

# 11

## Surfacing Organizational Competence\*

Lars Mathiassen  
Peter A. Nielsen

**Abstract.** This paper is about organizational competence in development of computer-based information systems. We address this theme by demonstrating and reflecting upon a systematic and inexpensive approach to surface organizational competence in initial analysis and design of an information system. The approach relies on the specific organizational competence of the actors already in the organization. Change is brought about by using soft systems and contradictions to surface the competence, knowledge, views, and ideas present in the situation at hand.

### 1. Introduction

The paper shows how Checkland's Soft Systems Methodology (Checkland 1981) can be combined with explicit thinking in contradictions (Mathiassen *et al.* 1989) to support early analysis and design considerations in information systems development. The presentation is based on a specific case, The Supervisor Case (Bjerknes *et al.* 1990). The game we play is a simple one. As consultants we have been asked to support a group of nursing supervisors and their unit manager in making the surgery function as one unit and more specifically in designing a management information system. Initially we have interviewed and had meetings with the seven nurses and in this way we have learned about the situation in the surgical unit. We have then gone back to our own environment for a few days and thought about the situation. Thinking in systems and

contradictions made us come up with a Consultancy Report to facilitate and structure a debate amongst the unit manager, the six nursing supervisors, and ourselves. The report is to be read by the involved persons before the debate that will take place at a one day seminar. Since our purpose is to bring about learning amongst the organizational actors we cannot on beforehand find and anticipate the outcome of the inquiry—the inquiry is a process.

In the following we present The Consultancy Report, the applied approach, and a discussion of the relevance and usefulness of applying Soft Systems Methodology (SSM) and dialectical thinking in surfacing organizational competence in systems development. Section 2 presents the reader with the manifest result of applying our approach to the Supervisor Case: The Consultancy Report. Section 3 contains a description of the approach itself. In section 4, we discuss and evaluate the relevance and usefulness of applying our approach to systems development in general, and to surfacing organizational competence during project establishment in particular. Finally, we have entitled section 5: From Description to Intervention, and it describes the basic attitude behind our approach. Section 6 contains a brief summary.

## **2. The consultancy report**

On the subsequent pages we present The Consultancy Report as developed by ourselves and presented to the unit manager and the nursing supervisors.

---

Mathiassen & Nielsen  
March 1989

### **Making the surgery function as a unit**

This report is addressed to the project group consisting of the unit manager, the nursing supervisors, and ourselves. Our group has agreed to have a one-day seminar next month. The report is produced by us, the consultants, as an introduction to the seminar, and it is based on the informal discussions we have had with you, i.e. the nursing supervisors and the unit manager. At the seminar the idea

is to create a debate about the management of nursing in the surgical unit. The purpose is to:

- design management of nursing and information systems to support it, and
- design a project to develop and implement a computer-based management information system for nursing.

We encourage you to read the report carefully and critically. At the seminar we will present parts of the material, and based on this we will structure a debate between us. A detailed plan for the seminar will appear later.

### **The situation**

The project is facing a situation where the following problematic issues are important. How should information technology be introduced to increase your professional competence as nursing supervisors and unit manager? What kind of computer-based management information system can contribute to the improvement of your work environment, in particular your ability to cooperate? How should a systems development project be designed to obtain such objectives?

To answer these questions we have to look carefully at the situation in the new surgical unit. There used to be independent departments, but these have now—at least formally—been reorganized into one surgical unit in response to the economic crisis in the health sector. The official intention behind this reorganization is to reduce expenses by making the new sections share resources. As we all know, the reorganization was not too well planned and implemented, and the surgical unit now struggles with the consequences.

In the picture below we have expressed our interpretation of some of the major characteristics of the present situation. In the picture we focus on the old traditional organization on the one hand and on the new organization on the other. We believe that the problems and possibilities related to this change process is a key feature of the situation. At the seminar we will present the picture in greater detail.

### **Relevant Viewpoints**

As one important starting point for our project we should ask ourselves: what are the problems or challenges you face in the management of surgical nursing, and how should we design and organ-

DEVELOPING SYSTEMS

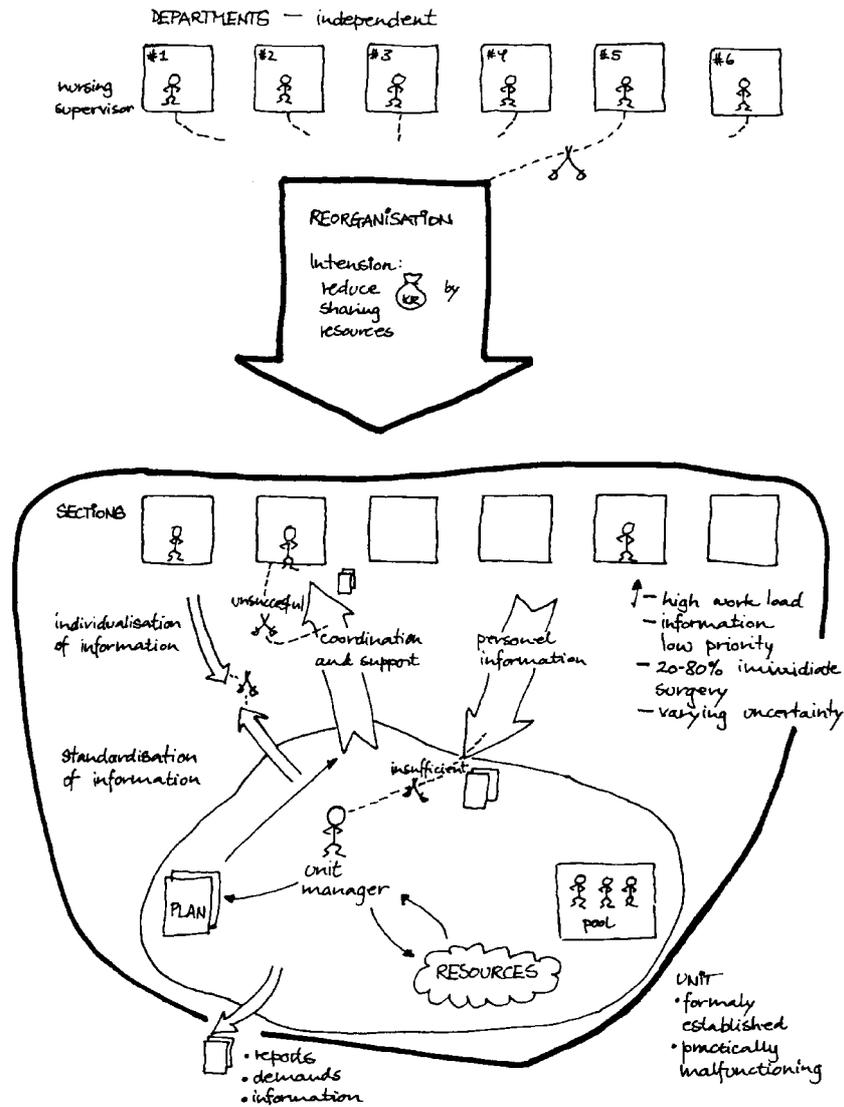


Figure 1. Picture of the situation in the surgical unit.

ize the unit in response to these? In fact, the whole idea behind the project is to answer these questions on some level. Or in other words: the whole idea is to design and implement some systems to

help you solve your problems.

There are, of course, several relevant and equally valid viewpoints on the present situation. We could for instance choose to focus on:

1. Provision of professional and efficient surgical service for the community.
2. Reorganization of surgery into one unit.
3. Preservation and development of nursing skills and values.
4. Management of resources and personnel in a unit.
5. Obtaining resources to a unit.
6. Support of sections and coordination between them.
7. Communication between sections.
8. Management of resources and personnel in sections.
9. Provision of information for the unit manager about status in the sections.
10. Provision of information for nursing supervisor about status in their section.

There are other relevant views on the situation. Do you see other useful viewpoints on the situation? Which viewpoints do you find most relevant? We suggest that we—at least—examine number 2 and number 4 in detail as they relate to our project in a very direct way.

In the following we will look at these two viewpoints in a more systematic way. By doing so we will, hopefully, be able to see ways of improving the present situation for surgical nursing. Below we give a more precise definition of viewpoints 2 and 4. Do you agree in our way of describing the viewpoints? Would you emphasize the same aspects? Are there words or phrases you do not like? Later, we will use each of these definitions to model a relevant system.

**Viewpoint 2:**

We need a system owned by the nursing supervisors and the unit manager themselves. The system reorganize their roles and patterns of cooperation based on previous reorganization activities and supported by consultants. The reorganization must lead to an improved competence of unit manager and nursing supervisors to manage within the formally established surgical unit. The reorganization

DEVELOPING SYSTEMS

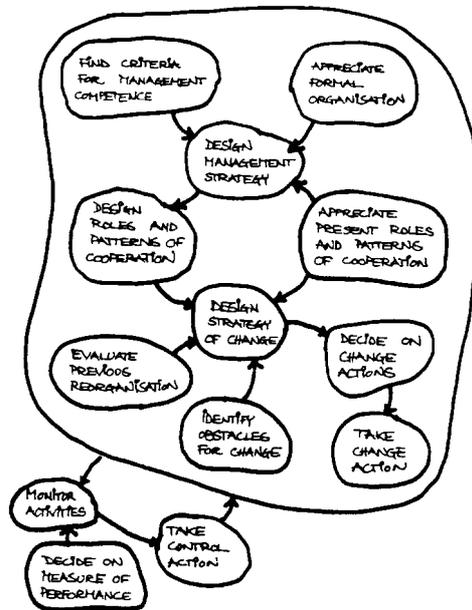


Figure 2. Model 2 showing the activities implied by viewpoint 2.

should last less than half a year. This viewpoint is based on the belief that you yourself can reorganize the way you work and cooperate by learning from what has already happened, and supported by us as consultants.

Viewpoint 4:

We need a system owned by the hospital. The unit manager and the nursing supervisors use this system to manage resources based on shared plans and communicated status information. It supports and enhances professional and efficient surgical services under the constraint of limited resources and externally provided surgical tasks of varying types. This viewpoint is based on the belief that we can design a system that you as a group can use to manage effectively based on shared plans and communicated status information.

As another important starting point for our project we should look closer at some of the contradictions in the present situation. In this way we can learn something about the conditions for our project,

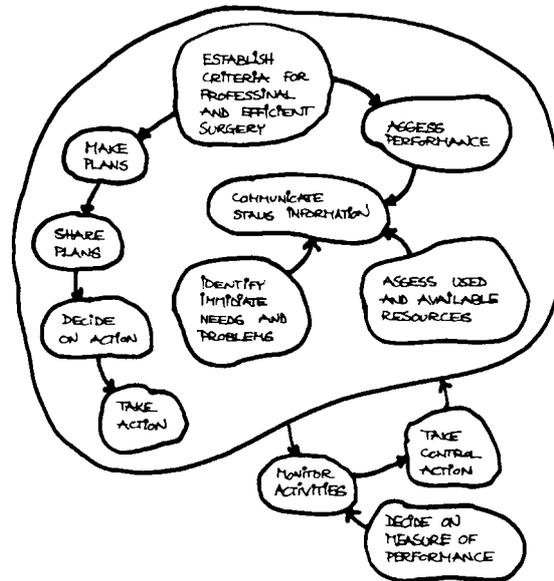


Figure 3. Model 4 showing the activities implied by viewpoint 4.

and we can become aware of basic choices and possible options and obstacles. Again, there are several relevant viewpoints. We could for instance choose to focus on:

1. The contradiction between reorganization and established traditions.
2. The contradiction between coordination in the unit and autonomy of sections.
3. The contradiction between one unit and variations in planning uncertainties and needs.
4. The contradiction between standardized and individualized information.

Again, there are other relevant contradictions. Do you see other useful contradictions? Which contradictions do you find most useful? We suggest that we—at least—look closer at number 1 and number 3 of these. Like before, we can give a more precise description of each of these. Do you agree in our way of describing the contradictions? Would you emphasize the same aspects? Are there words or phrases you do not like?

**Contradiction 1:**

This is a unit-situated contradiction between, on the one hand, reorganizing into one unit headed by one unit manager and containing sections with the intention of reducing expenses by sharing resources, and, on the other hand, the established traditions in independent departments each headed by a nursing supervisor.

**Contradiction 3:**

This is a unit-situated contradiction between, on the one hand, centralized management and shared resources, and, on the other hand, great local variation in needs and planning uncertainty.

At the seminar we are going to discuss which problems and contradictions that are relevant for our project, and we will examine some of these in greater detail, starting out from more precise descriptions as the ones above.

**Practical implications**

At this stage we can draw some practical implications by looking more closely at viewpoints 2 and 4. If we really need these systems, we should ask ourselves: which activities are necessary in each of these systems? The two models below give an answer to this question based on a systematic examination of the two viewpoints.

At the seminar we will go through models like these and compare them with the present situation. In this way we will, hopefully, be able to generate quite specific ideas on how to proceed in our project. Both in relation to the models and in relation to the contradictions there are a number of issues to be debated.

**Issues to be Debated**

The purpose of this report is to stimulate our thinking and our debate. We should look upon the above models and descriptions as themes to be discussed and evaluated at the seminar with the purpose of finding ways to improve the situation in the surgical unit. For each of the models we should discuss the following issues:

- Are the properties of the system desirable?
- For each activity and each link:
  - How is it done today?
  - Is it done well?

- Can it be improved?
- For each activity in model 4:
  - What information is relevant?
  - How is it provided today?
  - How can it be improved?

In relation to contradiction 1 we should discuss the following issues:

- Which features of the established tradition are obstacles for reorganization?
- Which positive features of the established tradition are put in the background or removed by the intended reorganization?
- Which new advantages can the sections hope for through the intended reorganization?
- How can the reorganization effort benefit from the established tradition?
- Which of the two aspects of the contradiction is dominating? Is this acceptable, or should we intervene?

Correspondingly, in relation to contradiction 3, we should discuss the following issues:

- To what extent can we make the sections more alike with respect to needs and uncertainties?
- To what extent can we centralize management and share resources considering local variations?
- What are the reasons behind and the advantages of the local variations between sections?
- What are the reasons behind and the advantages of centralized management and shared resources?
- Which of the two aspects of the contradiction is dominating? Is this acceptable, or should we intervene?

Reading this report has hopefully inspired you to think about our project. We are aware that parts of the report can be difficult to digest. But at the seminar there will be opportunity to ask questions, go into details and raise new issues. After the seminar it is our hope that we have reached some useful conclusions about the design of the new information system and how to continue the project from there.

---

### 3. Soft systems and hard contradictions

The approach we have applied in dealing with The Supervisor Case is a combination of Checkland's Soft Systems Methodology (SSM) and thinking in terms of contradictions (Checkland 1981; Mathiasen *et al.* 1989).

#### 3.1. Soft systems

SSM is an approach for thinking in systems about a problematic situation, where the situation at hand is explored and debated by means of several views expressed in systems (i.e. wholes) and models hereof. The main activities of SSM are expressed pictorially in the figure below.

The starting point is a problematic situation in which some actors (the unit manager and the nursing supervisors) perceive that the situation (in the surgery) needs to be improved. A problematic situation is highly unstructured and to get started a rich picture is made (as illustrated in figure 1). A rich picture express some of the characteristics of the situation as they are perceived by those doing the inquiry (the two consultants). In the process of making a rich picture one must try to be as open-minded as possible, e.g. not taking a stated problem definition for more than a viewpoint. At the same time one is encouraged to show particular interest in elements of process, structure, and climate, i.e. the relation between process and structure and associated value-judgments.

The purpose of going through the process of pictorially expressing the situation is to enable the naming of possibly relevant systems to be considered in the inquiry (in The Supervisor Case we made a list of ten). Considering a hopefully relevant system is done in SSM by formulating root definitions giving a precise and concrete account of a human activity system. Many different human activity systems may meaningfully map onto the same human activity (as the list indicates). A root definition is, however, a precise and concrete account of one specific system describing several basic elements, of which *Weltanschauung* is most importantly denoting the ideas and beliefs that makes the system meaningful (two such root definitions are used in full in the Consultancy Report and for each of them the implied *Weltanschauungen* are stated explicitly).

Formulating root definitions is a systems thinking activity together with building conceptual models. Where the root definitions each contrive a single viewpoint or belief as a whole, the conceptual

SURFACING ORGANIZATIONAL COMPETENCE

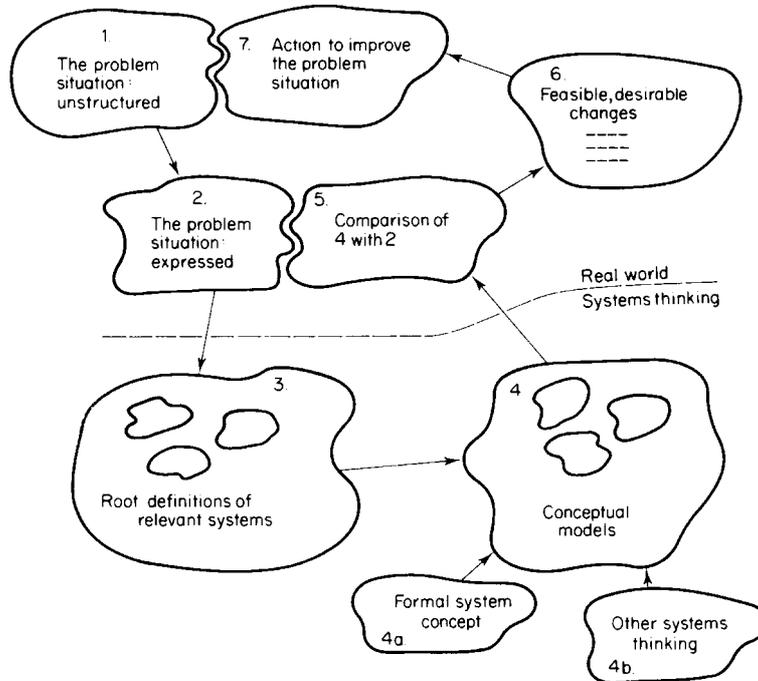


Figure 4. A model of SSM.

models express the consequences of taking each of these views. A conceptual model consists of the minimal set of activities and their logical dependencies necessary to operate the system prescribed in the corresponding root definition (two conceptual models are shown in figures 2 and 3).

Returning to the situation with the root definitions and the conceptual models a comparison is made between the situation and the root definitions and models that came out of the systems thinking activities. A debate is orchestrated by the models and we are able to ask and discuss questions like: "Is this activity done well? How do you know?" as a way of learning about the practical and concrete consequences of taking a particular view. The more fundamental questions like: "Are the properties of this system, seen as a whole, desirable?" are likely to give substantial insight into the visions and beliefs of the actors in the situation.

The outcome of the debate—if any outcome—is a set of proposed changes to improve the situation. The purpose of the debate is

to decide on action. The suggested actions should not necessarily be decided on in consensus, but they should be feasible within the culture of the situation, where culture is used in a broad sense. At the same time, the actions must be defensible against some of the desirable systems views used in the debate. Hence, the changes should simultaneously meet the two criteria: culturally feasible and systemically desirable. (The Consultancy Report does not in itself illustrate the debate and the use of the two criteria as it is an intermediate report produced with the purpose of creating the debate amongst the nursing supervisors and the unit manager.)

### **3.2. Hard Contradictions**

Organizational actors face many hard contradictions in their daily activities, e.g. the contradiction between efficient use of resources and quality of outcome or the contradiction between established organizational forms and needs for change. We have, therefore, for some time experimented with the idea of supplementing SSM with explicit thinking in contradictions (Mathiassen *et al.* 1989). This means that besides formulating systems views we also formulate contradictory views relevant to learn about a problematic situation. (In The Supervisor Report we have identified four possibly relevant contradictions and two of these are examined in detail.)

A contradiction is seen as a relation between two opposite aspects of a phenomenon. One aspect in a contradiction cannot be fully understood without considering the other aspect and changing an aspect implies a change in the other aspect. In this way the aspects of a contradiction are intrinsically related, but at the same time they are opposite and distinct from each other. Thinking in terms of contradictions supports a holistic view different from that of systems thinking (Nielsen 1989).

We formulate contradictions in much the same way as we formulate systems (two examples are given in The Consultancy Report). We do not yet know how to model a contradiction in a similar powerful way as with systems models. Neither are we sure whether it is possible to do so. We can, however, ask very specific questions based on a formulated contradiction (as illustrated in the last section of The Consultancy Report) and thereby structure a debate.

In learning about organizational situations we have come to appreciate contradiction as a different but just as important concept as that of a system. In the work that led to the Consultancy Report

we were thinking in terms of systems and contradictions simultaneously and the report shows that the systems and the contradictions are about the same aspects of the situation. But the outlook and the questions for debate remain different. In the examples shown the consultants, their relation to the situation and even the selected properties of the situation (i.e. reorganization and management of resources) are similar or the same. At the same time, however, the two approaches generate quite different interpretations and types of questions.

In asking questions based on a systems view we invite the actors to evaluate and debate one possible world by comparing it to the real situation. In asking questions based on a contradictory view we invite the actors to take a stance, to compromise, or to resolve dilemmas related to the real situation. Looking at contradictions the actors face a whole spectrum of possible worlds. Basically, we find that combining thinking in systems and contradictions leads to a more complete approach to organizational learning and change.

#### **4. Surfacing organizational competence**

In order to see how The Consultancy Report could structure a debate and thereby surface and develop the organizational competence of the nursing supervisors and the unit manager we need to play the game a little further. On the one-day seminar it is the plan to:

- Debate according to The Consultancy Report.
- Elicit suggestions for change from the debate.
- Take all the suggestions for change and decide which are both culturally feasible and systemically desirable.

A significant part of the process at the seminar has already been designed by making the report. At the seminar we want to create a constructive dialogue between the nursing supervisors and the unit manager about the reorganization and the future of the surgical unit. The discussion of the details of reorganization (both the system presented in viewpoint 2 and contradiction 1) further helps to design the remaining parts of the process. Moreover, the report contains a set of viewpoints and concepts suitable to discuss the management of the unit (again both the system presented in viewpoint 4 and contradiction 3). Organizational aspects are focused on by looking at the activities of the system and the links between them

and technical aspects by looking at information provision in each activity. Correspondingly, the contradiction provides insight into basic choices and dilemmas related to the design of the new management information system.

The Consultancy Report is not giving answers, it is merely a means for structuring a debate. We expect the outcome of the seminar to be improved organizational understanding and awareness amongst the seminar partakers together with a first attempt to give qualified answers to the questions raised concerning the reorganization and the management of shared resources in the surgical unit.

Reflecting on the approach we can identify two levels of organizational competence:

- At the level of designing, maintaining, and operating the learning process.
- At the level of bringing about, using, and developing specific organizational competence in the learning process.

The consultants are required to have organizational competence at the first level, and the approach itself represents organizational competence in the form of a general framework for creating a constructive debate. But in addition, the consultants should know how to establish cooperation, how to interview, where to focus, how to arrange and conduct a seminar, etc. At the second level, the consultants are required to know about organizational change, management of resources and about information systems for management purposes. This kind of general organizational competence is needed to help suggesting and formulating possibly relevant viewpoints, and more specifically it is a prerequisite for creating the conceptual models.

The nursing supervisors and the unit manager have the latter type of competence while they have only little or no experience on the first level of competence. By relying on the dialogue we assume that organizational competence in terms of specific and concrete knowledge about how to manage nurses in a surgical unit is already there in the situation. This competence is surfaced, questioned, and changed during the dialogue. The consultants are not there because they are experts in managing nurses or want to become such experts. The purpose of the dialogue is not so much to convey a specific kind of management competence so that the actors can decide what to do about the situation. The consultants are there to bring about a

process where the actors confront themselves with each others ideas, attitudes, and experience. Thereby they learn about the situation and they debate and negotiate in order to improve it.

As an additional outcome of the learning process we expect the seminar partakers to have improved their organizational awareness. We expect them to have learned something about the variations and differences between the individual departments, and we expect them to be more aware of the problems, possibilities and challenges related to managing the unit as a whole. There are, of course, many possible conflicts related to this reorganization process, and we are not in any way suggesting that our approach will overcome these. We are, however, approaching the situation in a way where the actors are challenged to surface and learn about variations, differences, and contradictions. In this way some misunderstandings and differences in opinion are removed, mutual understanding and respect is increased, and, hopefully, some real challenges are made visible.

## 5. From description to intervention

It has been argued that there is a paradigm change on the way in information systems development (Floyd 1987). The trend is to move away from the product-oriented view where the systems developers focus on specifying requirements and constructing an information system meeting the specified requirements. Floyd argues in favor of a change towards a process-oriented view where focus is on the processes of cooperation between developers and users and where the system is gradually discovered and developed.

(Munk-Madsen 1983; Bjerknæs *et al.* 1985; Bødker *et al.* 1987; Kensing 1987; Nurminen *et al.* 1987) represent recent approaches from Scandinavia based on a process-oriented view. In all of these examples, organizational and technical solutions are not developed and decided by consultants in the guise of organizational all-knowers. Instead, the basic assumption is that the future users should play a major and active role in analyzing and designing their own situation. On a more general level, the present interest in experimental approaches to systems development (Budde *et al.* 1984) represents a change towards a process-oriented view.

Traditionally, systems development has been perceived as an analytic discipline, and there has been a narrow focus on developing

and transforming descriptions (Stage 1989). Even if descriptions inherently must play a major role, we agree with Floyd, that there is a need to take a broader view to face today's challenges in systems development. This paper is based on the belief that systems development should be understood as intervention, and that descriptions should be seen as only one of several important means to intervene effectively.

In many respects the logic of intervention differs from the logic of analysis (Lanzara *et al.* 1985). In an analytic approach we focus on producing descriptions from given perspectives. We apply concepts like process, function, dataflow, entity, and the like to interpret and describe specific events and situations based on the general semantics of the concepts applied. In an intervention approach we focus on the situations as they are experienced by the actors involved. We engage the actors in reflecting on their own situation and in inventing possible actions to improve it. Intervention is to be understood as an inquiry into the knowledge and beliefs of the actors involved in the situation, whereas analysis is seen as a process of producing knowledge that can be used as instruments for setting goals and making decisions. In terms of Argyris *et al.* (1978) intervention is to be understood as an inquiry in the cognitive and learning domain, whereas analysis is to be understood as an inquiry in the technical-instrumental domain.

The approach presented in this paper is intended to help us move towards a process-oriented paradigm based on intervention, but still including analytic approaches and descriptions as key features. With our approach we want to move:

- from expert strategies to strategies based on constructive dialogues between systems developers and user,
- from description, deduction and construction to interpretation, invention and change,
- from methods focusing on the ways we should express ourselves to methods focusing on the ways we should think and act.

*From expert strategies to strategies based on constructive dialogues between systems developers and user.* In the Lancaster tradition of action research it has been a crucial finding that intervention into an organization can only be successful if the organizational actors are engaged in changing and improving the situation. If experts im-

pose a specific structure and solution on the organizational actors it is likely (and sometimes even inevitable) that the effort fails both in coming up with useful suggestions for change and in committing the actors to the suggested change. An expert report in the bookshelf is not a desirable outcome of an inquiry. The true spirit of SSM is that inquiry is carried out by the actors in the problem situation and the task of the consultant is that of enabling the inquiry to take place by providing help occasionally to keep the inquiry moving (Checkland 1985, p. 822). We have followed SSM in this sense.

*From description, deduction, and construction to interpretation, invention, and change.* More specifically, we have presented an approach supporting interpretation, invention and change. In the first two activities (see figure 4) of the approach we emphasize interpretation rather than description. The starting point is a highly unstructured problematic situation. To get started we make one or more rich pictures expressing some of the characteristics of the situation as they are perceived by those doing the inquiry. From there we name several possibly relevant viewpoints denoting systems or contradictions. Some of these are then systematically studied and critically confronted with the situation. In this way, we emphasize invention rather than deduction. In traditional methods the design is mainly deduced on the basis of descriptions of the existing system (Stage 1989). In SSM activities 2, 3, 4, and 5 represents an invention leap (Lanzara 1983) inviting the actors to generate, explicate, and evaluate possible worlds in an iterative fashion. Finally, the ultimate purpose of the approach presented in this paper is to support the actors in changing the situation. Traditional approaches, in contrast, aim at constructing computer systems to be implemented later.

*From methods focusing on the ways we should express ourselves to methods focusing on the ways we should think and act.* The approach is given in the form of ideas and techniques to support professionals in thinking and acting. At the very heart of the approach is the distinction between activities where we confront ourselves with the problematic situation, and activities where we reflect upon relevant aspects of the situation in a detached manner. The basic idea is to emphasize both types of activities and to stress the interaction between them. Moreover, in our approach we suggest using two general concepts, i.e. systems and contradictions, as basis for reflecting upon the situation. Some hints for making various kinds of

descriptions are given, but the approach emphasizes in a more general way how to use systems and contradictions as effective means for reflection.

Most traditional systems development methods are based on a specific set of diagrams (e.g. data flows, entities and actions, entity relationships). Each type of diagram is related to an information oriented concept, and it supports the systems developer in describing the problematic situation from this perspective. By emphasizing ways and means of expression such approaches invites its users to one-sided and narrow reflections detached from the complexity and uncertainty of the problematic situation at hand. In contrast, the approach presented here supports the actors in applying experiences and intuition, and it allows the consultants to face many facets of the problematic situation and to listen to the different and maybe even conflicting interpretations given by the actors involved.

## 6. Conclusion

The intention behind this paper has been to present and demonstrate a rich and systematic, but still inexpensive approach to engage the involved actors in reflecting constructively in processes of change. We have presented a process-oriented approach to initial analysis and design of information systems. The major characteristics of the approach are:

- It takes no problems for granted and it contains no solutions. It explores the actual situation as viewed by the involved actors, and it provides systematic ways to reflect, generate ideas, and debate.
- It invites the actors to surface their own knowledge and experience and to reflect and improvise.
- It helps the actors to reflect systematically and thoroughly about their own situation using the concepts of system and contradiction.
- It is basically process-oriented, though product considerations play a major role.

## References

Argyris, C. & D. A. Schön (1978): *Organizational Learning: A Theory of Action Perspective*. Reading, Massachusetts: Addison-Wesley.

- Bjerknes, G., T. Bratteteig, J. Kaasbøll, K. Nygaard, H. Sinding-Larsen & G. Thingstad (1985): Mutual Learning. Florence Report 1, Institutt for Informatikk, Oslo Universitet. (In Norwegian)
- Bjerknes, G., B. Dahlbom, L. Mathiassen, M. Nurminen, J. Stage, K. Thoresen, P. Vendelbo & I. Aaen (Eds.) (1990): *Organizational Competence in Systems Development*. Lund: Studentlitteratur.
- Bjerknes, G., P. Ehn & M. Kyng (Eds.) (1987): *Computers And Democracy*. Aldershot: Gower.
- Bødker, S., P. Ehn, J. Kammersgaard, M. Kyng & Y. Sundblad (1987): A Utopian Experience: On Design of Powerful Computer-based Tools for Skilled Graphic Workers. (251–278) in Bjerknes *et al.* (1987).
- Briefs, U. *et al.* (Eds.) (1983): *Systems Design For, With, and By the Users*. Amsterdam: North-Holland.
- Budde, R., K. Kuhlenkamp, L. Mathiassen & H. Züllighoven (Eds.) (1984): *Approaches to Prototyping*. Berlin: Springer.
- Checkland, P. B. (1981): *Systems Thinking, Systems Practice*. Chichester: John Wiley.
- Checkland, P. B. (1985): Achieving “Desirable and Feasible” Change: An Application of Soft Systems Methodology. *Journal of Operational Research Society*. Vol. 36, No. 9 (821–831).
- Docherty, P., K. Fuchs-Kittowski, P. Kolm & L. Mathiassen (Eds.) (1987): *Systems Design for Human Development and Productivity: Participation and Beyond*. Amsterdam: North-Holland.
- Floyd, C. (1987): Outline of a Paradigm in Software Engineering. (191–212) in Bjerknes *et al.* (1987).
- Kensing, F. (1987): Generation of Vision in Systems Development: A Supplement to the Tool Box. (285–302) in Docherty *et al.* (1987).
- Lanzara, G. F. (1983): The Design Process: Frames, Metaphores, and Games. (29–40) in Briefs *et al.* (1983).
- Lanzara, G. F. & L. Mathiassen (1985): Mapping Situations Within a Systems Development Project. *Information & Management*. Vol. 7 (3–20).
- Mathiassen, L. & P. A. Nielsen (1989): Soft Systems and Hard Contradictions. *Journal of Applied Systems Analysis*. Vol. 16 (75–88).
- Nielsen, P. A. (1989): The Emergence of Contradictions in Soft Systems Practice. In R. L. Flood *et al.* (Eds.): *Systems Prospects*. New York: Plenum.
- Munk-Madsen, A. (1983): Systems Analysis With Users. (157–162) in Briefs *et al.* (1983).

DEVELOPING SYSTEMS

Nurminen, M., R. Kalmi, P. Karhu & J. Niemelä (1987): Use or Development of Information Systems: Which is More Fundamental? (187–198) in Docherty *et al.* (1987).

Stage, J. (1989): *Between Tradition and Creation. Analysis and Design in Systems development*. Ph.D. thesis, Department of Mathematics and Computer Science, Aalborg University.