SYSTEMS DEVELOPMENT AND TRADE UNION ACTIVITIES

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Abstract

Systems development is the process of constructing or modifying edp-based systems as a means of changing organizations. Since the early seventies Scandinavian trade unions have initiated a number of research projects within the field of edp-based systems and systems development as part of their endeavours to gain control over technological development. This paper contains a survey of these research activities. It describes the research methods applied. Edp-based systems and systems development are then discussed from a trade union point of view. Finally the research projects are related to other trade union activities and to activities within research and educational institutions.

Keywords and phrases: edp system, edp-based system, systems development, systems development method, involvement, influence, organization, impact, trade union.

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Contents

1. INTRODUCTION

In 1975 the Trade Union Council and the Confederation of Employers in Norway made an agreement covering "edp-based systems which influence employees and their working conditions directly".[1]

Among other things this edp agreement says:

> "It is important that the edp-based systems are evaluated not only from a technical and economical point of view, but also from a social, in such a way that an overall view can be taken when constructing, implementing and using the systems".

> "Through the shop stewards the management must keep the employees orientated about matters which lie within the field of the agreement, in such a way that the shop stewards can put forward their points of view as early as possible, and before the management puts its decisions into effect. The orientation must be given in a well-arranged form and in a language that can be understood by non-specialists".

> "The two federations suggest that besides representatives of the shop stewards, other employees that are directly influenced should also be engaged as far as possible in the activities of the projects".

> "It is a condition that the representatives of the employees have the opportunity to make themselves acquainted with general questions concerning the influence of edp-based systems on matters that are of importance to the employees. The representatives must have access to all documentation about software and hardware within the field of the agreement".

Since 1975 similar edp agreements have been made between various employers' organizations and trade unions in Scandinavia. The appearance of this new type of agreement is one of many expressions of the current development: both hardware and software are becoming still cheaper and more sophisticated, edp

is being used more intensively within an increasing number of application areas, and already today this new technology has become a dominant factor in determining the working conditions of many people.

Obviously, edp agreements like the one quoted above will have influence on how edp-based systems can be constructed, implemented and used. For the computer specialist this means that he must have appropriate tools and techniques for evaluating edp-based systems — also from a social point of view. Furthermore he must have tools and techniques for describing edp-based systems in ways that are understandable, not only to other computer specialists, but also to people without particular knowledge about edp. Hence the development of new and appropriate tools and techniques becomes an important task for the computer scientist.

The increasing activities in fields like *information systems, systems development*, and *social impacts* already reflect the current development.[2] However, most of the tools and techniques that have been developed are inappropriate in the sense that they have not been designed for applications where the trade union, in accordance with edp agreements like the Norwegian one, claims influence.

The objective of this paper is to report from a number of Scandinavian computer science research projects. All of these projects have been carried out by trade unions in cooperation with researchers with the purpose of promoting trade union interests in the use and development of edp. Our aim is twofold. First we will discuss how trade union interests are affected by the increasing use of edp. Secondly we want to demonstrate that the type of research in question is a necessary and fertile supplement to other activities within computer science.

Section 2 attempts to characterize the approach used and introduces our terminology. Sections 3 and 4 contain a discussion of edp-based systems and systems development from a trade union point of view. In sections 5 and 6 we describe various activities that have been initiated by trade unions and by research and educational institutions in continuation of, or as an integral part of, these research projects. The purpose of these activities is to contribute to the efforts of the trade unions to gain influence on the use of edp in accordance with their interests. Finally, section 7 contains a brief summary.

2. THE TRADE UNIONS: NEW USERS OF RESEARCH

In recent years trade unions in Scandinavian countries have initiated a number of research projects within or related to computer science. The projects have been carried out by the trade unions in cooperation with researchers and students from universities and research institutions. The projects are part of the trade unions' efforts to develop a strategy concerning the use of edp-based systems within their fields of interest. The strategy must indicate how to counteract impacts of edp-based systems, which the unions consider to be negative and — even more important — to actively influence the systems in order to promote the interests of the unions.

2.1 Background

The primary cause of the trade unions initiating research has been demands for assistance from work places and local unions. The members of the union are faced with edp-based systems in their daily work, for example production planning and reporting systems, accounting systems or point of sales systems. Obviously these systems affect the organizations in which they are used. But in what way do they affect the interests of the unions? How can the local union evaluate the impacts of a specific system? And how are the unions to act, centrally and locally, to promote their interests? The unions were faced with questions like these which they were unable to answer. And therefore they decided to build up resources.

One possible solution for the trade unions could have been to utilize results from the extensive research which had already been carried out within computer science and related fields. But the starting point of this research is most often the requirements of those buying the systems, i.e. the employers. Thus several of the basic assumptions underlying the research and development are in conflict with the interests of the unions. For example, it is normally assumed that manpower and machines are resources to be manipulated by edp-based production control systems in order to utilize them completely. This is in conflict with the trade union point of view that all workers should themselves be active participants in the production control process.

Similarly, the existing sociological and organizational oriented research in this field mainly deals with managerial problems arising from the development, implementation and use of edp-based systems. Many problems, which are

important to the unions are not considered at all — for example how the solidarity between workers is affected by changing man-to-man communication into man-to-computer communication on the solidarity between the workers.

Finally, as discussed below, the traditional research methods, with their total dependence on academic researchers, do not suit the practice of the unions. The conclusion reached by the trade unions was that they themselves had to initiate research based on their own interests.[3]

2.2 Survey of projects

As the first of the Scandinavian unions, the Norwegian Union of Iron and Metal Workers decided in 1970 to initiate a research project on the use of edp and modern methods of planning and control. The project started in 1971 with participation from the staff of the national union, four local unions and two researchers from the Norwegian Computing Center. The project was financed by the Norwegian Council for Industrial and Scientific Research. [4]

At first the project was designed in a rather traditional way: the researchers were to carry out a number of investigations including

- — an evaluation of two or three edp-based planning and control systems,
- — a survey of the goals of the union in fields such as working conditions and control of organizations,
- — a formulation of demands on edp-based systems in the interests of the union, and
- — an evaluation of the need for knowledge within the union concerning planning, control and edp.

However, as the project progressed it turned out that it was impossible for the researchers to make the union representatives see any direct connection between the project and their daily work as members, shop stewards or as representatives at the national level. There was no framework within which the partial results from the project could be applied and further developed.

The project was then redesigned. Each of the four local unions formed one or more workplace groups consisting of union members. In these groups the workers defined and treated the questions in relation to planning, control and edp which they themselves considered to be most important for their workplace. The work of the researchers concentrated on supporting these

workplace groups. As an important part of this work the researchers produced a text book on planning, control and data processing.[5]

The experience gained in the Iron and Metal Project is now being used within large parts of the Norwegian Trade Union Movement. At present research projects of a similar nature are being carried out by the Norwegian Union of Employees in Commerce and Offices and the Norwegian Union of Chemical Industry Workers.

In 1975 the Swedish Trades Union Council initiated a project inspired by the Iron and Metal Project. In the Swedish project the work of the local workplace groups is supplemented by sociologically-oriented theoretical work on the limits and preconditions for democratization in working life and by computer-science-oriented work.[6]

In Denmark the Trade Union Council, also in 1975, established a course on edp-based systems. At the same time the Danish Trades Union Research Council decided to initiate research within the field of edp. Based on the experience from the courses and inspired by the Iron and Metal Project, the Research Council formed a project on democracy, development and edp: Project DUE.[7] While this project was organized a number of local workplace groups were established with support from other parts of the national unions. These groups, consisting of workers, shop stewards, students and researchers, looked at systems such as point of sales systems and hospital information systems. One of these groups has produced an "Edp Handbook for Nurses", published by the National Union of Nurses.[8]

In order to characterize the research approach used in the above-mentioned projects we proceed with a more detailed description of Project DUE.

2.3 Project DUE

The primary objective of the project is to contribute to the efforts of the trade unions to gain influence on the use of edp in accordance with their interests. The secondary objective of the project is to contribute to the evolution of research and graduate professional education within the field of systems development.

The main task of the project is to assist in a process of building up resources within the unions. One fundamental resource is knowledge about the problems arising from the use of edp. To be useful such knowledge must be developed

as an integral part of the acitivities of the unions. It must be related to the practice of the unions and contribute to the development of this same practice. For example the knowledge can be used in negotiations with the employers and in education within the trade unions.

Organization
The research project is organized around a project group, a control committee and a number of local workplace groups.

The project group, consisting of three graduate computer scientists and a graduate engineer, leads the work in close cooperation with three shop stewards, who have been appointed by the trade unions to work in the project. The control committee consists of representatives from the Trades Union Council and representatives designated by the Trades Union Research Council. Workplace groups take a central position in the project. Each consists of trade union members from the concerned workplaces, a member of the project group, one of the above-mentioned shop stewards, and one or two graduate students.

Methods
In project DUE we have tried to establish research methods and working habits suited to fit the requirements of the trade unions. The methods and working habits are based on four principles:

1. The research project is founded in the interests of the unions.

2. The project has a democratic research process as ideal.

3. Actions aimed at changing the situation at the workplaces are an integral part of the project.

4. The work combines investigation, preparation, and dissemination.

We are not trying to consider all possible consequences of the use of edp-based systems in organizations. The project is founded in the interests of the trade unions. The impacts upon the employers and management are only considered to the extent that these impacts affect trade union interests.

In the long term the goal of the trade unions is a truly democratic control of organizations and society. But which are the short-term goals? This question of basic concern has no simple answer because the short-term interests of the trade unions are closely connected to the actual state of working conditions in

the concerned industry — the use of technology, the workers' political conciousness, the means of action etc. These factors differ from one workplace to another. This is one important aspect which forces us to work in close cooperation with the local trade unions.

An ideal of the project is to assure the trade unions a democratic control of the research process. The direction of the project is dependent on the trade unions' active participation and influence on the project. The workplace groups, the control committee, and the shop stewards connected to the project group all play a significant role in the explicit formulation of problems, in evaluation of practical means of action, in development of new working habits within the trade unions and especially in testing the applicability of the current results.

In the workplace groups the research project is action oriented. The work in the workplace groups will alternate between analyzing various edp-based systems and carrying through and evaluating activities aimed at strengthening the position of the local trade union. The action orientation of the research process increases the probability of gathering knowledge and experience which is fit for use in practice.

The work of the project group consists of investigation, preparation, and dissemination. Investigation comprises collection of information from workplaces through visits, through the workplace groups, and through discussions with members of the local and central branches of the trade unions. It also comprises analysis of specific edp-based systems and study of relevant literature. The materials and knowledge gathered through investigation have to be prepared with regard to the explicit formulation of problems and needs. Preparation leads to the formulation of proposals for activities or to the compilation of research reports or teaching material. Dissemination of the results is an important part of the research process. Results are disseminated with special regard to the possibilities of gathering further experience.[9]

Activities
The research project is divided into three phases and is planned to run over three years.

The first phase was finished in the spring of 1978. It has resulted in a report, surveying those problems arising from the use of edp which were considered most important by local trade union representatives in a number of private and public organizations.[10] In order to get an initial, general view of the problems and to establish a basis for selecting a number of workplaces for further

investigation, we started by sending a questionnaire to the local unions at 165 workplaces throughout Denmark. We received answers from 96. Based on the information gathered by this questionnaire we selected twelve workplaces for further investigation in collaboration with the trade unions. The main emphasis in the first phase of the project was put on visiting these twelve workplaces. In each case we had thorough discussions with shop stewards and workers on how the use of edp had caused changes from their point of view. Sections 3 and 4 below contain a survey of the insight gained in the first phase.

The now ongoing second phase is planned to last eighteen months. The three main activities are:

1. A detailed investigation of the problems in three specific workplaces and development of resources necessary for the local trade unions to gain influence upon the use of edp.

2. Theoretically oriented studies. Based upon the results of the first phase, and in connection with the work in the workplace groups, the project group is analysing methods for planning and control and systems development. Existing methods and working habits are analysed and criticized, and alternatives stated.

3. The project group is starting to develop educational material both for the unions and for the universities.

The third phase is planned to last nine months. The main activities will be:

1. Writing a report about the project. This will contain the experiences presented in a form generally applicable by trade unions. It will cover aspects of edp-based systems relevant to the unions and discuss the methods of work of the local unions when dealing with edp-based systems. Finally the report will contain guide-lines on how to establish workplace groups.

2. Producing educational material for shop stewards and other workers. Gathering experience from the use of this material, and writing a revised version.

3. Helping to disseminate the experiences gained during the project to the different parts of the trade unions.

4. Writing a report reviewing the research method of the project and relating it to the current discussions within sociology, psychology and computer science.

2.4 Terminology

Our discussion will be limited to a simplified organizational model. *Organizations* are social entities, which are consciously built and rebuilt to pursue specific goals.[11] Factories, insurance companies, hospitals and public offices are all examples of organizations. Different groups may pursue different and even conflicting goals within the same organization, when it is necessary to be specific we talk about "the goals of management" etc. The *systems development process* (SDP) is regarded as a partial process of *organizational development* which is the process of consciously changing an organization to improve the organization's ability to pursue specific goals. The name *SDP* denotes those activities within the organization which aim at constructing or modifying edp-based systems. The subprocesses relating to specific systems are denoted (systems development) *projects*. The SDP can be evaluated by the extent to which the product, the new or modified edp-based systems, improves the organization's ability to pursue specific goals. Since the SDP itself is part of the organization, a second way to evaluate the SDP is by the extent to which it meets the goals of processes within the organization, for example how resource consuming it is.

Within the organization we choose to focus on edp-based systems, the product of or the object of the SDP. An *edp-based system* consists of an edp system and those parts of the organization which carry out tasks contributing to the same functions as the edp system. Thus the clerks when working at the terminals are parts of an edp-based point of sales system, whereas the cleaning personnel are not.

An *edp system* in turn consists of hardware, software, and input/output (listings, etc.). Edp systems are developed as tools to fulfil specific functions within the organization. People who serve an edp-based system by contributing to the functions of the edp system are called system *servants*, whereas people who use an edp-based system as a tool, when fulfilling their functions are called system *users*. Thus the above-mentioned clerks are servants, whereas the personnel manager is a user, of the point of sales system. We choose edp-based systems as our focus of interest in preference to edp systems in order to encapture the connections between the edp system and the total organization, and hence to illustrate the difficulties and range of the SDP.

In most organizations the goals of management include economically efficient operation. Three major categories of edp-based systems are used to achieve this goal:

— systems which automate work processes (e.g. accounting systems and numerically-controlled production machines),

— systems which control work processes (e.g. production control systems), and

— systems which control organizational development (e.g. budget simulation systems).

Some important features of the SDP, and hence of the organizational change, are the present structure of the organization, guidelines for organizational development, the edp equipment used, the knowledge and experience of the edp specialists participating, and the *system development method* (SDM) applied. In this paper we focus on those aspects of the SDP's which relate themselves to the SDM applied rather than to other features. We say that an SDP corresponds to an SDM (and vice versa) when the SDP is carried out as specified by the SDM.[12]

All SDM's are founded on a set of fundamental — but usually implicit — assumptions about the organizations in question. We call this set of assumptions the *"perspective"* of the SDM. The perspective of an SDM determines which groups within an organization are most likely to benefit from the use of the SDM. For example an SDM may assume that all groups participating in a project have coherent goals. If the opposite seems to be the case it will be legitimate for management to treat a conflict as e.g. lack of communication. An SDM specifies the corresponding SDP's by means of *a set of techniques, a set of tools* and *principles of organizing* the SDP.

A technique specifies a way of carrying out a process by describing the partial processes of the total process and the inter-relationships between these partial processes, without paying attention to the division of labour. The tools are designed to be used in and to support the various processes. The principles of organization specifies the necessary resources and the distribution of these between the various processes, and it specifies how the SDP is related to the surrounding organizational development.

3. EDP-BASED SYSTEMS

After having characterized the research approach used, we now proceed along the lines of our first objective: to discuss how trade union interests are affected by the increasing use of edp. To make our point we use this section to discuss the *product* of the SDP: the edp-based system, from a trade union point of view. In section 4 we then turn our attention to the *process* of developing or modifying edp-based systems: the SDP itself.

3.1 Areas of Application

Edp is in use in practically all organizations. The members of the trade unions are in almost all cases in daily contact with edp-based systems within the organization. Furthermore, we have found that this contact is not only due to the automation of administrative functions within the organization, for example payments, but also to the considerable integration of edp systems with the functions of other areas of the organization: production, transport, trade, maintenance etc. Figure 1 summarizes some of the observations made through the investigations within project DUE.

> Some trends in the use of edp within Danish organizations. The figures are based on the investigations within the first phase of Project DUE.
>
> ⁰ In 88% of the cases edp is in use within the organization.
>
> In those organizations using edp the following was observed:
>
> ⁰ In 85% of the cases the members of the local trade union are in contact with edp systems within the organization.
>
> ⁰ In 87% of the cases edp systems are used for administrative functions within the organization.
>
> ⁰ In 79% of the industrial organizations edp systems are used within production or in connection with the store.
>
> ⁰ In 73% of the cases the organization includes an office or a department working specially with edp.

Figure 1.

Today it has become the rule, that trade union members carry out their work, or at least a major part of it, within edp-based systems. The impacts of edp-based systems on organizations have therefore become a serious question in relation to trade union interests.

3.2 Impacts

There have been many investigations which have tried to cover various aspects of the impact of the use of edp-based systems. It is, however, a very difficult area to investigate, partly because of the relative intense technological development and partly because of the problems connected with isolating the sources of impacts in complex, dynamic organizations. Also the subject of impacts covers both impacts of edp on society and impacts of society on edp.

In Project DUE it was decided to start by identifying a set of development trends, supported by the present use of edp. Below we present the set of trends based on our investigations carried out in cooperation with local trade unions.[14]

The functions and the substance of work
In connection with the construction or modification of edp-based systems the functions and the substance of work have undergone changes. A wholesale business can serve as example. When the organization started to use an edp-based system for controlling the store, those functions which required experience and skill from the storemen disappeared. It used to be necessary for the storemen to have a thorough knowledge about the assortment of goods. A storeman was expected to find alternatives to a specific requirement and to assist in purchasing. Today the store is reorganized so that each article is identified by an unambiguous number. The storemen's function now consists in placing automatically purchased goods on the right shelves and in finding the goods corresponding to the numbers on a filled order form.

Taking an overall view of the changes in the functions and the substance of work the main trends are:

- some jobs are completely changed;
- there is an increased division of labour and specialization;
- for most of the workers it becomes more difficult to understand the connection between the individual work functions;
- routine work is becoming more dominant;
- there is less demand for skill and experience in a large number of jobs.

Demand for labour

The changes in the functions of work results in a change in the demand for labour. It becomes possible to produce more per unit of labour. Dependent on the organization's possibilities of expanding, this trend can lead to a decrease in the work force.

Planning and direction of work

The workers used to have significant influence on the planning of the details of their own work. Today management takes more control over this part of the planning by the use of edp-based systems. This happens directly, through edp-based systems specially designed for planning and direction of work, and indirectly, through systems which require that actions have to be taken at specific hours or in a specific sequence.

For example in a municipal office several of the edp-based systems demand that the daily work is organized within narrower limits than before. It used to be the case that information about various matters, for example payment of social contributions, could be treated immediately. Today the information must be collected, and input to the centralized edp system on specific days of the month.

Supervision

In most organizations the work is controlled and supervised. However within edp-based systems it becomes easier to get a detailed overview of that part of the work which can easily be registered.

Management may produce statistics showing the productivity hour-by-hour for each operator at a numerically controlled machine or for each clerk at a terminal. In some cases statistics are placed on a notice board or they are used openly, for instance when the labour force is reduced. But this is the exception — normally the trade union does not know if and how such statictics are used.

In most cases when the local trade union asks, management assures them that the edp-based system in question is not used to supervise the individual worker more closely. However most workers feel stressed. This is because much of the information about the work is registered individually, and because the workers are uncertain about how this information is used by management.

Work load

Often the use of new edp-based systems is followed by an increase in physical and mental work load. This may be because of poor attempts to design the technical framework appropriately — noise, heat, uncomfortable and unhealthy

working position, and incomprehensible output formats. Or it may be because of changes due to the fact that the edp-based system is designed with the purpose of improving the organization's ability to reach the goals of management: We find a trend towards a more effective utilization of labour, and consequently work has to be done within narrower bounds, speed of work is increased, there is less contact with fellow workers and there is, as already mentioned, increased stress because of automated supervision and less understanding of the connection between the individual work functions.

In some cases edp-based systems for automation of work processes (e.g. photo-typesetting systems) improve working conditions in some respects (e.g. getting rid of lead). A recent Norwegian study[15] concluded however that in no case had the working conditions been improved unless this was profitable to management. An implication of this is illustrated by the photo-typesetting systems: the improvement caused by the abolition of lead was almost nullified by the introduction of chemical liquids with negative effects on the workers.

Information
Edp-based systems are used by management to improve their own basis for making decisions. At the same time the total insight of the local trade union into the organization is often weakened. This is partly because of the increased specialization, partly because of the decreased contact between fellow workers.

Evaluation of changes
Several of the immediate changes which may be regarded as drawbacks from a trade union point of view are due to the fact that the trade unions have been neglected and kept out of the SDP. Examples of this type of drawback are incomprehensible design of input and output forms, insufficient training in the operation of new equipment, and uncomfortable working positions. Common to these problems is that they might have been avoided without affecting the goals of management.

Others of the immediate changes which may be regarded as drawbacks are more difficult to handle because they relate to basic conflicts between the goals of management and those of the trade unions. Examples of this type of drawback are decreased demand for labour, and speeding-up and detailed registration of daily work. Extensive efforts are required from the trade unions if they want to prevent changes like these, because the changes are in the interests of management, and they may be the reasons why management want to introduce the edp-based system.

It is important for the trade unions to understand and evaluate the immediate changes in relation to managements plans as a whole and in relation to long-term changes which do not become apparent from day to day. The long-term changes may appear as increased division of labour, decreased influence in the daily work, and increase in routine work. It is difficult for the trade unions to influence the long-term changes because they are part of management's endeavour to improve their control over the organization, as a means of improving the organization's ability to reach the goals of management, and because the unions have extremely few resources aimed at analyzing and influencing these changes.

The present use of edp threatens the interests of the trade unions, as illustrated by the above-mentioned trends. But at the same time new possibilities of fighting for greater influence and more resources are created: increased productivity is a basis for demanding higher wages, educational activities within working hours, a reduction of working hours, automation of unhealthy jobs, etc. It is not primarily a question of technical possibilities. It is a question of who is controlling the organizational development.

4. SYSTEMS DEVELOPMENT

After having discussed edp-based systems and the question of impacts with regard to trade union interests, we turn our attention to the development of such systems, in other words to the SDP.

4.1 Goals of the development process

Management and trade unions pursue different and often conflicting goals within the same organization, also with regard to the SDP. In addition, the goals of an SDP is of two kinds. The first kind of goal relates to the product of the SDP — the edp-based systems. How well does these systems improve the organization's ability to pursue specific goals? The second kind of goal relates to the process itself. How well does it meet the goals of processes within the organization, for example how resource consuming is it? Whereas management has been striving to master the SDP for decades, the trade unions have only now begun to do so. Indeed much of the work on SDM's has aimed at increasing the probability of reaching the goals of management, both with regard to the edp-based system and with regard to the process itself.

4.2 Reaching the goals of management

Managerial control
In order to secure that the SDP contributes to the goals of management, managerial control over the SDP is essential. Two principles of organizing the SDP is used for that purpose, namely the division of labour and the splitting of the process into phases.

Usually the actual work in an SDP is carried out by various project groups consisting of people from an edp department and a number of users from the departments involved. The decisions concerning the functions to be provided by the systems, budget and time table, as well as the supervision of the work of the project groups, are often separated from the actual work and carried out by management.[16] This fundamental separation of the planning and control functions from the actual work is organized by the use of a strongly specialized hierarchical structure within the edp department and sometimes also by forming various control committees consisting of members of the top management.

Each individual project within the SDP are normally viewed as consisting of a number of phases following each other in time. It is uncommon to distinguish between more than four or five phases, although SDM's often prescribe eight to ten. Each phase ends in a control point, where it is decided if and how to proceed with the SDP. These decisions are taken on the basis of reports from project groups to control committees or from the lower to the higher levels of the hierarchy. The interest in developing SDM's based on division of labour and the notion of phases is illustrated by the fact that SIS, the Swedish Standards Institution, has proposed an SDM along these lines. The method, called RAS, has been proposed as an international standard for SDM's (ISO-recommendation), and IBM has decided to adhere to RAS within the Scandinavian countries.[17]

However, managerial control based on division of labour and the notion of phases following each other in time is founded on some fundamental assumptions which seem to be in conflict with the present characteristics of edp-based systems. In the SDP it is nearly impossible to conceive of the new edp-based systems in advance. The SDP is a design process demanding a creative effort. And at the same time it is an inquiring process[18] in which new insight is gained into the relationship between the actual organization and the use of technology. The use of SDM's like RAS therefore creates a number of problems. This is indicated both by the difference in the number of phases between what is prescribed by the SDM's and what is found in the actual SDP's, and by the difference between the simple sequential nature of the SDM's and the multisequential, iterative nature of the SDP's.[19]

The difficulties within the SDP are enlarged by the trend towards an increasing integration of the edp systems into the operation of the organization. Unforeseen organizational and social changes in connection with the installation of a system may very well prevent management from reaching its goals. Thus newer SDM's pay a lot of attention to the total set of changes within the organization, and to how these can be controlled in order to reach the desired goals.

Involvement
In order to get a positive response to a new system from servants on all levels it is often necessary to adjust their perception of the system or to adjust the edp system itself. Of course the same SDP may involve both. Adjustment of servants has a number of advantages over adjustment of the edp system. Existing SDP's do not need to be changed, in particular the functions to be performed by the system may be decided upon as usual in cooperation with its users. A special, but not unusual or unimportant, case occurs when the edp

system is developed, and adjustment of the edp system is unfeasible. Since the late sixties SDM's within the socio-technical school have had as a primary characteristic analysis of attitudes and expectations in order to plan the manipulation giving the best adjustment of servants to a new system.[20]

Adjustment of servants, however, has its limits. Often people oppose aspects of a system which simply constitute bad design, and adjustment of their perception will in this situation decrease the organization's ability to reach the goals of management. Therefore, while most of the existing SDM's suggest cooperation with the users of the new system, recent SDM's also prescribe involvement of servants in order to use their specific technical and organizational knowledge in the development process, and possibly incorporate it into the edp system.

The aspects of the SDM's discussed so far are fully explicable from a managerial point of view. However many of their supporters also claim that the increasing involvement specified in the methods and the concern for the total set of changes in the organization make these methods a useful tool for the employees. We agree that the growing need for specific technical and organizational knowledge could possibly be used by the employees to obtain greater influence on the goals supported by the systems. As discussed below and in sections 5 and 6, we do not agree that existing SDM's are suitable tools for the trade unions in their endeavour to obtain greater influence.

4.3 Not reaching the goals of trade unions

Trade union control?
The data from our questionnaire in Project DUE[21] indicate that the local unions have had very few possibilities to influence the development of edp-based systems within organizations.

One of the most clear indications is the local union's lack of relevant information. 63% of those who answered the questionnaire knew nothing about the plans of the organization concerning edp systems. 31% knew something, whereas only 6% considered that they knew much about the plans of the organization. If we consider the quality of the information, with respect to trade union goals, it turned out that this was extremely poor. This is illustrated by some examples from the twelve case studies:

— In an insurance company the management had on two occasions decided upon the installation of specific edp systems before the employees were informed. The only information they finally got concerned the details of the actual operation of the system. They have received no information about organizational changes or plans for the future.

— In a large factory the local union knows that there exists a long-term plan on the development of the use of edp. But they have no written material about it, and only one of the shop stewards has seen part of the plan. The management has not given a survey of the contents of the plan. They say that the plan does not concern the employees, and that it contains business secrets.

— In a big company within the iron industry the management decided to adapt and install a registration system used in a sister company. After a first meeting, where the management informed them about the system, the local union agreed that it seemed to be possible to install it without severe problems. However, the union wanted more information. It took about a year to get what the union considered to be enough information, and then the conclusion they reached was negative. After another year with experimental use of the system in one department, it was abandoned by the company — at least for the time being.

To indicate in another way to what extent the local union influences the SDP, we asked in the questionnaire if the local union or any of the shop stewards had been asked for an opinion about the use of edp, for example in a committee, a project group or at an informal meeting. 60% answered that they had not been asked for an opinion at all. 34% had been asked to some extent and only 6% considered that they had been asked a lot. Furthermore, the efforts of management to include the opinions of the local union and shop stewards did not seem to depend to any noticable degree on the impact of the edp systems on the working conditions as perceived by the shop stewards. This is illustrated by the table below where the answers to the question "have you been asked for an opinion" are grouped according to the answers to the question "have the working conditions been changed by the installation of edp systems".

	asked a lot	asked to some extent	not asked
no changes	4%	33%	63%
changes	10%	35%	55%

In contrast to this the activity of the local union does indeed depend on the perceived impact. This is illustrated by the table below where the answers to the question "to what degree has the local union taken initiatives to get more influence on the use of edp within the organization" have been grouped according to perceived changes.

	taken a lot of initiatives	taken some initiatives	taken no initiatives
no changes	4%	10%	86%
changes	17%	33%	50%

Criticism of existing SDM's

When evaluating the existing SDM's it seems reasonable to take RAS as a typical example, if one does not want to present a comprehensive comparative study. As already mentioned SIS have received international recognition of its work and furthermore the people behind RAS claim not to have contributed anything new, but rather to have compiled established knowledge in the field.

The Swedish trade unions have criticised RAS a great deal. In a report [22] the Swedish white-collar worker's organization concludes: "RAS prescribes that the employees must be given thorough, detailed, stepwise instructions for the work to be done. Management are encouraged to work these instructions out in cooperation with the systems analysts. Other employees, those whose jobs are being 'systems developed' are not to participate in the process of development". The Swedish Trade Union Council is equally harsh in its judgement, and a group of systems analysts assembled at a seminar arranged by the Norwegian Dataprocessing Association[23] came to the conclusion that RAS, due to its division into phases and its lack of involvement, was unsuitable for use in SDP's under the new edp agreement.

Information, involvement and influence

Relevant information about the new edp-based systems, and insight into the SDP are necessary prerequisites for influencing the SDP. They are however in no way sufficient. To illustrate this we consider an SDP where the local union was involved, and had the opportunity to ask questions and formulate demands which the new system should, preferably, fulfil. The example is taken from our case studies.[24] It was the only case out of the twelve where the local union was given information about a planned SDP from the start.

The organization in question is a public institution with about 3000 white-collar workers. It is a member of a large concern whose top management places great emphasis on taking a leading position in the country with respect to involving the employees in planning organizational development at all levels.

In 1970 the management informed the local union that a major automation based on edp was under consideration. At that time the union asked the following questions:

— will the automation cause dismissals?
— will there be any major changes in working hours, and especially
— will the automation cause the introduction of a night shift?

The answers were, in 1970:

— there will be no dismissals. However there will be a reduction in the number of employees as employees quit their jobs voluntarily,
— there will be no major changes in working hours.

Later, during the SDP the shop stewards formulated a few supplementary demands which they wanted the system to fulfil. The one they placed most emphasis on was that the system should allow the existing 9 person groups to continue to work together. When this demand was formulated the systems analysts assured the union that it would be fulfilled by the system under development. All the same several months later the systems analysts announced that the edp-based system under development did not allow the demand to be fulfilled. Instead the employees would be reorganized into groups of 25. The shop stewards did not receive any verifiable documentation.

In 1977, a year after the installation of the system, the answers to the original questions are:

— no one has been formally dismissed,
— working hours have been changed for more than 600 people. Most of these have been moved from day to evening or night shift. Furthermore most of these employees have had a decrease in numbers of working hours and salary of more than 25%.

To this picture has to be added that although no one has been formally dismissed, the number of people quitting their jobs voluntarily has increased, primarily because they could not afford the decrease in salary or were unable to get someone to look after their children when working on evening or night shift.

Management's involvement of servants can be used by the local union to gain insight into the SDP. It is however in no way a guarantee for influence. Management is interested in controlling the SDP, and involvement is one of the means by which they seek to utilize the knowledge and experience of servants to build more efficient systems while at the same time adjusting the servants' perception of the organizational change.

5. TRADE UNION ACTIVITIES

In the following two sections we turn our attention to the second objective of this paper: to demonstrate that the type of research in question is a necessary and fertile supplement to activities within computer science. Throughout our discussion we emphasize various results obtained within the projects.

The traditional concept of 'results' of research: knowledge presented in reports written by the research workers, is too limited to include the results of the research projects discussed in this paper. All of these projects are an integrated part of building up resources within the trade unions. Hence our results include activities carried out by the unions, centrally or locally, as part of or initiated by the projects. Obviously, the research projects are at the same time an integrated part of the activities within research and educational institutions.

In this section the research projects are related to trade union activities. In section 6 we change our focus of interest to research and educational activities.

A major problem when assessing an edp-based system or an SDM from a trade union point of view is that the goals of the trade unions are not usually operationalized with respect to edp-based systems. And in particular short-term goals, such as securing acceptable wage increases, are not combined into a plan together with long term goals such as industrial democracy. This situation is gradually changing as the impact of edp-based systems within fields of interests of the trade unions increases. Within Project DUE, we hope to provide some of the resources necessary for the operationalization of goals, and for working out plans. This work is in progress, but it is too soon to make general statements.

5.1 Present activities

The Scandinavian trade unions have initiated various activities besides the research projects. A number of local working groups are analyzing the problems in relation to the use of edp-based systems within specific organizations.[25] Some of these groups are working in cooperation with researchers and students. There are also a number of working groups within the central union bodies. Some of these are considering the development within a specific branch of industry, others are trying to coordinate joint national Scandinavian activities.[26] As a part of this work several conferences

have been arranged. Furthermore, various educational activities have been initiated by the trade unions with the purpose of communicating knowledge and experience relevant from a trade union perspective, and some trade unions have elected or employed consultants with expertise in edp-based systems. Finally, a number of local and central agreements have been negotiated and reached within the field of edp-based systems. Within the space of this paper it is not possible to give a comprehensive description of all these activities, but as an illustration the following subsection contains a detailed description of one of the educational activities within the trade unions in relation to Project DUE.

Edp courses for trade union members

As mentioned earlier the Danish Trades Union Council decided to develop a one-week course on edp-based systems in 1975. The development of the course was made an integral part of Project DUE.[27] The courses are open to shop stewards and other interested members of the unions within the Trades Union Council. Approximately 20 workers participate in each course, and the number of courses per year varies from four to eight. The courses are at present organized and run by members of the project group within Project DUE. Other similar courses within Scandinavian trade unions are run by consultants from the trade unions.

During the course a number of subjects are covered in class, ranging from peripherals to systems development to industrial democracy. A substantial part of the time is, however, spent in smaller groups discussing one single question throughout the week: "What activities would you suggest that your local trade union initiates within the field of edp-based systems?" This work in smaller groups is designed with the purpose of creating a coherent process of learning which relates to the urgent problems within the local unions. A typical course outline is given in Figure 2.

Outline for the one week course on "Democracy, Development and Edp".

Monday

9-10   Introduction.   Examples   of   edp-based   systems   within
        organizations. Impacts and possibilities of influence.

10-12   Project.
        The project on which the participants are going to work
        throughout the week is introduced. The title is: "The activities
        of your own local union within the field of planning, control
        and edp". Groups of 3-5 participants are formed.

14-18   Experience from a local trade union. Representatives from a
        local trade union talk about their activities and experiences
        within the field of planning, control and edp.

Tuesday

9-11   Data-processing.
        Data-processing, edp, the computer, i/o-equipment, software.

11-12   Project.

14-16   Planning and control.
        A case example is used to illustrate how edp is used as a tool
        for planning and control within organizations.

16-18   Project.

20-21   Systems development.

Wednesday

9-11   Local trade union activities.
        A model of local trade union activities with special attention to
        the use of edp-based systems within the organization.

11-16   Project.

16-18   Overview of application areas.

Thursday

9-10   Evaluation of edp-based systems.
        A local union's evaluation of an edp-based production planning
        and control system.

10-12   Project.

14-16   Edp agreements and legislation.

16-18   Project.
        A written project report is handed in for duplication.

Friday

9-12   The activities within the trade union movement.

14-17   Discussion of reports and evaluation of the course.

Figure 2.

5.2 Towards trade union control

The overall strategy of the Scandinavian trade unions is not to stop technological development, but to gain control over it. However, looking at the current development in the use of edp-based systems within organizations, the local trade unions lack several important resources.

Information.
The local trade unions lack information about existing and future edp-based systems. In particular they lack information which can be applied to evaluate the impact of systems on their members.

Operational goals
The local trade unions lack clear, operational goals, which can be used in a short and long range planning of their activities.

Experience and knowledge
The local trade unions lack experience and knowledge when evaluating edp-based systems. For the unions edp is a relatively new field of interest.

Other resources
The local trade unions lack a number of other resources. The people working within the SDP are paid by management, and are therefore also controlled by management. In most cases the local union cannot even form a single working group to deal with these matters unless all meetings are arranged outside working hours. The local trade unions need to build up the above-mentioned resources in order to increase their control. And in doing so they are very much dependent on supporting activities initiated by the central trade union bodies.

What can the trade unions do, locally and centrally, to gain control over the current development? There is no final answer to this question. But the research projects, being integrated parts of the activities within the trade unions, must necessarily relate themselves to this question. Within Project DUE we have done so by proposing a set of activities.[28] These activities constitute an idealized framework within which to increase the local union's control over the edp-based systems. They are at present being applied, adjusted and further developed within the project and within the trade union movement.

The idealized framework consists of three types of activities. First the local trade union should initiate activities to *make management meet demands* (for information about existing and future edp-based systems, for the participation

in project meetings, about the design of specific edp-based systems, and for alternative uses of edp). Secondly the local trade union should initiate activities to *build up their own resources* (participating in relevant educational activities within the trade union movement, arranging meetings and study circles for members, negotiating and reaching local agreements, and establishing working groups to clear up specific problems). And thirdly the local trade union should *formulate and develop goals and plans* for its own activities. The three types of activities should be initiated and developed in parallel. As a concrete example we list the proposed demands about the design of a specific edp-based system:

Number of jobs
Demands for creation of new jobs when existing jobs are eliminated due to, for instance, automation. The number of workers employed must not be reduced either by dismissal or by so-called 'natural decrease'.

Functions of work
Demands for coherent work functions within the individual job. The individual job must give the worker a general view of the context of the job. The jobs must be designed to support contact between fellow workers and to ensure use and further development of skill and experience.

Training and education
Demands for a thorough training of workers within the new edp-based system. In the long term there should be a thorough education scheme, making it possible for the individual worker to understand the interrelationship between the edp-based systems and the organization.

Physical environment
Demands regarding the work processes in connection with the operation of the edp system. For instance, demands about the type of terminal used, the design of input and output formats and about the working position at the terminal.

Planning
Demands ensuring that the new edp-based system does not decrease the workers' freedom to independent and joint planning as part of their daily work. Demands about the design of edp-based planning and control systems in order to increase the local trade union's knowledge of the organization.

Supervision
Demands about what information about the utilization of labour, machines and materials may be registered. Demands about how this information may be used.

The process of increasing control within the individual organization is, however, part of the activities of the trade union movement. The central bodies within the trade unions should aim at increasing the support to local branches. Support can be given in the form of knowledge about planning, control and edp, and about existing agreements and legislation. Support can also be given in the form of experience from other local unions, who have been confronted with similar problems, and in the form of moral support. The central bodies within the trade unions should initiate activities to build up and further develop the resouces necessary to give this support, for example by educational activities, by electing or employing consultants, by initiating investigations and research, by participating in international trade union activities, and by negotiating and reaching central agreements.

The proposed idealized framework is an integrated part of an ongoing process. The short-term goal of this process is to build up resources to influence technological development. The long-term goal is to gain full control over it.

6. RESEARCH AND EDUCATIONAL ACTIVITIES

In this section we discuss the Scandinavian trade union projects in relation to activities within computer science. To this end three examples are given. The examples selected are not given a thorough treatment as their purpose in this context is to serve as illustration.

Trade union involvement in the SDP creates new demands on the SDM's used. This point is illustrated by the Norwegian edp agreement. The demand that information about edp-based systems which influence the employees and their working conditions directly is given "in a well arranged form and in a language that can be understood by non-specialists", has a direct effect on the tools and techniques that should be used as parts of the various SDM's.

6.1 Example 1: Tools

In order to evaluate and compare different tools and techniques it is necessary to refine the above-mentioned demand further. One attempt to do this has been made by researchers at the Norwegian Computing Center (NCC), in continuation of the Norwegian Iron and Metal project. Researchers at the NCC have worked on the development of a conceptual framework and a language — the DELTA language — for understanding and communicating about systems[29]. As basis for designing the DELTA language a set of more refined demands has been developed[30]:

1. It must be possible to make system descriptions in several forms, to match the different roles and interests which people in the system may have. A system description must contribute to people's understanding of their own and others' jobs within the system and the relationships between them.

2. The whole which is chosen must be expressed clearly in the description. The description must make clear which components in the system are important and explain the most important kinds of relations between these components.

3. A language for system description must be usable for expressing where in the system decisions are made, what these decisions affect, who make the decisions, and the decision rules applied.

4. System descriptions must be usable as a basis for discussion of changes in the decision forms and decision rules in the system and for the formulation of wishes and demands regarding the design of the system. It should be possible to formulate such wishes and demands with reference to specified sections of the system description.

5. System descriptions must help the reader to find where in the system the cause of given characteristics of the system are found.

6. It should be possible to make several editions of a system description, some giving a rough general view of the system and others giving more and more details about all or selected parts of the system. It is important that all these descriptions can be described in the same language.

7. System descriptions must make it possible for the reader to arrange the description on the basis of that perception of the system which he finds natural in his working situation.

At present there are only a few practical experiences with the use of DELTA. It is therefore difficult to evaluate the extent to which DELTA meets these demands. They illustrate, however, how ongoing research results in additions to the list of qualities that the tools of SDM's should possess. A closer look at an example will make this point clear.

Demand 1 gives a more explicit formulation of the word "understood" in the edp agreement. It points out that the understandability of a system description depends on the working situation of the person reading the description. The cashier, the storeman and the manager each have their different perceptions of, attitudes towards and jobs in the supermarket, and consequently the descriptions of, for example, a new point of sales system should be different for each of them. Several system descriptions must be constructed, and these descriptions must, among other things, be usable as the basis for formulation of wishes and demands regarding the new point of sales system.

The cashier will look in the system description for components like: customer queue, cash register, article, price, cashier etc. And she would like answers to questions like: What are the working conditions at the new cash registers? What is the new workload? Will there be any kind of automatic supervising? How much education do we get? What are the alternatives?

The storeman will look in the system description for components like: article, requisition, supplier, time of delivery, packing etc. And he would like answers to questions like: How much of the work around the store is automated? Will there be any further division of labour? What type of qualifications will be required from new personnel? How much education do the existing personnel get? What are the alternatives?

The manager already has knowledge about most matters concerning the supermarket, so he will be able to understand most descriptions of various aspects of the supermarket. Most likely he will look in a system description for components like: personnel, stock, purchase, marketing etc. And as a basis for deciding he would like answers to questions like: What are the expenses? What is the saving? In what ways are the basis for decision making improved? What are the alternatives?

6.2 Example 2: Techniques

The previous section gives one example of how trade union involvement in the SDP creates new demands regarding the SDM used. In this second example our starting point will be the same: the demand that orientation must be given in a well-arranged form and in a language that can be understood. The focus this time however will be on techniques instead of tools.

On the basis of the research project carried out by the Danish Nurses' Organization[31], a set of techniques for system description have been developed[31]. The project was carried out by eight nurses, one computer science lecturer, and two graduate students of computer science. The techniques are based on the hypotheses that system description *for* servants (SDFS) cannot replace system description *with* servants (SDWS). SDFS is defined to be a teaching process carried out by computer specialists oriented towards servants, whereas SDWS is defined as a process of perception carried out by a group of computer specialists and servants. SDFS is part of the later stages of the SDP and it results in an improvement of the organization's ability to pursue the goals of management through greater servant acceptance of the edp-based system. SDWS is either part of the earlier stages of the SDP or it is part of trade union activities. SDWS may result in an improvement of the organization's ability to pursue the goals of management because the edp-based system is better adjusted and it may result in an increased servant influence.

Figure 3 illustrates a general model of SDWS and its immediate surroundings. The boxes denote subprocesses and arrows indicate important interactions.

The arrow going down indicates that if you have a description of the working situation it is easier to point out important consequences of a given edp-based system. The arrow going up indicates that when you analyze a given edp-based system you see important consequences for the working situation. This contributes to a more useful description of the working situation.
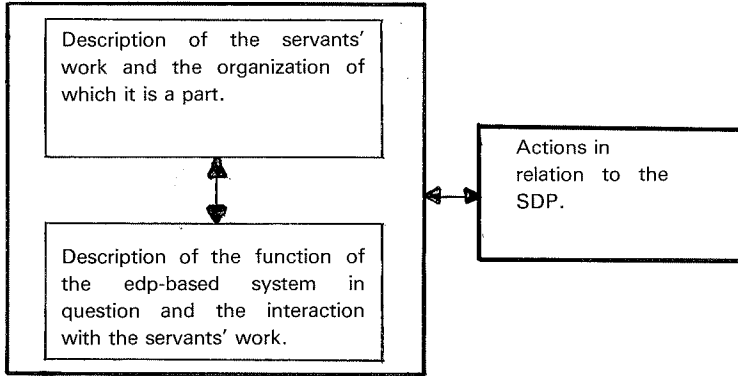
SDWS

Figure 3.
SDWS and its immediate surroundings.

The horizontal double arrow has the following meaning: On the one hand, when the edp-based system and its consequences is described you can start changing reality. If SDWS is part of the SDP, management can start evaluating the system and the computer specialists can eventually start constructing it. If SDWS is part of trade union activities the system description can be used as a basis for a debate among the members of the trade union and as a basis for initiatives started by the trade union in relation to the SDP. On the other hand, practical experiences with the use of the system description can lead to changes in the demarcation of the system or to the application of new techniques for system description. Or simply to a more correct and useful description because matters that up to now only have been described analytically are now experienced in reality.

Inside the framework of this general model of SDWS a set of hypotheses has been formulated. These hypotheses together form a basis for the development of techniques for describing edp-based systems in cooperation with servants.

1. It is important that SDWS emphasizes the description of future systems by including existing plans and ideas.

2. The description of the development of the servants' work and the organization of which it is a part and the description of the function of the edp-based system in question and the interaction with the servants' work must proceed in parallel to support each other.

3. The description of the development of the servants' work and the organization of which it is a part must be developed in a dialogue. Suitable tools in this process are general views of the working functions, diagrams of information flow and general views of the contents of data in registers. The computer specialists can get a fairly concrete description of the servants' working situation by visiting the place of work and by interviews.

4. A structured description of the edp-based system must be built out of descriptions of the edp-based system with the present working situation of the servants as a starting point. Suitable techniques are visits to other similar edp-based systems, discussions of sequences of terminal displays, paper I/O, contents of edp-based registers and of algorithms for control. At a later stage the description can be coordinated with the description of the servants' work.

5. SDWS is a process of perception, which implies that there is an interaction with those actions that support the SDWS and supply it with impulses. The two partial processes of SDWS must proceed in parallel.

We illustrate hypotheses 1 and 2 by an example from an SDWS which was part of the project within the Danish Nurses' organization. A group of nurses and computer scientists described an edp-based hospital information system. When the group started only the basic patient journal database was implemented and in operation. That part of the system did not have any noticeable impact on the nurses' working situation, and, as it turned out, would probably never get it. As the SDWS progressed it became clear that in the future the system might be used in planning the details of the treatment of the patients and the work of the nurses. This would make it possible to change from a gross regulation of the personnel, where everybody are permanently attached to a specific department, to a net regulation, where only a minimum is permanently attached and the rest are assigned on a day-by-day basis from a common pool.

As part of the SDWS the nurses developed a set of demands to their working situation which they wanted to be fulfilled when the complete system was in operation. One of the demands was that their employment contracts should specify which department they were to work in. One might argue that the nurses could have formulated this demand without knowledge of existing plans and ideas. The point is, however, that without this knowledge it was difficult to focus on those aspects of the working situation which may be changed due to the system, and hence the nurses might have used all their resources on discussing aspects that remain unaffected. At the same time the evolving structured description of the nurses' working situation acted as a framework within which a restructured description of the edp-based system was built. This process of restructuring the description of the edp-based system then in turn made it even easier to focus on other relevant aspects of the working situation. Most of the techniques that are provided by existing SDM's make it impossible to apply the techniques of SDWS in the SDP. For example many existing SDM's suggest, as discussed in section 4, that the SDP is separated into a number of phases which are strictly separated in time. This restriction obviously contradicts hypothesis 5 and in most cases also hypothesis 2.

6.3 Example 3: Principles of organizing

A central part of the Norwegian edp agreement states that it shall be possible for the shop stewards to "put forward their points of view as early as possible and before the management puts its decisions into effect". This statement places a number of demands on the SDP which are not fulfilled today.

In this section we introduce and discuss a set of hypotheses about the principles of organizing the SDP and related activities within the local trade unions. (The hypotheses presuppose that the resource situation is not much different from what it is today within the Scandinavian trade unions.)

1. Decisions and actions to fulfil trade union policy on SDP's should be taken by the same committee that deals with other parts of organizational development.

2. When the SDP is extensive the local union should form an edp committee to coordinate the activities. Otherwise this coordination may be done by the same committee that makes the decisions.

3. The most important basis for such decisions is thorough discussions of goals and possible actions: discussions within the local union involving

both committee members and ordinary members; discussions with representatives from the central union bodies; and discussions with representatives from other workplaces.

4. Whenever necessary it should be possible to get technical assistance via the central union bodies.

5. Resources should be allocated to the local union as a part of the organization's allocation of resources for SDP's and organizational development in general.

Hypotheses 1 to 5 are at present being "tested" within Project DUE (except that the resources mentioned in hypothesis 5 are provided via the project).[32]

Hypothesis 1 is intended to provide a more coherent policy of organizational development, and to assure that the workers' representatives are not isolated and talked into wrong decisions in project groups, control committees etc.

Hypothesis 2 says that coordination within the local union is important. Coordination includes collection of information from management and other sources, writing up policy proposals, and arrangement of discussion meetings. If there is too much work for the normal committee a special one should be formed. In particular coordination should not (only) take place in joint committees with representatives from both unions and management.

Hypothesis 3 stresses that the most important way to develop policies within the trade unions are by discussion. Furthermore extensive discussions both vertically and horizontally are needed, especially with respect to edp, since no or few operational goals exist and experience and knowledge is scarce. The kind of discussions mentioned in hypothesis 3 are time consuming and rule out the normal timetables for SDP's.

Hypothesis 4 states that the SDP's of the local union, as well as other SDP's and other union activities, are, at times, dependent on (not il-) loyal technical assistance.

Finally hypothesis 5 states that the local unions need resources of their own in order to participate in SDP's and that these resources should be considered a part of the overall resource consumption in SDP's. None of the existing SDM's, as far as we know, prescribe that the local unions should have resources, which they alone control.

We illustrate hypothesis 4 by an example from Project DUE, concerning the implementation of a production control system with a large number of terminals. The system was put into operation in one department and its use was closely followed by a group of representatives from the management (including the edp manager) and the local unions. After a couple of months most of the known bugs were removed and management, as well as some of the union representatives, wanted to put the system into operation in all departments. However, most of the union representatives felt insecure, and wanted more time. The edp manager supplied the union representatives with some supplementary material, in particular wage-information. He did, however, firmly believe that all groups in the factory had coherent goals with respect to the production control system, and he interpreted the vague resistance of the unions as psychological resistance against things not especially developed for their factory.[33] Later, when going through the system with computer scientists from Project DUE, the local unions found out that the new system would facilitate the building of a database which would allow a centralization of a large part of the planning of the details of the daily work. This would, among other things, reduce the demand for skill and experience. Consequently the unions decided to resist installation of the system, and they were successful in this resistance.

Existing SDM's have all been formulated on the basis of practical experiences from SDP's, where no or at least very few attempts have been made to put forward trade union interests. Hence we find that the existing SDM's correspond to SDP's which aim at improving the organization's ability to pursue the goals of management. The tools, techniques and principles of organizing discussed in this section represent attempts to develop alternative SDM's that are in accordance with the goals of the trade unions.

At present, alternative SDM's are included in some of the computer science educational programs at Scandinavian universities. At the same time additional attempts are being made within research projects and master's theses, to use the knowledge and experience gained through cooperation with trade unions in the development of more appropriate tools, techniques and principles of organizing.

7. SUMMARY

The Scandinavian trade unions are becoming more and more interested in influencing technological development, in particular the SDP within organizations. A process has started in order to build up resources within the trade unions with the purpose of changing the present conditions for influencing the use of technology. The negotiation of edp agreements and the initiation of research projects are just part of this process, which is motivated by the present impacts of the use of technology and in particular the use of edp-based systems.

This situation cannot be ignored by the computer specialist who works within an SDP. Edp agreements and initiatives from local trade unions aiming at influencing the SDP create new conditions under which he has to work. Unfortunately, existing SDM's do not reflect this situation. Research projects like the ones described here provide insight which is a necessary prerequisite for developing new and more appropriate SDM's.

Analysis and criticism of existing SDM's are important parts of the research activities within trade unions. At the same time progress is being made in understanding how the insight and criticism can be used in a constructive process of creating new tools, techniques, and principles of organizing the SDP. Whereas the process within the trade unions probably will continue and develop, it is urgent that computer scientists understand the necessity of using the insight gained and the criticism raised in the activities of research and educational institutions.

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Notes

1.   Datamaskinbaserte systemer, Rammeaftale/**Edp-based systems,
     General Agreement**, The Norwegian Trade Union Council, Oslo, 1975.

     There exists no official translation of the edp agreement. A translation
     into English is contained in an article by K. Nygaard (see note 6). This
     translation does not, however, follow the original text particularly
     closely. Thus the translation included in this paper is our own.

2.   An extensive list of references is contained in: **Curriculum
     Recommendations for Graduate Professional Programs in
     Information Systems**, Ashenhurst, R.L., (ed.), Comm. ACM, vol. 15,
     no. 2, May 1972, pp. 363-398. In 1976 the ACM announced a new
     department on Social Impacts of Computing (Comm. ACM, vol. 19, no.
     1, January 1976, p. 38). Zelkowitz surveys the state of the art in:
     Perspectives on Software Engineering, Zelkowitz, M.V., ACM
     Computing Surveys, vol. 10, no. 2, June 1978, pp. 197-216.

     Recent contributions to the various fields may be found in the
     forthcoming proceedings from the CREST Course **Information
     Systems, Organizational Choice, Social Values**, Universita di Pisa,
     Pisa, April 1979 and from the Second IFIP Conference on **Human
     Choice and the Computer**, Vienna, June 1979.

3.   A more detailed discussion of this point can be found in: **The trade
     unions, new users of research**, Nygaard, K. and Bergo, O.T.,
     Personnel Review, vol. 4, no. 2, 1975, and **Computers Dividing Man
     and Work**, Sandberg, Aa. (ed.), Swedish Center for Working Life,
     Stockholm, 1979.

4.   Nygaard, op. cit., see note 3.

5.   Planlegging, styring og databehandling/**Planning, control and data
     processing**, An introduction for trade union members, parts 1 and 2,
     Nygaard, K. and Bergo, O.T., Tiden Norsk Forlag, Oslo, 1974. At
     present the European Federation of Trade Unions plans to have the
     books translated into various European languages.

6.   Sandberg, op. cit., pp. 108 ff., see note 3.

7.   Demokrati, udvikling og edb/**Democracy, development and edp**, DUE-report no. 2, Computer Science Department, Aarhus University, March 1978. DUE is an acronym for the Danish title of this report.

8.   Edb-haandbog for sygeplejersker/**Edp-handbook for nurses**, Danish National Union of Nurses, Copenhagen, 1977.

9.   Our research method is inspired by the works of Nygaard (see note 3), Freire in Latin America (**Pedagogy of the Oppressed**, Freire, P., Herder and Herder, New York, 1970) and Negt together with German trade unions (Soziologisches Phantasie und exemplarisches Lernen/**Sociological Fantasy and exemplified Learning**, EVA, Frankfurt/M, 1972.) We find that a comprehensive discussion of research methods should be based on our own practical experience, hence such a discussion is included only in the last phase of the project.

10.   DUE, op. cit., see note 7.

11.   See e.g. **Modern Organizations**, Etzioni, A., Prentice-Hall, 1964.

12.   The "important features" mentioned are not independent. For example a shipyard modifying a production control system is more likely to apply an SDM specifying involvement of servants than is a supermarket modifying a point of sales system, since shipyard workers are more skilled than clerks working at terminals in a supermarket — on the average. It is outside the scope of this paper to analyze the relationships between these features, and we simply treat the SDM as an independent factor.

13.   Section 3 is primarily based on DUE-report no. 2, pp. 7-42. See note 7.

14.   Similar trends have been reported from other research projects, for example: Edb basert informasjonsteknologi og mulighetene for utveckling av et bedriftsdemokrati/**Edp-based information technology and the possibilities of developing an organizational democracy**, Hennestad, B.W. and Soerby, T.O., Institute of Economics, Oslo, 1977.

15.   Industriel automatisering — hvorfor og hvordan?/**Industrial automation — why and how?** Westhagen, I., Data 7-8, Copenhagen, 1977.

16. A detailed description of the present trends in the organization of the work of edp professionals can be found in: **Division of labour in the Computer Field,** Greenbaum, J., Monthly Review, Vol. 28, No. 3, pp. 40-65, 1976, and in: **Programmers and Managers — The routinization of computer programming in the United States,** Kraft, P., Heidelberg Science Library, 1977.

17. **Systems Development — A Constructive Model,** Swedish Standards Institution, Stockholm, SIS handbook 125, 1975, and e.g. Paalidelig programmering/**Reliable Programming**, Soevndahl, T. and Traberg, J., Gyldendal, 1977, Copenhagen, pp. 24 f.

18. **The Design of Inquiring Systems,** Churchman, C. West, Basic Books, New York, 1971.

19. Ashenhurst (op. cit., see note 2) mentions the phases analysis, design, implementation and operation. Naur (**Concise Survey of Computer Methods,** Naur, P., Studentlitteratur, Lund, 1974) splits "implementation" into "implementation" and "installation". Ashenhurst states that the separation into analysis, design and implementation is not reflected in a clear sequence in time of the phases, and Naur says that the division is highly questionable — at least with the present stage of development of the understanding of large systems.

20. See for example: **Computers: Planning for People,** Mumford, E., Batsford, London, 1968.

21. Due op. cit., see note 7.

22. Datorn in arbetslivet/**The Computer in Working Life,** TCO, Stockholm, 1976, p. 20.

23. RAS-seminar i Norge den 26.-28. april 1976/**RAS-seminar in Norway, April 26-28, 1976,** Andersen, N.E., Computer Science Department, Aarhus University, 1976 (mimeo).

24. DUE op. cit., see note 7, and: Erfaringer fra anvendelsen af edb paa en dansk arbejdsplads/**Experiences from the use of edp at a Danish workplace,** Joergensen, I., in DUE-notat nr. 4, Computer Science Department, Aarhus University, 1977.

25. Some of these activities are documented in:
    — Bedriftspolitisk handlingsprogram/**Company Policy Action Program**, The trade union at A/S Hydraulik, Tiden Norsk Forlag, Oslo, 1974.
    — En vurdering af styrings- og informationssystemet KVPOL/**An Evaluation of the Control and Information System KVPOL**, The trade union at Vaapenfabrikken, Tiden Norsk Forlag, Oslo, 1974.
    — Vi vaegrar laate detaljstyra os/**We Oppose Detailed Control**, Ehn, P., et at., Demos Report No. 10, Swedish Center for Working Life, Stockholm, 1979.
    — Edb-systemer i detailforretninger/**Edp systems in the retail trade**, Jensen, V.T., DUE-notat No. 3, Computer Science Department, Aarhus University, 1977, and
    — the Edp-handbook for nurses, op. cit., see note 8.

26. Some of these activities are documented in:
    — Handlingsprogram for foeretagsdemokrati och data/**Action Program on Industrial Democracy and Data**, Swedish Trade Union Council, Stockholm, 1976.
    — Rapport fraan NFS' arbetsgrupp om Datafraager/**Report from NFS' Working Group on Questions relating to Data**, Stockholm, 1978, and
    — the TCO report, op. cit., see note 22.

27. During 1976 and 1977 the course was based primarily on material from the Norwegian Iron and Metal Project, gradually supplemented by Danish material, which we found suitable and which was borrowed from other sources. The members of Project DUE are currently finishing a set of teaching material to replace the Norwegian textbook.

28. A detailed description of these activities is given in DUE, op. cit., pp. 81-100, see note 7.

29. **System Description and the Delta Language**, Holbaek-Hanssen, E., Haandlykken P. and Nygaard, K., Norwegian Computing Center, Oslo, 1975.

30. DELTA-prosjektet og dets tilknytning til problemene i systemutvikling/**The Delta Project and its relation to the problems in Systems Development**, Nygaard, K., in PB-46, Computer Science Department, Aarhus University, 1975.

31. The techniques are described in detail in: Systembeskrivelse med brugere/**System description with servants**, Munk-Madsen, A., DUE-notat No. 9, Computer Science Department, Aarhus University, 1978.

32. DUE, op. cit., see note 7, and Edb forandrer forholdene paa vore arbejdspladser/**Edp is changing our workplaces**, Noehr, P., New Politics, Copenhagen, June 1979, No. 6, pp. 27-28.

33. This view was put forward by the edp manager in an article in a professional journal: Edb-fællesskab på 2 jyske værfter/**Edp-cooperation between 2 shipyards**, Beier, A., Data no. 7-8, Copenhagen, 1977.