive additional resources from the university budget. Due to difficulties in the reorganisation of the university IT services (at the same time another IT department was dissolved), the formal decision (i.e. the boxing) was delayed until October 1999.

We Reorganise the Administration!

The introduction of a new curriculum forced the informatics department to reorganise examination administration, which can only be accomplished with computer support. To avoid using some interim

solution for computer support and to combine reorganisation with the introduction of the new system, departmental actors tried to put pressure on the project. In November 1999, the IS expert team met with the planner of the informatics department to agree on tasks, responsibilities and a schedule for the implementation procedure in this department. For the next months, introducing the computer support became a high priority on the daily agenda of the planner and other staff members (competing with the staff's commitments to a number of other pressing tasks). The IS expert team achieved a boxing by elaborating an accepted project plan (including role assignment, tasks, and schedules) for each organisational unit involved.

Hardware, Database and Virtual Private Network Soon!(?)

At project meetings, the central computing centre always assured everybody they would provide the necessary hardware, database and virtual private network shortly after it would be officially assigned to run the system. The centre's general responsibility was boxed in a "goal agreement" between the main stakeholders. However, complicated administrative procedures, a risk avoiding strategy, the lack of personal resources, the need to get acquainted with new technology and other reasons led to the centre's failure to fulfil its assigned role. In addition, leading members of the centre refused to agree to any kind of service agreement, fixed project plan or schedule, or any other kind of detailed contract – a boxing of the commitment beyond the verbal statement general intention was never achieved.

Hardware and Database Now!

In April 1999, the software producer and the departmental computing centre set up a test system at the informatics department accessible to a number of clients via local network. As the central computing centre realised its failure to provide the service assigned, one of their members brought in a machine leaving the informatics department to install an operating system, the database and the server software (provided by the software producer). To meet the pressing needs of the department, the IS expert team and the departmental computing centre set up a stand-alone system ready to be used in January 2000. Here, the boxing was the installation itself: due to the general role assignment, the departmental computing centre had to maintain any system it sets up within the department.

We Run the System!

Facing the situation at hand, all departmental actors involved (head of department, departmental council, administrative staff, head of examination committee, departmental computing centre) agreed that the department would run a computer supported administration system of its own – at least until the central computing centre is ready to take over. In March 2000, the IS expert team trained three members of the department administration to use the system. Right away the new users start to enter results of the examinations which have taken place during the previous weeks. PUD and university administration do not object this, although the economics department, which faces similar needs, is left without any computer support. However, the departmental commitment is based on oral agreements only (no formalised boxing) since, at this time, everyone thought the stand-alone system would be needed for a few weeks only.

Epilogue

This is an ongoing project, so is the networking, there is no end to this story yet. At the time of writing, it is rather uncertain whether the project will ever turn out to be a success. In the autumn of 2000, the departmental administration is facing a number of operational problems: the technical situation is still the same (there is still no central service), but the departmental planner (as the organisational expert) left his job in April and the IS expert team finished its last contract in July. Some procedures turned out to be complicated and requiring unacceptable effort. The software producer sent a patch to ease the work-arounds, but without secure networking facilities the producer is not allowed to log into the system and to provide

online support. Rumours on the system's performance start spreading. The enthusiasm of the new users decreases as operational problems become serious and the lack of overall support turns out to seriously impede the motivation of the administrative staff. Since it had become obvious that the preliminary stand-alone installation lacks organisational support, it draws the critical attention of the works councils and data protection experts. In December 2001 a discussion with the university's president results in assigning the central computing centre (instead of the dissolving PUD) as the new project co-ordinator. In April 2001, the stand-alone system is still "successfully" running at the informatics department (fulfilling only fragments of its assigned tasks), and a new staff member had been employed to help cope with the increasing workload of the examination administration.

5. PROJECT MANAGEMENT FOR DISTRIBUTED SYSTEMS DEVELOPMENT

Taking part in this effort of getting an information system 'up and running' to support the university's examination administration taught us (the IS experts) a number of lessons. Some of these we assume to be characteristic of projects where co-operation takes place in distributed environments, i.e. which involve a number of social actors from different, more or less independent organisational units:

- The experience of 'missing links' to draw on necessary resources in due time is one of the major obstacles in accomplishing project tasks.
- With no stable social frame of reference and no executable power structures to frame the project environment, the declared intentions of social actors involved to support the project are not sufficient for allocating resources when they are needed.
- Selecting and accessing resources are critical success factors: a large part of the development work is to achieve stabilised relations between all actors (humans and nonhumans) to create a network, which will eventually support the use of the system.

Based on this experience we adopted Latour's idea (1997) "that by following circulations we can get more than by defining entities, essences or provinces". Drawing on ANT, we have followed commitments to explain our experience from a theoretical standpoint and to provide an analytical frame as well as practical guidelines for ISD projects in distributed and unstable organisational environments. Now, what guidelines can be concluded? What does ANT teach the ISD practitioner?

1. *Initiating the actor network:*
   Faced with the need for certain resources to support development and use, social actors concerned with project management start to look for other social actors to convince them to enrol their resources in the network. Thus, the starting point for project co-operation is to reach out for commitments, which results in the subsequent enrolment of humans and nonhumans.

2. *Relating distributed network elements:*
   Viewing systems development as forming a network-of-association aligning heterogeneous resources concentrated in a few places (e.g. computing centre, departmental administration, software producer), the links between the elements are of crucial relevance. Here, we have focussed on (black)boxed commitments (actors' intentions to allocate resources) as the means for connecting network elements. By this we can identify network structures (e.g. see figure 2) supporting the use of the system.
   Aiming at the flow of necessary resources in due time and place, ISD project management must seek to stabilise network relations and connect them with others. A number of these relations may seem stabilised as the respective commitments for allocating resources (e.g. in case: decentralisation of examination administration, producer's provision of software and support) are boxed in a way that subsequent action draws on their output as "for granted" without opening the box – these boxes have become black. Other relations may not be stable because the commitments themselves are/might not be sustainable (e.g. in case: ISD expertise, hosting assignment) – the respective boxes are black only for some period of time, but (may be) not for the process as a whole. Therefore, ISD project management must continuously look to boxing commitments to create and maintain immutable mobiles enabling action (allocating resources)

at distant times and places. In case allocation of resources turns out to be worthless after some time (e.g. in case: in addition to the department's commitment to run the system the stand-alone installation now needs a secure network access for the producer's online support): the social actor's commitments still there must be supplemented by additional resources and respective commitments, i.e. project management must seek to enlarge the actor network in order to stabilise the relations it already achieved.

3. *Project planning for systems development as networking:*
Given that systems development is networking – i.e. establishing a network of commitments by all actors whose consent and effort are necessary to make use of computer systems' potentials by putting these commitments in a '(black) box' and circulate them among those actors – progressive project planning should include the concern for:

   a) *Process*: The whole process of co-operation in ISD may be structured on the micro level by identifying subsequent social events (meetings, activities) leading to one or more commitments. The link between these events are the boxed and circulated commitments as preconditions (required for the success of the event) and as postconditions (as a basis for future social events), forming a network of commitments as the development proceeds. The level of granularity for analysis is flexible, events come into focus according to the observer's subjective judgement of the commitment's importance to the development progress. The accumulation of commitments then represents the project history. It may be described by identifying the increasing number and complexity of boxes which become more or less "black" in the sense that the project budget and time constraints usually do not permit unravelling the boxes as the development moves on.

   b) *Milestones*: Certain (groups of) commitments may be interpreted as milestones which enable to plan and carry out project management: What kinds of commitments do we need to set up this system in this organisational context? Who can/must commit required resources? What kind of process and what kind of preconditions do we need to achieve this? It is a requirement driven approach bringing into focus social actors, resources, and environmental conditions as the development moves on (e.g. in case: what do we need to get an IS for exam. administration up and running at the informatics department?). Recurrent activities to achieve such milestones include: identifying necessary resources to be aligned; enrolling new actors; calling for, boxing and circulating commitments; allowing actors to work with past commitments as resources; renewing or substituting commitments under changing conditions.

   c) *Actors*: Only social actors can make commitments. However, the software installed is also an actor (or actant) "calling" for resources and respective commitments (to allocate hardware, network, trained users, workflow organisation). It is also a mobile blackbox of its own carrying the unchangeable commitment to set up a client-server architecture. Here, ANT offers potentials to analyse the impact of commitments made in the past at some distant place, becoming relevant for the development project at stake by using existing infrastructure and IT devices (e.g. in case: the software imported by the university is "committed" to certain ideas on how to co-operate on examination administration). It is a task of future research to examine the impact of these past and distant commitments and to suggest how project management could cope with these.

To sum up, systems development as networking brings into focus the developers' work to subsequently reach for commitments, thus aligning social actors and their resources in a network. This approach offers the potential for reflecting and managing co-operation especially in distributed ISD environments. Future research applying this approach should provide empirical studies as a sound basis for developing new methods and possibly tools to support co-operation during the course of systems development and use.

Acknowledgements:

I wish to thank my colleague Bernd Wolff for putting in most of the 'hard work' to keep the examination administration project going and for having shared a great deal of his empirical data. I also thank the anonymous reviewers for valuable comments on a previous version.

REFERENCES

Atkinson, C. (2000). The 'Soft Information Systems and Technologies Methodology' (SISTeM): an actor network contingency approach to integrated development. *European Journal of Information Systems*, 9 (2), 104-123. DAMSGAARD, J. and R. SCHEEPERS (1999). A Stage Model of Intranet Technology Implementation and Management. In Proceedings of the European Conference on Information Systems, 100-116

Floyd, C., F.-M. Reisin, G., and G. Schmidt (1989). STEPS to Software Development with Users. In Proceedings of ESEC '89, 48-64, Springer, Berlin.

Gärtner, J., and I. Wagner (1996). Mapping Actors and Agendas: Political Frameworks of Systems Design and Participation. Human-Computer Interaction, 11, 187-214.

Gasson, S. (1999). A Social Action Model of Situated Information Systems Design. In Proceedings of IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Issues and Future Changes (1998), 307-326, IFIP. (www.bi.no/dep2/infomgt/wg82-86/proceedings/index.htm)

Jones, M. (1999). Information Systems and the Double Mangle: Steering a Course Between the Scylla of Embedded Structure and the Charybdis of Strong Symmetry. In Proceedings of IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Issues and Future Changes (1998), 287-302, IFIP. (www.bi.no/dep2/infomgt/wg82-86/proceedings/index.htm)

Kling, R. and R. Lamb (1999). IT and Organizational Change in Digital Economies: A Socio-Technical Approach. Computer and Society, 29 (3), 17-25.

Klischewski, R. (2000). Systems Development as Networking. In Chung, H. M., ed., Proceedings of the 2000 Americas Conference on Information Systems (August 10-13, Long Beach, CA), 1638-1644, Association for Information Systems.

Latour, B. (1987). Science in Action: How to Follow Scientists and Engineers through Society. Harvard University Press, Cambridge, MA.

Latour, B. (1997). On Recalling ANT. Lancaster University, Department of Sociology, www.comp.lancs.ac.uk/sociology/stslatour1.html.

Law, J. (1997). Traduction/Trahison: Notes On ANT. Lancaster University, Department of Sociology, www.lancaster.ac.uk/sociology/stslaw2.html.

Mcmaster, T., R.T. Vidgen, and D.G. Wastell (1999). Networks of Association and Due Process in IS Development. In Proceedings of IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Issues and Future Changes (1998), 341-357, IFIP. (www.bi.no/dep2/infomgt/wg82-86/proceedings/index.htm)

Newman, M., and D. Robey (1992). A Social Process Model of User-Analyst Relationships. MIS Quarterly, 16, 249-266.

Robey, D., and M. Newman (1996). Sequential Patterns in Information Systems Development: An Application of a Social Process Model. ACM Transactions on Information Systems, 14 (1), 30-63.

Vidgen, R.T., and T. Mcmaster (1996). Black boxes, non-human stakeholders and the translation of IT through mediation. In Orlikowski, W., G. Walsham, M. Jones, and J. DeGross, eds., Information technology and changes in organizational work (IFIP Working Group 8.2, 1995, Cambridge, UK), 250-271, Chapman and Hall, London.

Walsham, G. (1997). Actor-Network Theory and IS Research: Current Status and Future Prospects. In Lee, A.S., J. Liebenau, and J.I. DeGross, eds., Information Systems and Qualitative Research, 466-480, Chapman and Hall, London.