PART ONE:
SYSTEM DESIGN AND INDUSTRIAL DEMOCRACY

1 The Collective Resource Approach to Systems Design

PELLE EHN* and MORTEN KYNG
Computer Science Department
University of Aarhus
Denmark

*On leave from the Swedish Center for Working Life.

Abstract

This paper is about democracy and skills and the role of trade unions in systems design. We describe and discuss a Scandinavian tradition for trade union influence on new technology which has evolved during the last fifteen years in close co-operation between researchers, trade unionists, and their organizations. We call it the *collective resource approach.*

In the first part of the paper the origin and the development of the Scandinavian collective resource tradition is outlined. It centers around descriptions of some of the major *projects* of this approach, from the beginning with the Norwegian Iron and Metal Workers project and until the "second generation" projects of today.

In the second part of the paper we present some of the results of the collective resource approach as a set of theses dealing with aspects relating to *inquiries into design and democratization.* Primarily we discuss trade union design activities to be performed locally and centrally. We also propose a design perspective including tools and techniques to be used in participative skill-based design.

Introduction

This paper is about the design and use of new technology in relation to democracy at the work place. We describe and discuss a Scandinavian approach which has evolved during the last fifteen years through a number of research projects and the practices of the trade unions. The main focus is strategic: how to increase the workers' influence on new technology, and one of the primary means has been development of independent union activities in design and use of computers and other kinds of new technology. Our emphasis is on these union activities and their relations to what is traditionally termed systems design — in the context of democratization.

The strategic aim distinguishes the collective resource tradition from other approaches to organizational development in general, and to systems design in particular. Other factors, primarily participation, are shared with other approaches such as socio-technical design and most of those involving prototyping, but — as we shall see — they are approached differently.

The structure of the paper

As a background for understanding the role played by the unions in relation to the collective resource approach we first sketch some characteristic features of Scandinavian industrial relations. Then we briefly describe our own background. The rest of the paper is divided into two parts.

In the first part the origin and the development of the Scandinavian collective resource approach is outlined. We sketch the dominating research tradition in relation to industrial democracy in Scandinavia in the late sixties and the beginning of the seventies: the *socio-technical* research tradition. The negative strategic implications of this tradition, in terms of no real changes in worker-influence, was an important part of the challenge to develop an alternative research approach for participation, work organization, and democracy in the development and use of computer-based systems and tools — the *collective resource approach.* Then we continue by describing the practices of the approach. We do this in terms of some of the major *projects* , from the beginning with the Norwegian Iron and Metal Workers project and until the "second generation" projects of today.

In the second part of the paper we present some of the results of the collective resource approach as a set of theses dealing with aspects relating to *inquieries into design for democracy and skill*. The theses are based on practical experiences from the projects and a general theoretical understanding of the driving forces of rationalization of labour processes. Basically we discuss trade union design activities to be performed locally and centrally. This includes a "new Scandinavian model" for research and development, where we try to sketch some possibilities for an offensive co-operation between unions, employers and the governments in relation to new technology. We also propose methods to be used in participative skill-based design.

Scandinavian industrial relations

Scandinavian countries have, for quite some time, been well known for their industrial relations. The following should be counted among the more distinguishing facts:
- high level of unionization,
- strong national labour federations,
- centralized negotiation systems,
- large social democratic parties with strong links to the the national federations of blue (and some white) collar workers, parties which for long periods of time have led the governments,
- relations between trade unions and employers are to a large extent regulated by laws and central agreements,
- positive attitude to new technology from the central trade union federations, at least since World War II, based on the assumption that jobs lost by introduction of new technology would be compensated by active labour-market policies from the governments (there have however been some opposition at the local level).

These factors have probably contributed to the relative stability of Scandinavian labour relations.

Another distinguishing fact, at least when foreigners look at Scandinavian labour relations, is the high degree of democratization. Einhorn's remark after a tour of Scandinavia is a typical outsiders' view:

"Democracy [in USA] stops at the office door and the factory gate. ...Western Europe is extending democracy into working life. Democratization of work has gone further in Scandinavia than elsewhere in Europe. Job redesign projects, ...Co-determination arrangements, ...Health and safety legislation ...Employee representatives on corporate boards ..." [2]

These are important historical prerequisites for understanding the development of the collective resource approach. But just as important is the other side of the coin. The Scandinavian countries are themselves advanced capitalist economies, and also an integratred part of the international western capitalism. Hence, even if the historical situation is different in Scandinavia, the forces of rationalization of work and technology that workers and their trade unions meet are basically the same as in other capitalist economies.

---

2 Einhorn, E. and Logue, J. (eds.): *Democracy at the Shop Floor — An American Look at Employee Influence in Scandinavia Today*, Kent Press 1982, p.5,11,12.

Our background

Since the mid-seventies most of our own work has been related to the collective resource approach. From 1975 to 1980 we worked on the first Swedish and Danish projects within this new emerging approach taking up the ideas of the pioneering Norwegian project conducted by the Iron and Metal Workers Union with the assistance of researchers from the Norwegian Computing Center. From then and until now we have conducted the Utopia project, developing the collective resource approach to include development of human-centred skill-based technology and professional education. Thus we view our topic from within this tradition. Our personal involvement will shape our selection, description and discussion, but hopefully our exposition gains more from our first hand experience with most of the material described than it looses from that bias.[3]

Socio-technical satisfaction

During the sixties computers began to be introduced in a variety of applications, especially for administrative purposes, in Scandinavia as in most western developed countries. In the same period research on systems design based on rationalistic, scientific management, and systems theory approaches emerged. Some quite influential traditions also developed in Scandinavia. Focus in Scandinavia was on information analysis and on the organization and control of the design process[4]. The perspective was partly different than that of the management information systems tradition,[5] but there was no real understanding of work organization or concern for democracy at work.

Another research tradition not specifically dealing with computer applications, but with organizational and technical change, was at the same time growing: *the*

socio-technical approach, that explicitly dealt with worker participation and quality of working life.[6]

It may appear as a paradox that the trade union oriented collective resource strategy developed as an alternative in opposition to the socio-technical approach. We will try to explain some of the reasons below.

The Socio-technical Approach in Scandinavia

Quite early the socio-technical approach was taken up and further developed in Norway[7], and from there spred to Sweden in different kinds of co-determination experiments.[8] Similar experiments were also initiated in Denmark at the turn of the decade.[9]

The Norwegian Industrial Democracy Project was a co-operation project between the Norwegian Federation of Trade Unions and the Norwegian Employers' Confederation. It was initiated around 1960, approximately ten years after the initial Tavistock socio-technical experiments, based on the Tavistock experiences and conducted in co-operation with researchers from Tavistock. The leader of the experiments, E. Thorsrud, summarizes the background in the following way:

> "At the end of the fifties the growth in many areas seemed to come close to the limits set by the natural resources. Differently with the resources which depend on human initiative and creativity.....Both economic considerations ...... and a growing unrest in the left wing labour movement contributed to the creation of strong interests......"[10]

Between 1964 and 1967 four experiments on work organization were carried out.[11] The new work organization solutions were all of group production type. They included some planning activities, but were primarily concerned with changes in job distribution and wage systems.

However, the experiments did not create much interest among the involved workers. From one of the four companies Thorsrud reports, that the workers "lost

---

3 Another more literary but certainly challenging exposition of the problems this tradition is facing today is given by Mathiassen, L. and Bøgh-Andersen, P.: *Systems Development and Use — A Science of Truth or a Theory of the Lie*, in this book 1986.

4 The key person was Börje Langefors. See e.g. *Theoretical Analysis of Information Systems*, Studentlitteratur, Lund 1966. More pragmatic approaches were taken in e.g. Sveriges Standardiseringskommission: *Riktlinjer för administrativ systemutveckling*, SIS-Handbok 113, Stockholm 1973 (English version: *Systems Development — A Constructive Model*, SIS handbook 125, Stockholm 1975) and, Andersen Chr. et al.: *Syskon — en bog om konstruktion av datamatiske systemer*, Gads Forlag, København 1972.

5 The tradition of March, J.G. and Simon, H.A.: *Organizations*, John Wiley, New York 1958.

6 The history of this research tradition, from its origins at the Tavistock Institute until today, is told in Mumfords, E.: *Sociotechnical System Design — Evolving Theory and Practice*, in this book, 1986.

7 Thorsrud, E. and Emery, F. E.: *Mot en ny bedriftsorganisation*, Tanum, Oslo 1970.

8 For an overview see Sandberg, T.: *Work Organization and Autonomous Groups*, Liber Förlag, Uppsala 1982.

9 See e.g.: *USA 1968/Danmark i 70'erne*, Danmarks Erhvervsfond, København 1968. *Motivation*, Danmarks Erhvervsfond, København 1969.

10 Thorsrud, E. and Emery, F. E.: op. cit., p. 9, authors' translation.

11 The four experiments are described in Emery, F. and and Thorsrud, E.: *Democracy at Work: The Report of the Norwegian Industrial Democracy Program*, Martinus Nijhoff, Leiden 1976.

interest in all of it" when it turned out that management was not interested in going into further discussion on the more important issues.[12] And in another company the attitude of the workers "gradually turned into resignation, since no important improvement in their situation seemed to come about".[13] The ideas did not really disseminate in Norwegian industry.

In Denmark eleven experiments in industrial democracy of a similar kind were carried out in the years 1969 to 1973, but they were rather based on American works on motivation and autonomous groups than on socio-technical theory. The experiments attracted some public attention, but — as in Norway — very little enthusiasm was generated among the involved workers and employers. The workers found that changes stopped before any substantial changes towards real influence had been achieved, and they were reluctant to press for more influence for fear of repraisals.[14]

Though developed in Norway, the real diffusion of the socio-technical approach in industry happened in Sweden. Here, most of the socio-technical experiments were carried out without involvement of independent researchers. They were controlled by local management and co-ordinated by the Technical Department of SAF, the Swedish Confederation of Employers. LO was, however, skeptical to this approach as expressed in a program document:

> "In its development projects, SAF stressed the individual, in a form which complicated collective solutions and the possibilities available to the trade union movement"[15]

When socio-technical analysis, in the early seventies, was introduced in Scandinavian systems design research it was not as a diffusion from the Norwegian theoretical development nor from the Swedish practical industrial experiments. Once again it was imported from England. This time in the form developed by researchers at Manchester Business School, especially Enid Mumford[16]. As Kubicek summarizes in a research overview[17]:

"Without exaggeration it can be said that the work of Enid Mumford has greatly influenced the discussion about user participation in the behavioural sciences in the seventies."

It certainly had some challenging impact on research in systems design in Scandinavia[18], but there was also an early critique of ideology from the emerging collective resource tradition. The socio-technical systems design method, as presented in an early paper[19], was regarded as anti-trade union and even anti-democratic.[20] And no matter how efficient the socio-technical method was, neither practical experience in Scandinavia nor the theoretical approach to systems design seemed to have much to do with participation and industrial democracy.

However, our critique of the socio-technical approach should not be seen as a complete dissociation from all techniques connected with the socio-technical approach. Many of the analytical "tools" that have been developed are useful in analysing work organization and production technology; and the job requirement and group autonomy criteria are, when taken seriously, really a challenge to systems designers. The problem is that these requirements seem to have disappeared in the practical application of the approach. To our understanding, theoretically and empirically, this can be explained in terms of inadequate assumptions concerning the social forces of production and the distribution of power. The critique is basically not one of techniques, but one of *strategy* — in the context of democratization.

It may certainly be true that the main features of the socio-technical approach have changed in a much more participatory and less manipulative direction during the last decade[21], but this is how we[22] met it in the early seventies when trying to formulate a research approach for democratization of systems design.

To our understanding, democratization of design and use of computer-based systems in the Scandinavian setting had to be based on stong local union involvment. In practice the socio-technical approach had failed to support this.

12 Thorsrud, E. and Emery, F. E.: *Mot en ny bedriftsorganisation*, Oslo 1970, p. 72–74, authors' translation.

13 Thorsrud, E. and Emery, F. E.: op. cit., p. 99, authors' translation.

14 For a short and clear evaluation see Tjørnehøj, H.: *Arbejdsmiljøet i jernindustrien*, Modtryk, Århus 1976. The Danish experiments are reported in: *De fire første samarbejdsforsøg*, Samarbejdsnævnet mellem LO og DA, København 1972, and Agersnap, F. and Junge-Jensen, F.: *Rapport om samarbejdsforsøg i jernindustrien*, København 1974.

15 LO: *Codetemination and the Foundation of Solidarity*, Lund 1977, p 61.

16 As early as 1968 she wrote Mumford, E and Ward, T.B.: *Computers: Planning for People*, Batsford, London 1968.

17 Kubicek, H.: *User Participation in System Design* in (Ulirch Briefs et. al. eds.): Systems Design for, with, and by the Users, North-Holland, Amsterdam 1983, p 4.

18 The tradition was developed in Scandinavia by e.g. Bo Hedberg (Sweden), Nils Bjørn-Andersen (Denmark) and Rolf Højer (Norway) who all had contacts with Enid Mumford.

19 Mumford, E.: *A Comprehensive Method for Handling the Human Problems of Computer Introduction*, Manchester Business School, 1970(?), mimeo.

20 For a detailed critique of the report see Ehn P.: Bidrag till ett kritiskt social perspektiv på datorbaserade informationssystem, TRITA-IBADB-1020, Stockholm 1973, pp. 29–32.

21 See for instance Hedberg, B.: *Using Computerized Information Systems to Design Better Organizations* in (Bjørn-Andersen, N. ed.) The Human side of Information Processing North-Holland, Amsterdam 1980, and Mumford, E.: *Designing Human Systems*, Manchester Business School 1983.

22 "We" should here be interpreted as the group of researchers in Norway, Sweden, and Denmark with whom the authors worked in the beginning of the seventies. Kristen Nygaard, Åke Sandberg, Bo Göranzon, and Lars Mathiassen were some of the more influential ones.

Hence, we had to look for an alternative based on a historical, social and political understanding of the Scandinavian situation, alternatives where the trade unions could play a major role. To do this the trade union resources in design and use of computer-based systems had to be strengthened. These were basic assumptions in all the emerging *collective resource* projects.

The projects of the Collective Resource Approach

By the end of the sixties a new platform for industrial democracy was established in Norway: a new law stated that in all companies with more than 250 employees a company assembly should be established, where one third was elected by the employees and two thirds by the shareholders. This assembly should then elect the company board by proportional vote. This legislation was seen by the unions as a necessary supplement to the socio-technical co-determination experiments, about which the Norwegian Iron and Metal Workers Union (NJMF) in 1970 said:

> "The co-determination experiments, . . . show, that possibilities exist for the development of a new and better work situation for the individual human being. But if one fails to make this kind of initiatives part of a whole they will not carry in them the possibilities of creating a real democratic situation."[23]

The unions wanted to accompany the new legislation with intense educational activities, and, based on the experiences from the first union courses dealing with the impact of computers, it was understood that planning, control and data processing were key areas in this context. Furthermore, it seemed to the unions that the existing knowledge in the area did not reflect workers' interests, and it was believed that workers would run the risk of acquiring a management perspective, if educational activities in this area were based on existing knowledge.

The NJMF project

In 1970 the Norwegian Iron and Metal Workers Union (NJMF) decided to initiate research of their own. In co-operation with researchers from a governmental research intitute, the Norwegian Computing Center, who had taught at the above mentioned trade union courses on the impact of computers, an application was prepared for the Royal Norwegian Council for Scientific and Industrial Research.

After some initial resistance to this "political" application, money was granted from January 1971, and the project was completed in August 1973.

When the NJMF-project was first set up the design was quite traditional: A steering committee, a project group and four associated local union clubs at four different work places. The associated clubs were to act as reference groups. The project group consisted of two researchers and two staff members from the national union, and the plan was that the researchers were to carry out a number of investigations in close co-operation with the two other members of the project group. These investigations included:

- a study of two or three computer-based planning and control systems,
- a survey of the goals of the union in areas such as working conditions and control of organizations,
- formulation of demands on computer-based systems based on the survey, and finally
- an evaluation of the need for knowledge within NJMF in the areas of planning, control and data processing. And possibly develop teaching material.

However, as the project progressed it turned out to be impossible for the involved union people to actively use the project in the daily work at the factories, the local unions, or the national unions. There was no connection between the work in the project and the action possibilities of the workers and the union. The original project design had to a large extent been copied from traditional research used by managers, management consultants etc in a context where the goals are clear and means have been discussed for decades. For the unions the situation was different. There had been no extensive discussions on planning, control and data processing and there were no established or clear goals. If the project was not redesigned it seemed likely that it would fail for much the same reasons as the co-determination experiments, from a union point of view, had failed: there was no strategic whole in which the partial results from the project could be applied.

In the fall of 1971 a new research strategy was developed. This happened at the same time as, and under influence of, the development of the highly successful strategy of the Norwegian anti-European Economic Community (EEC) movement. An important aspect of the new strategy was reflected in the new definition of result:

> "as a result of the project we will understand actions carried out by the Iron and Metal Workers' Union, centrally or locally, as a part of or initiated by the project."[24]

In this strategy knowledge was acquired when actions had made the need for new knowledge clear. It was realized that successful initiatives at the national level had

23 Quoted after Nygaard, K. and Bergo, O. T.: *Planlegging, Styring og Databehandling*, part 1, Tiden Norsk Forlag, Oslo 1973, p. 171.

24 Nygaard, K.: *The Iron and Metal Project: Trade Union Participation*, in (Sandberg ed.) Computers Dividing Man and Work, Swedish Center for Working Life, 1979, p.98.

to build on discussions, actions, etc., at the local level. The revised strategy towards new technology aimed at creating a process which would build up knowledge and activities at all levels, with the main emphasis at the local level.

The steering committee played a central role in the discussions leading to the revision of the strategy, and from then on the committee was instrumental in developing the strategy as well as in diffusing the ideas of the project within the union movement.

The new strategy was finished and presented in a report in january 1972, and the spring was used to produce a first version of a textbook presenting a union view on planning, control and data processing based on the experiences gained so far. Probably the most important change was the new role to be played by the union clubs. It was decided, as a part of the project, to try out the work practices that the people in the project believed would become commonplace in the future: that the union locals themselves investigate their important problems at the factory and in the relation between the factory and the local community, and that in this work they use external consultants as well as consultants and other resources provided by the company. At each of the four workplaces a number of working groups, consisting of union members, were formed. These groups began a process of
- building up knowledge about planning, control and data processing,
- investigating selected subjects in this area, which were considered to be of special importance by the local union clubs, and
- taking initiatives, action, towards management in order to change the use of new technology.

All the union locals chose by themselves the subjects they wanted to work with. The groups always began with discussions of practical work place problems, problems which everybody were familiar with. Attempts to analyze and to solve the problems rapidly led to requirements for new knowledge and an educational process was started.

The groups met regularly, 2–3 hours at least twice a week, and between the meetings the members did a lot of "home work", in preparing proposals, discussing with fellow workers etc. In addition to this the groups participated in different kinds of educational activities. The work of the researchers now concentrated upon supporting these groups. The investigations carried out by the groups included:
- evaluations of some of the computer-based planning and control systems in the companies, including an on-line production information system under development in one of the companies,
- evaluation of experiences from participation in the planning of a new plant,
- proposals for reorganization of one of the main assembly lines,
- a company policy action program for the club.

To illustrate the content of the work in the groups we will give a few examples from Kongsberg Våpenfabrikk (KV).

- In their analysis of the IBM planning system CLASS, the working group showed how its use inevitably led to overtime.
- A number of proposals were made for a new planning system under development at the factory. These included support of two way terminals , as opposed to the data entry terminals of the IBM system.
- Changed work organization in connection with numerically controlled machines, including shop floor programming.[25]

As an important part of their work the researchers produced a textbook on planning, control and data processing.[26] The first version was used in the initial knowledge building process in the local working groups, and experiences from their work were used in the revision of the book. The book was a key source in developing trade union courses on planning, control and data processing in the Scandinavian countries.[27]

One of the most tangible, and certainly the most widely studied and publicised, outcomes of the NJMF-project were the data agreements. These agreements primarily regulate the development and introduction of computer systems, especially aquisition of information. The first agreement was local, and it was signed in the beginning of 1974. It was followed in april 1975 by a central agreement between the Norwegian Trade Union Federation and the Norwegian Confederation of Employers. The central agreement was soon followed by a large number of local agreements and the election of numerous so-called data shop stewards, a new kind of shop steward introduced in the central agreement.

Among other things the central agreement says:

"Through the shop stewards the management must keep the employees orientated about matters which lie within the area 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."

"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

25 Nygaard, K. and Bergo, O.T.: *En vurdering av styrings- og informasjonssystemet KVPOL*, Tiden Norsk Forlag, Oslo 1975.

26 Nygaard, K. and Bergo, O.T.: *Planlegging, Styring og Databehandling*, part 1, Tiden Norsk Forlag, Oslo 1973.

27 The project is not very well documented, but besides the above mentioned reports and books we refer to Nygaard, K. and Bergo, O.T.: *The Trade Unions — new users of research* in Personal Review 4, no. 2, 1975.

representatives must have access to all documentation about software and hardware within the area of the agreement."[28]

The DEMOS project

Up to the mid-seventies the Swedish trade unions had participated in a large number of joint projects where researchers were supposed to work for both unions and employers. However, as the issue of industrial democracy was emphazised by the unions, problems began to surface quite clearly. The Swedish Confederation of Employers sat up their own development projects, and in 1975 the Swedish Trade Union Federation decided to initiate its own project: "Democratic Control and Planning in Working Life: On Computers, Trade Unions, and Industrial Democracy", the DEMOS project.

An interdisciplinary group of researchers was set up, and a project plan consisting of two parts was designed:
* in co-operation with the local unions the project group was to set up and support working groups at four different work places, along the lines of the NJMF project,
* in connection with that work the project group was to contribute to the development of alternative theories and research methods in the areas of planning, control and computer use.

The project was carried out over a four year period, during which the Norwegian strategy was modified and further developed, including a so-called negotiation model for independent trade union investigatory work as a basis for participation in management projects. The work together with the local union groups contributed to the union debate and actions relating to new technology, especially in the areas of production control and newspaper production. Textbooks with a trade union perspective on new technology and work organization were other significant results of the project, especially since they have been widely used both in trade union education and at universities.[29]

The DUE project

In Denmark local demands for support from the central union levels in the area of computers resulted in a decision to create a one week course for shop stewards. The decision was reached in 1975 and the next year the first three courses took place. In 1976 the newly established Trade Union Research Council decided to promote research on computers from a trade union point of view. In 1977 the DUE project on Democracy, Development and EDP from a trade union perspective began. The design of the project was based on the Norwegian experiences.

The project was divided into three phases:
* first a survey was made of those problems arising from the use of computers which were considered most important by shop stewards in a number of private and public companies,
* secondly, in co-operation with the local unions, the project group set up and supported working groups at three different work places, along the lines of the NJMF project,
* thirdly, the last phase of the project was used to produce reports, educational material and in other ways help to disseminate the experiences gained to the different parts of the trade unions.

Work in the first phase included a questionnaire to approximately 150 local union clubs, and visits to twelve different work places, arranged by the union clubs. The trends were similar to those of the NJMF and DEMOS projects, e.g. less influence on planning and control of work and increased supervision after the installation of new computer systems. In addition the survey showed an extremely low degree of union/worker influence on the development and use of computers, independent of the degree of participation.

In the second phase work concentrated on supporting the working groups at the workplaces, a shipyard, a large metal factory and the central post giro office.

Writing of teaching materials, teaching at trade union courses, and contributing to the union debate on new technology, especially technology agreements, took most of the time in the last phase.[30]

28 *General agreement on Computer Based Systems*, Norwegian Employers Federation and Norwegian Federation of Trade Unions, 1975.

29 The ideas behind the Demos project are described in Carlson, J. et al.: *Planning and Control from the Perspective of Labour: A Short Presentation of the Demos Project* in Accounting Organizations and Society. vol.3, no 3/4, 1978. Results are documented in Ehn, P. and Sandberg, Å.: *Local Union Influence on Technology and Work Organization — some results from the Demos Project* in (Ulrich Briefs et. al. eds.): Systems Design for, with, and by the Users, Amsterdam, North-Holland 1983, and Sandberg, Å.: *Trade union-oriented research for democratization of planning in work life — problems and potentials* in Journal of Occupational Behaviour, vol 4, 1983. For practical use there is the textbook Ehn, P. and Sandberg, Å.: *Företagsstyrning och löntagarmakt*, Prisma, Stockholm 1979.

30 The DUE project is described in Kyng, M. and Mathiassen, L.: *Systems Development and trade union activities*, in (Bjørn-Andersen, N. ed.) Information Society, for richer, for poorer, North-Holland, Amsterdam 1982. For practical use there is the textbook by the DUE project group: *Klubarbejde og EDB*, Fremad, København 1981.

The "second generation" projects

For the last decade the ideas, working practices etc. of the first collective resource projects has spread throughout Scandinavia. Local data agreements have been negotiated, data shop stewards appointed, union clubs have formed their own investigative groups, and the unions have arranged numerous courses to support the clubs in their attemps to influence the design and use of computer systems.

But although growing, the extent and impact of these activities did not meet the initial expectations. It seemed that one could only influence the introduction of the technology, the training, and the organization of work to a certain degree. From a union perspective, important aspects like opportunity to further develop skill and increase influence on work organization were limited. Societal constraints, especially concerning power and resources, had been underestimated, and in addition the existing technology constituted significant limits to the feasibility of finding alternative local solutions which were desirable from a trade union perspective.

As an attempt to broaden the scope of the available technology it was decided to try to supplement the existing elements of the collective resource strategy with union based efforts to *design* new technology. The main idea of the first projects, support to "democratic planning", was complemented by the idea of designing "tools for skilled work".

The UTOPIA project

To try out the ideas in practice, the UTOPIA project was formed in co-operation between the Nordic Graphic Workers' Union and research institutions in Sweden and Denmark. The aim was to design computer support and professional education for integrated text and image processing.

We tried to summarize our experiences in a number of principles on which we wanted to base the design. These included:
- quality of work and products,
- democracy at work, and
- education for local development.

To carry out the design work we formed a project group consisting of graphic workers, computer scientists and social scientists. The project has just been concluded after a four year period. It has contributed to the development of alternative participative and skill-based design techniques in general, as well as to more skill-based and democratic work organization in the newspaper industry, to computer-based tools which support such work organization, and to professional education for printers.[31]

The NJMF, DEMOS, DUE and UTOPIA projects are by no means the only projects of the collective resource approach.[32] Here they are chosen because of our personal involvement and the fact that they represent early attempts to contribute to "democratic planning" and "tools for skilled work" in a trade union context in Scandinavia.

The labour processes of design and use

What are the results of the collective resource research projects? To what extent were the aims fulfilled? What kind of problems did the projects run into? How did practice and theory evolve? What kind of reformulation of theoretical theses and practical recommendations did this point at? In trying to give answers to these questions the projects may be evaluated with respect to many different aspects: research strategy and methodology, education, planning and control, work organization, qualifications and technology, etc. However, in the following discussion we will focus on the projects as *inquieries into design for democratization and skill*, and only marginally touch upon the other aspects.

In our view, the systems design process must be regarded as part of a larger organizational development process. Futhermore, this process of organizational

---

31 The project is described in: Bødker, S. et al.: A Utopian Experience, in this book 1986, which also gives further references.

32 Some other projects within or related to this Scandinavian tradition are: The Dairy Project, which was conducted by architects, but used methods and perspective similar to the DEMOS and DUE projects (see Steen, J. and Ullmark, P.: *De anställdas Mejeri*, Royal Institute of Technology, Stockholm 1982). The PAAS project, which besides contributing to a theoretical understanding of changes of skills when computers are used, also contributed to methods for trade union design work (see Göranzon, B.: *Datautvecklingens Filosofi*, Carlsson & Jönsson, Malmö 1984). The Bank Project was conducted by researchers originally from the socio-technical tradition, but they worked closely with trade unions and with methods and perspective very similar to the collective resource projects (see Hedberg, B. and Mehlmann, M.: *Datorer i bank*, Swedish Center for Working Life, Stockholm 1983). The Carpentry Shop project, which worked with methods and a design perspective similar to the UTOPIA project but within a "low tech" area (see Sjögren, D. (ed.): *Nyhetsblad från Snickeriprojektet*, Swedish Center for Working Life, 1979-83). The Florence project is another project within the designing for skill oriented "second generation" of collective resource projects (see Bjerknes, G. and Bratteteig, T.: *FLORENCE in Wonderland — Systems Development with Nurses*, in this book 1986). These are examples of different, but by far not the only collective resource projects. Neither is the approach limited to Scandinavia today. Especially in Britain, despite a very different trade structure, there are several projects working with similar perspectives and methods.

development and change is seen in a broader context than traditional organizational development, including and emphasizing trade union activities as well as societal constraints and opportunities.

A central concept is that of *labour processes*. A labour process is a process to produce use values; specific products or services of some kind. These use values are laboured by man using instruments of work (specific machines, tools, techniques etc.) to refine objects of work (specific "raw materials"; goods, services, ideas, etc.). Conception as well as execution are fundamental parts of man's work in this process. The division of labour between different groups of people, their qualifications to accomplish different tasks, and the quality of the use values being produced are key aspects of the labour process in the context of democratization of work.

The design process reflects, at least conceptually and so far in most cases also practically, the division of labour in conception and execution. In the *design process* the use process is conceptualized; technology and use values, as well as work organization and requirements to skills are designed. In the *use process* work is executed given the constraints and opportunities set by the design process. The other way around, the characteristics of a given use process also sets constraints and opportunities for the design process.

In the following we will argue a number of theses concerning design, democratization, and skill, based on experience from the collective resource projects. But first we will add a brief summary of the underlying theoretical framework for our understanding of changes in work and technology — the driving forces of rationalization of labour processes.

Rationalization of labour processes

One way of describing changes in and relations between the labour processes of systems design and actual applications is in terms of the subjective aims or goals of the parties involved; managers, workers, customers etc. But sooner or later this kind of descriptions call for answers to questions like: Why are there conflicting interests between employers and workers concerning new technology and work organization? What is the rationale for the different interests in the design process? Naturally, these question also turned out to be important for the collective resource research approach. Knowledge of overall societal forces and tendencies in the change of technology and work organization helps to understand the limits to democratization and the shaping of a realistic strategy.

The collective resource projects were never really developers of labour process theory, but they constituted interesting cases for practical application and reflection. It was understood as a basic thesis that *systems design is a fundamental division of the labour process.*

Systems design reflects a fundamental division of labour, the division between conception and execution. In the labour process of design, technology, skill

requirements and organizational options for another labour process, the use process, are "frozen". The design process as well as the use process are separate labour processes, and at the same time parts of a "total" labour process. Hence,

theses on changes of labour processes must be applied to the totality as well as to the separate parts, to the division of labour between different groups of workers within the labour process of systems design, to the division of labour between systems design and the use labour process, and to division of labour within the use labour process.

Given this basic understanding, it is no wonder that the debate and research in the mid-seventies emanating from Braverman's work[33] came as a great relief and to a large extent formed the general understanding of work and technology within the collective resource approach. Braverman utilized Marx's analysis of labour processes under capitalist mode of production, and was able to formulate useful theses on principle driving forces for change of technology and work today. In summary the main theses were that the Tayloristic way of organizing work was the most adequate form for division of labour and use of technology in capitalist enterprises. Hence, there was an overall tendency by management to divide the labour process into planning and execution activities. By taking away the planning activities from the shop floor and concentrate them in the hands of management, workers would be easier to control and replace and cheaper to buy. The computer seemed to be the appropriate technology for the ultimate realization of these basic capitalist interests. Braverman himself provided striking illustrations to the theses from shop floor as well as from office labour processes that had been automated, and the theses certainly helped to understand several cases in the collective resource projects, especially those on planning and control systems.[34] Others, elaborating on the same theses, gave illustrations and important contributions to the understanding of the labour process of systems design.[35] These theses were also applied by the collective resource tradition with

33 Braverman, H.: *Labor and Monopoly Capital — The Degradation of Work in the Twentieth Century,* Monthly Review Press, New York 1974.

34 See e.g. Ehn, P. and Erlander, B.: *Vi vägrar låta detaljstyra oss,* Swedish Center for Working Life, 1978, Ehn, P. et al.: *Brytningstid,* Swedish Center for Working Life 1984, and the DUE project group: *Demokrati, udvikling og edb — Rapport fra første fase,* DUE report No. 2, Computer Science Department, Aarhus University, Århus 1978.

35 Important contributions were given by Greenbaum, J.: *Division of Labor in the Computer Field* in Monthly Review, vol 28 no 3, 1976 and by Kraft,, P.: *Programmers and Managers — the routinization of computer programming in the United States,* Springer Verlag, New York 1977.

some success as a critique of ideology of dominant systems design approaches in Scandinavia.[36]

However, there were also practical and empirical anomalies that could not be explained by these theses. Work was not deskilled in all cases. More collective forms of work organization than the Tayloristic were some times proposed by management. It happened that workers gained from the introduction of new technology etc. But this does not mean that the marxist approach to understanding changes of the labour process in a capitalist economy has to be rejected. On the contrary, today its explanatory power is greater than ever. There is now a better understanding of several important factors including:

- the relation between capital accumulation and managerial control,
- the role of class struggle at work and workers resistance,
- the importance of the specific economic, social and historical situation, in which a change takes place,
- the role of the existing technology and labour processes.

This holds for the design process as well as the use process and their relations. It is beyond the scope of this paper to go into a detailed presentation of the labour process tradition and its result.[37] However, we will present some theses we claim are important for understanding opportunities and constraints to a democratic and skill enhancing design and use of computer-based systems and tools.

Capital accumulation or generation of profits is the basic driving force in changes of labour processes.

This means that changes that are, at least in the long run, contradictory to this interest are most unlikely to occur. Trade union demands that go further also have to take into account changes of the economic system.

Intensification of work and use of new technology are two basic strategies for capital accumulation.

This means that when a labour process changes, trade unions have to be aware of the risk that e.g. new planning and control systems may intensify work beyond acceptable limits. The main reason for introducing new technology is in many cases its ability to intensify work. Especially when technology has been stable in an industry for some time there is a tendency to lower skill requirements and intensify work. However, when really new technology is introduced this may imply increased requirements to skill, especially in the first period where experience with the equipment is sparse. In any case, trade unions will hardly be able to resist, at least in the long run, new available more productive technology, especially if other companies introduce it. This reveals the importance of conscious trade union strategies for design of new technology.

Direct control and responsible autonomy are complementary strategies for capital accumulation.

This means that even if the Tayloristic detailed division of labour (intensified, unskilled, cheap labour) in the short run is the most obvious strategy for capital accumulation it is not the only alternative. Opposition from workers and their trade unions to the detailed control (strikes, high labour turnover, absenteeism etc.) may imply such high production costs that alternatives are more profitable. Besides, possible economic advantages of using a skilled work force are lost. This opens up for complementary strategies, by Friedman labeled responsible autonomy.[38] They are based on some local responsibility, some development of skills and some co-operation among workers. This may for instance explain some of the interest from employers in socio-technical experiments. To trade unions these strategies are an opportunity for better working conditions, and at the same time a threat. It may well end up in competition between small groups of workers where common interests and solidarity are lost out of sight and where the overall control of the labour process remains firmly in the hands of management. This is even more obvious when considering the fact that the different strategies may be applied to different groups of workers within the same company. Friedman suggests that one of the determining factors in management's choice of strategy towards a group of workers is whether that group is central or peripheral to management's interests in capital accumulation and control. Skilled workers or workers in areas with labour shortage may for instance be approached differently than migrant workers, women and other resource weak groups.

However, the actual outcome of these tendencies to rationalization of labour processes is not deterministic. It depends on a lot of factors such as available technology, the economic situation, the power and strategy of workers and their

36 See e.g. Ehn, P. and Sandberg, Å.: *Systems Development — on Strategy and Ideology* in Data no 4, 1979, and, Kyng, M. and Mathiassen, L.: *Systems Development and trade union activities*, in (Bjørn-Andersen, N. ed.) Information Society, for richer, for poorer, North-Holland, Amsterdam 1982, and as a later, more theoretical critique Mathiassen, L.: *Systemudvikling og Systemudviklingsmetode*, DAIMI PB-136, Computer Science Department, Aarhus University, Århus 1984.

37 See e.g. the following Ph.D. theses Dahlkvist, M.: *Att studera kapitalet*, Bo Cavefors, 1978 for an introduction and Helgeson. B.: *Arbete, teknik, ekonomi*, Högskolan i Luleå, 1986 for an overview of trends in modern industrial sociology and, for cases e.g. Björkman, T. and Lundqvist, K.: *Från Max till Pia* , Arkiv, Malmö 1981, and Ekdahl, L.: *Arbete mot kapital*, Arkiv, Lund 1983. Internationally we can e.g. refer to books like Edwards, R.: *Contested Terrain*, Heinemann, London 1979, Projektgruppe Automation und Qualifikation: *Theorien über Automationsarbeit*, Argument-Sonderband AS 31, Berlin 1978, Noble, D.: *Social Choice in Machine Design* in (Zimbalist, A. ed.) Case Studies on the Labor Process, Monthly Review Press, New York 1979, and Friedman, A.: *Industry and Labour*, Macmillan Press, London 1977.

38 The concepts used here are based on Friedman, A.: *Industry and Labour*, Macmillan Press, London 1977, and Friedman, A. and Cornford, D.: *Strategies for Meeting User Demands — An International Perspective*, in this book, 1986.

trade unions, etc. This in a way brings us back to the beginning, adding to the objective side of societal tendencies, the subjective side of interests of different groups or classes in society, and may be formulated as a last thesis on changes of technology and work:

Class struggle is an important aspect of actual changes in labour processes. Not only of the the use process designed, but also of the systems design process and of possible integrations in the future. [39]

With this general understanding of changes of labour processes in mind, let us now turn to the developed design strategies and methods for democracy and skill.

Trade union "design" activities

The collective resource approach is, as mentioned earlier, based on the assumption that:

In democratization of design and use of new technology in Scandinavia, trade unions — especially on local level — should play an active role.

This basic assumption is certainly supported by the historical experiences of democratization in the Scandinavian countries. It is also well in line with the theoretical perspective outlined above. No doubt, it was also part of the political conviction of the people that engaged in the collective resource projects.

A main effort of the projects has been to understand the role local trade unions may play in the democratization of the use of new technology, and especially their role in the design process. Based on the experiences from the projects, this part of the paper will argue a number of theses on this specific aspect of changes in the labour processes. We will deal with internal local union work, with the union clubs' relation to management and to the "traditional" systems design process, and with the union clubs' relation to other parts of and activities within the trade unions and in society as a whole. In addition we will also discuss central union "design" activities and touch upon the role of the state.

Local union "design" activities

We will start by arguing that

the design and use of new technology requires new trade union activities.

The reasons for this are many. Traditionally trade unions have been focusing on what Sandberg[40] calls *distribution issues* such as wages, working hours, and general terms of employment. Such issues are characterized by
- relatively well developed union objectives
- clearly formulated demands, often quantified
- demands based on the workers' own practical experience
- clearly delimited, short negotiation situations.

The design and use of new technology is in Sandberg's terminology typical *production issues*. They are, on the other hand, characterized by:
- only vaguely formulated union objectives
- demands that are difficult to quantify
- practical on-the-job experiences have to be supplemented by more theoretical, technical/scientific knowledge
- the decision-making processes stretch over long periods of time, and it is hard to distinguish clearly defined negotiation situation.

Several of the prerequisites for traditional wage negotiations do not exist. As Sandberg puts it: "Constructive problem solving and the design of new models for work seem to require more deep-seated and qualitative aspects to be considered than can be easily fitted within the traditional trade union strategy. Of course, this is deeply problematic for the trade unions."[41] How to prepare and conduct negotiations? How to build up knowledge and formulate demands? How to ensure the internal union democracy; that the demands put forward are in the interest of the members and have their support? These are questions which will have to be addressed in new ways. Obviously participation in the design process gives access to important information. But is participation in the traditional systems design process really the answer to the questions? Below we will discuss the thesis that:

A participative approach to the design process is not sufficient.

39 Examples of practical design strategies and methods for trade unions developed within the frame given by these theses may be found in e.g. DUE project group: *Klubarbejde og EDB*, Fremad 1981, Ehn, P. and Sandberg, Å.: *Företagsstyrning och löntagarmakt*, Prisma, Stockholm 1979, Ehn, P. and Erlander, B.: V*i vägrar låta detaljstyra oss*, Swedish Center for Working Life, 1978, and Ehn, P. et al.: *Brytningstid*, Swedish Center for Working Life 1984.

40 Sandberg, Å.: *Technological Change and Co-determination in Sweden — Background and analysis of trade union and managerial strategies*, Temple Press, to be published in 1986.
41 ibid.

Here we will give some arguments which have to do with problems for the trade union.[42] To participate in project groups appointed by management is a trade union problem because:

- the appointed project group participants are often not trade union representatives, and if they are
- the union representatives have no real means of exerting power coupled to their project group participation, hence there is
- the risk that the union will get integrated in a generally unaltered employers' decision-making process, especially since
- the union representatives will often have to comment on alternatives and approve decisions without really having a chance to explore the questions from a trade union perspective, besides
- the return for giving management access to "shop floor information" is unclear, and
- trade union participation can in fact be part of a managerial strategy to make it easier to implement the changes planned by referring to the fact that the union has been involved, finally
- language, attitudes and values of management's technical and organizational design experts have a tendency to spread, and in fact by the end of the project it often happens that
- the trade union representative is offered some kind of expert position, and in this way the union looses access to information which its representative after all acquired while participating in the project work.

In the collective resource research projects practices to deal with these problems were tried out, the main hypothesis being that

The most important prerequisite for trade union participation in management's design process is a parallel and independent process of accumulation of knowledge on the part of the union.

A basic strategy along these lines that was tried out with local unions in several enterprises may be called the trade union investigation and negotiation strategy. The "experiments" were based on a "negotiation model" and it was stated that[43]:

" the main purpose of this negotiation model is to serve as a form within which the union may develop knowledge and realize its demands in a

democratic, efficient manner; a second objective is to facilitate what in planning theory is seen as preconditions for "quality in investigations" — for example, critical analysis, alternatives, openness. Also, from this point of view it is desirable for the union to make its own investigations and prepare its own alternatives.

More specifically, the purpose of the model and the style of organizing union work is:

- to allow the local union to obtain its own knowledge in new areas, by making its own investigations;
- to decrease the risk of the union being overpowered by management when participating in management project groups;
- to develop a basis for negotiations which is well supported by union members;
- to ensure that the working procedure itself contributes to activating and increasing the participation of union members."

According to the model, independent union investigative groups work in parallel with the company management project groups and provide a basis:

- for discussions at membership meetings and union study circles
- for union representatives in the company project groups
- for the union's position in negotiation with management.

Other potential resources for the local union are support from central levels of the union, wage-earners' consultants, and researchers. Study groups concerned with the actual problem area, for instance with work organization, may serve as reference groups for the investigative groups and for the external experts.

---

42 The arguments in this part of the paper are based on Ehn, P. and Sandberg, Å.: *Local Union Influence on Technology and Work Organization — some results from the Demos Project* in (Ulrich Briefs et al. eds.): Systems Design for, with, and by the Users, Amsterdam, North-Holland 1983 and Sandberg, Å.: *Technological Change and Co-determination in Sweden — Background and analysis of trade union and managerial strategies*, Temple Press, to be published in 1986.

43 Ehn, P. and Sandberg, Å.: *Systems Development — On strategy and ideology*, in DATA no 4, 1979, p. 52.
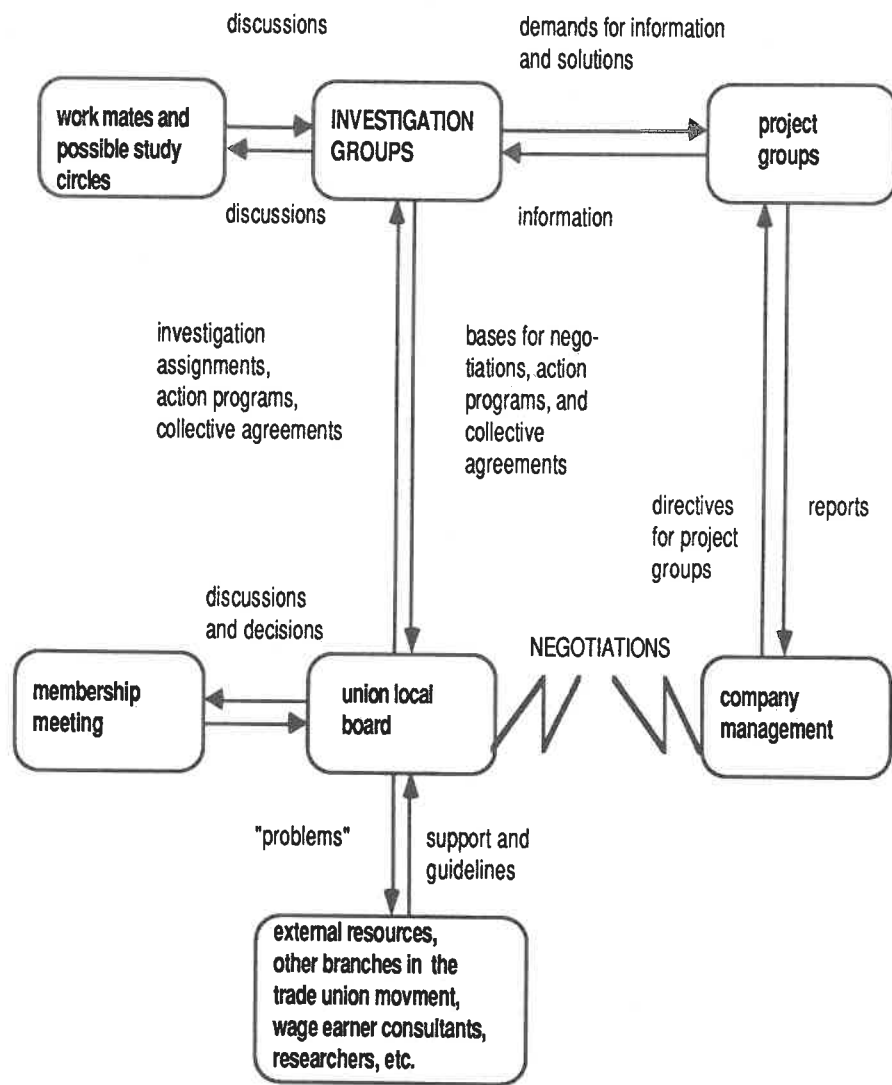
Figure 1: *A "negotiation model" for independent trade union investigatory work and participation in management's project groups.*

In practice the strategy has proved workable and most useful, thus demonstrating strong support for the hypothesis above. But there are basic obstacles as well. The most important one being the limited resources at the local unions' disposal. The strategy is extremely resource-consuming from the trade union's point of view, and even if it does its best the local union cannot really compete with management. Sandberg remarks that "in our type of society, it is seldom in the

position to build up a knowledge base, or plans which compare to those of management in quantity and quality — even if it has the advantage of being better able to involve employees and use their experience. This is true even if management is not always the well informed protagonist it is sometimes assumed to be."[44]

Another aspect of the limited resources has to do with priority. Design of new technology and work organization is a new and certainly very important issue for local unions, but there are other issues which are just as important and even more crucial to their ultimate democratic objectives, e.g. daily contact with the members, broad studies, etc. A central question for a local union is thus how important the change in technology and work organization is for the members, and whether it should participate and do its own investigation or not.

Given the limited resources, the trade union investigatory working groups in most cases have to desist from full participation in the design process. A realistic approach might be a "shadow investigation" covering aspects of specific interest to the union such as changes in qualifications, work organization, work environment and employment. A complementary way might be to require supp -lementary investigations from the company design group specifically addressing these issues.

Practical experience also indicates that some of the problems connected with a strategy based on participation only, affects this approach as well. This is true, for example concerning the risk of the trade union representatives acquiring a technical expert language and a management view on the problems. In some cases these representatives even make a career for themselves and leave their work mates behind. Of course, this makes those parts of the strategy aiming at securing internal union democracy, such as broad discussions at meetings of members and study groups to activate a well informed membership, key elements of the strategy. It has also been observed that some employers counter-act the strategy because they find it too militant, too time and resource consuming, or simply too threatening to have a really well informed union. However, to sum up, our empirical work on strategy supports the thesis that:

> *The union investigation and negotiation strategy is a democratic and workable complement to traditional design strategies. But it is very resource consuming for the local unions.*

The practical experience also points at the supplementary thesis that:

> *Local unions need external resources and support in their design activities.*

Such basic resources are wage-earners consultants and central union officials who have access to the work place and information on the planned changes in order to support the local union and its investigatory groups.

---

44 Sandberg, Å. op. cit.

But because of the limited resources at the unions' disposal, and the associated problems with internal union democracy, still other strategies for designing technology and work may be recommended. One such strategy that some unions have been practicing is a modification of the traditional strategy of wage negotiations.

Rather than doing its own investigations concerning a specific project, the union can emphasize the development of fundamental union principles, e.g. the right of existing workers to operate the new technology, and the right to qualified training and education. Once such basic principles have been established through negotiations, then perhaps the actual design can be carried out by participation in management's project groups. An essential prerequisite for these negotiations is then a long-term union activity formulating the fundamental principles, e.g. the development of local union action programs. Furthermore these long-term activities should be carried out in such a way that strong mobilization of the members can occur around the fundamental principles in times of concrete negotia-tions. Another prerequisite for the strategy is that management really has the resources, competence, and will to carry out the investigatory work spelled out in negotiations, e.g. on the consequences on qualifications and required complementary education.

Besides the fact that these prerequisites are not always present, there are other risks in this strategy. While the union is involved in working out fundamental principles and negotiating these, the company may take concrete steps which make it either difficult or impossible to realize these fundamental principles. The strategy also implies the risk that the union will fail to accumulate the techno-logical and design competence which enables it to determine whether or not management's proposals for new technology and organization are in agreement with the union's basic principles.

Nevertheless, this modified traditional mobilization and negotiation approach is a good alternative candidate for local trade union strategy concerning the development and use of new technology.[45]

A more general conclusion has to be that because of the limited resources at a local union's disposal

> *the practical application of the local union strategy has to depend on the particular prerequisites in each case.*

The three strategies outlined above (participation only, investigation and negotiation, and mobilization and negotiation) all have their problems. They may be seen as empirically based "ideal types", and in practice there will be combinations. However in the context of democratization it is important that the problems associated with each strategy are kept in mind, either as restrictions or as

limits which have to be overcome. Below we will sum up some of the conditions which may have an influence on the choice of strategy. The list includes:
- actual resources available for the local union in a specific situation
- management's resources and strategy
- relations to other unions in the company
- degree of harmony or conflict between management and the local union in the specific area of change
- type of change and the union's experiences with it
- type of change and how important it is to the work force
- degree of harmony or conflict between different groups of workers and different trade unions in the specific area of change.

The last point has empirically turned out to be crucial to the success of trade union efforts to influence new technology and work organization. This is because new technology tends to imply changes in the labour process which make traditional division of labour between different groups of workers obsolete. For instance, there are often changes affecting the distinction between planning an execution of a specific task. Since jurisdictions between different unions are often based on the division of labour within the traditional labour process, especially between blue and white collar workers, the changes of the labour process is a potential source for jurisdictional disputes. When not overcome, these disputes have in practice been severe obstacles to the development and use of collective resources to support the shaping of more democratic work organizations. This problem is also true for different groups within the same union. There is a tendency that stronger groups within the union support solutions at the expense of weaker groups of workers. The stronger groups are often skilled and male dominated groups, or groups which in the short run benefit from a specific change in the labour process, whereas the weaker are often unskilled or female groups, or groups which are specifically threatened by the specific change.[46] Hence, to be successful:

> *a local trade union strategy has to be based on solidarity between the different groups of workers involved, a solidarity which goes beyond the traditional division of labour in the labour process and the traditional jurisdictions between the unions involved.*

Such a solidarity could for instance be based on principles like that no one group of workers should be the victim of the new technology. Furthermore, that appropriate educational programmes are offered to all groups which are involved over a longer period of time.

45 Good examples of the strategy are given in the case study Ehn, P. et al.: *Brytningstid*, Swedish Center for Working Life, 1984.

46 See e.g. Dilschmann, A. and Ehn, P.: *Gränslandet* , UTOPIA report no. 11, Swedish Center for Working Life, 1985, Ehn, P. et al.: *Brytningstid*, Swedish Center for Working Life, 1984, and Ekdahl, L.: *Att bli maskinens herrar*, UTOPIA report no. 19, Swedish Center for Working Life, 1984.

Before leaving the issue of local trade union strategies on the design of new technology and work organization, we will comment upon a common objection to the involvement of trade unions. It is sometimes argued that democratization is best achieved by workers participating in the day-to-day decision-making process in the work organizations, and not via trade unions. We do not at all object to the importance of workers' participation in planning and decision-making in the work organization, but due to our experience we claim that:

a clear distinction based on negotiations between union and management roles in the design process is not in opposition to, but a prerequisite for the democratization of co-operation and decision-making in the work organization.

Central union "design" activities

Even if local union work is the key element in the outlined trade union approach there is also strong evidence that,

local trade union design efforts have to be supplemented by central union design activities.

Above we have pointed at the need for central union support to the local union design activities. Another central union activity which is crucial for a more democratic use of new technology has to do with the frequent observation that

the existing technology in many cases restricts the possibilities to locally reach trade union objectives, especially with respect to skill, but also with respect to work organization.

Hence,

central trade unions must influence the process of research and development of new technology to change the supply of technological and organizational solutions.[47]

The most obvious way of doing this is to try to influence national policies and programmes on technical research and development in a direction which promotes more skill-based technology and democratic work organizations. The firm links in Scandinavia between the trade union movement and the social-democratic parties often in government, ought to be a good basis for such a strategy. We will return to this possibility in a later discussion of national activities on design for democracy and skill.

But the major arguments for parallel and independent accumulation of knowledge on the part of the union, which we discussed above in relation to local activities, holds just as well at the central level. One way of contributing to such an accumulation of knowledge is to support specific technological research and development projects, such as the UTOPIA project. Furthermore the case of UTOPIA demonstrates that:

there are possibilities to design new technology based on social criteria such as skill and democracy at work.

It also demonstrates the possibility of involving researchers as well as software and hardware suppliers in design processes on the basis of such criteria. Naturally the suppliers' interest will depend on whether or not they can foresee the possibility of a profitable market. Of course there are many problems involved in such a co-operation, and the obstacles may be too hard to overcome, but never the less it has been demonstrated that such "new alliances" may be possible under certain conditions.[48]

But not only the supply of new technology must be influenced.

Equally important is a trade union strategy to influence the demand for these technological and organizational alternatives.

This involves two processes. On the one hand to support the members with information about the alternative options so that they can demand such solutions locally. On the other hand the central union has to try to negotiate national agreements with the employers, agreements that support the introduction of such technological alternatives and the necessary complementary training and education. Again this is not to say that the prerequisites for doing this generally exists. That will depend on factors like how productive and cost effective the alternatives are, what kind of concern there is for product quality among the employers, how militant or anti-union the employers organizations are, whether they will find it threatening with a technology that strengthens the workers' influence on the labour process because they obtain higher skill and more control over planning. And of course it will depend on the strength of the union. However, international trade union co-operation for common concrete requirements to new technology for democracy and skill — not just general ideas — and a common strategy to influence demand as well as supply of such technology on the market, as in the case of the Scandinavian graphic workers' trade unions and UTOPIA, will certainly increase the possibilities of success.

But the development of the skills of the work force has to be supported as well. There are at least two aspects of this problem. One has to do with the skill

---

47 Ehn, P. et al.: *Training, Technology, and Product from a Quality of Work Perspective — A Scandinavian research project on union based development of and training in computer technology and work organization, especially text and image processing in the graphic industry.* (Research programme of UTOPIA), UTOPIA report no. 2, Swedish Center for Working Life, 1981.

---

48 The UTOPIA project group: *An Alternative in Text and Images,* Graffiti no 7, Swedish Center for Working Life, 1985 and, Bødker, S. et. al.: *A Utopian Experience,* in this book 1986.

required to participate in the design process locally, and another with the skill required to professionally use the new technology. Hence,

> *central trade unions must provide training with a trade union perspective on new technology and work organization, and influence the supply of professional training for skilled work.*

A new Scandinavian model?

In a democratic society the state should play an important role in supporting research and development of a more democratic technology. And this applies to the process as well as to the results.

One approach to this problem may be labeled the "new Scandinavian model" for technological research and development. So far it is just an idea or a perspective with only few practical examples. The idea may be outlined as follows[49]:

- technology which supports good working conditions and good use quality products should be developed
- the trade unions should play an active role in formulating requirements to this technology, since they are best fitted to capture and draw upon the employees' knowledge and experience of work and working environment
- this helps developing technology which satisfies the demands of the employees, and that is useful, since it is based on their practical knowledge of the labour process
- this is a unique opportunity and resource which the Scandinavian high tech industry should utilize
- and the governments should foster and support such activities with national and Scandinavian research and development programmes
- furthermore, the traditionally calm labour markets make many sectors of Scandinavian industry good "test sites" for these technological and organizational alternatives
- and give opportunities for domestic markets of realistic size for at least initial production of this kind of technology, especially if the demands for it are supported by the trade unions and by government requirements
- in the long run this kind of technology which supports quality of work and products will give Scandinavian industry opportunities in foreign markets.

As pointed out earlier, there are only few activities going on along these lines today, and it would not be correct to describe it as a trend. Furthermore, other future scenarios would probably be more realistic. However, there is a growing concern, and in our opinion

49 For more details see Sandberg, Å.: *Technological Change and Co-determination in Sweden — Background and analysis of trade union and managerial strategies*, Temple Press, to be published in 1986.

a strategy like the "new Scandinavian model" is a promising approach to support more democratic design and use of new technology.

Needless to say, this approach has to be accompanied by changes in the public educational system. One important aspect is to enhance the designers' interest in and qualifications for dealing with this kind of objectives for technological and organizational development. Another, just as important, aspect is to provide good opportunities for qualification and requalification of workers in different branches of industry. What we have in mind is not short retraining courses, but real professional education fostering technological skills as well as genuine understanding and practical mastering of tools and materials in specific labour processes. Again, this may turn out to be just pious hopes. But it is hard to see how a democratic development and use of new technology can be achieved without these prerequisites being fulfilled.

Design for democracy and skill

So far in this paper we have basically discussed democratization of system design in Scandinavia today, and we have especially been concerned with the role of trade unions.

In this last section of the paper we will argue some theses on *the specific design perspective*, including tools and techniques, that is an important part of the collective resource approach. First we will make some remarks on tools and techniques for local union design work, and finally we will add some more general theses on design for democracy and skill.

Tools and techniques for local union "design" work

Within different collective resource projects much effort has been put into developing tools and techniques for local union investigatory work. One approach has been to "translate" traditional tools and techniques into the local union's specific situation. This includes planning instruments like the systems approach, systems descriptions, scenarios, check lists, etc[50]. Some problems which have to be taken into account are:

- the limited resources (time and money) at the local union's disposal
- the specific goals of the trade union
- the trade union practice of only short preparations before decisions

50 Good examples of trade union adopted methods are given in the textbooks Ehn, P. and Sandberg, Å.: *Företagsstyrning och löntagarmakt*, Stockholm, Prisma 1979 and, the DUE project group: *Klubarbejde og EDB*, Fremad 1981 and in Ehn, P. et al.: *Brytningstid*, Swedish Center for Working Life, 1984.

- the inexperience of most workers with theoretical and abstract work and of writing documents
- the comprehensive, often tacit knowledge of the workers concerning the labour process
- the lacking insight of most workers into planning and administration of the company.

A general experience is that the tools and techniques used, and the results produced must be concrete and reflect the experience of the workers. If, for instance, scenarios are used they must be very realistic. Tools and techniques for description of existing and future labour processes must again reflect the experience of the workers. They shall of course be theoretically and technically sound. But it is very important that they are quick and easy to use. On the other hand check lists, though partly reflecting the ideal above, and some times very useful for getting started, seem to passivate and counteract a process of collective learning.

Most tools and techniques that have been developed aim at supporting group discussions. They may for instance help building up comprehensive knowledge of pros and cons of the present situation in the company with regard to work organization, planning, and technology, taking into account aspects like work environment, work content, skill requirements, general employment, production control, union co-operation, etc.

Another area which the tools and techniques may support is the understanding of plans and changes in the company, such as decisions taken on investments in new technology.

Visits to other companies which have the most advanced technology to exchange experiences with workers and trade unions, as well as visits to trade shows and co-operation with researchers and systems designers have shown to be a most useful way to accumulate knowledge on external prerequisites for change in technology and work organization in the "own" company.

The tools and techniques may also help to formulate concrete demands to the future employment, education and training, and work organization. Especially the process of formulating a future work organization based on new technology which is not just a replica of the already existing work organization with minor corrections made for some of the known problems, has turned out to be difficult. However, some tools and techniques for this work, like the use of "mock-ups" and use labour process oriented and icon-based description tools like an "organizational tool kit" for a specific type of production may be useful.[51] To sum up we will

conclude that some useful tools and techniques for local union investigatory work have been developed and that there is strong empirical support for the thesis that:

tools and techniques for local trade union "design" work have to reflect the specific conditions of the work such as a trade union perspective and the limited resources available.

A challenge to designers

Below we argue a number of more general theses on design of new technology. The theses are based on experiences from the collective resource project, especially the UTOPIA project. They concern technology to be used in some material production labour process, but most of them apply, possibly with some modification, to development of consumer goods and services as well.[52]

It should be observed that some of the theses are idealistic — they presuppose organizational settings that are not common place in Scandinavian working life today. The required conditions for the proposed ways of deliberated communication and co-operation between designers and users do not normally exist. The users we have in mind, i.e. ordinary members of a union who use computer-based systems in their daily work without having much power in the organization where they are employed, will normally not have this access to skilled designers. Furthermore, the outlined perspective is not very well supported in training and education of designers today.

However, we find it important to discuss utopian design perspectives. They are needed for designers as well as for trade unions as illustrations of theoretically sound possibilities that may be realized under certain conditions. There ought to be a relation between the demands for more democratic conditions for systems design, and how this democratization may be utilized for better quality of work and products. This should especially be a challenge to designers who want to design for democracy and skill. One should, however, note the importance of the following discussion of our assumptions about the utopian conditions, as illustrated by the fact that some of the advice given below contradicts other given earlier and pertaining to the less favourable conditions of traditional Scandinavian systems design today.

Design of computer support is design of (conditions for) labour processes.

This statement is evident for many of the newer applications such as text-processing and other office automation equipment as well as work stations for computer aided design and electronic page make up. However, the statement holds

51 For example of "tools" see Sjögren, D.: *The Work Organization Tool Kit* in Dilschmann, A. and Ehn, P.: *Gränslandet*, UTOPIA report no. 11, Swedish Center for Working Life, 1985, Bødker, S. et al.: *A Utopian Experience*, in this book 1986 and, Bødker, S.: *Utopia and the Design of User Interfaces*. Precedings of the Aarhus Conference on Development and Use of Computer Based Systems and Tools, Aarhus, 1985.

52 This part of the paper is based on Ehn, P. and Kyng, M.: *A Tool Perspective on Design of Interactive Computer Support for Skilled Workers* in Proceedings of the Seventh Scandinavian Research Seminar on Systemeering, Helsinki, 1984 and Bødker, S. et. al.: *A Utopian Experience*, in this book 1986.

equally for most applications including production control systems and accounting systems. But contrary to this, dominating schools and practices within systems development

- reduce the jobs of workers to algorithmic procedures, and
- view people and computers as information processing systems, on which the designed data processing has to be distributed, but

labour processes cannot be reduced to information processes.

Again there is probably a great deal of concensus on this, but most development methods and description tools and techniques advocate just this reduction. A typical Scandinavian example is the methods based on the work of Langefors[53], as a more international example one may take Jackson[54]. According to these methods a new design is supposed to be based solely on an abstract information model. In the UTOPIA project we encountered great difficulties in the early stages of our work. Some of these came from the fact that our basic concepts were those of computer science only and that our design focused on information. Due to our later experiences we claim that one way to deal with this problem may be to

design use models.

The conceptual competence of users and designers are different. A use model is a means to bridge this gap in design as well as in use of the artifact under construction. The idea can be interpreted in Wittgenstein's language of "language games" and "family resemblance".[55]

The user is experienced in the application domain, and knows how to play the "language games" in the work or use situation. Similarly designers are experienced in the "language games" of systems design. The way we learn to practice new "language games" is by participating in them and by their "family resemblance" with other "languge games" we are familiar with. Both aspects are important.

We can say that a use model is a user oriented conceptual model based on the professional language related to the labour processes in question, enhanced with new concepts developed from possibilities and restrictions of the new technology being used and of external metaphors. It is instrumental in linking together the "language games" of design, education and use. In design it supports the design of functionality and user interface of the computer-based application. In education it supports activities aiming at enhanced conceptual competence. In use it supports

the user by making it possible to filter away technical distortions, i.e. to focus the awareness on the materials and products.[56]

Hardware should be considered early in the design, in parallel with software, not after.

This thesis contradicts most of the traditional system development methods, including those mentioned above. To us it is fairly obvious. As an example take text and image processing: questions concerning text screens versus graphic screens as well as possible resolutions, colour versus "black and white", etc. have to be considered in the early stages of the design. On the other hand, hardware considerations shall not bypass software, i. e. one should not try to decide on the number of characters per line or main memory size as the first thing in designing a text editor. Hardware considerations should, in all stages of a development project, be kept on a level matching the software design considerations, thus supporting the generation of new ideas. The relative success of many development projects probably comes from the fact that a lot of aspects concerning hardware, contrary to the theory, in fact enter into the design process in parallel with software.

Important aspects of labour processes — in relation to design of computer support — cannot be formally described.

This thesis is strongly supported by practical experiences from the collective resource projects. Philosophical support may be found in works of Heidegger and Polanyi on tacit knowledge and of Wittgenstein on language games[57]. Most methods on systems design also violate this thesis. On the other hand the relative success of many development projects comes from the fact that a lot of aspects, which are not described at all, enter into the design process contrary to the theory. Furthermore some of the problems involved in changing a project staff probably comes from neglect of these not described aspects.

56 The concept use model is inspired by Newman, W. and Sproull, R.: *Principles of Interactive Computer Graphics*, McGraw-Hill, Tokyo 1979, but is not seen as a mental model. For a detailed discussion about use models, refer to John Kammersgaard: *On Models and their Role in the use of Computers*, Precedings of the Aarhus Confererence on Development and Use of Computer Based Systems and Tools, Aarhus, 1985. See also Bødker, S. et al.: *A Utopian Experience*, in this book 1986.

57 Heidegger, M.: *Being and Time*, Harper & Row, New York 1971. Polanyi, M.: *The Tacit Dimension*, Routledge & Kegan Paul Ltd, 1966, and Wittgenstein, L.: *Philosophical Investigations*, Oxford Press, 1953. There is also strong support from recent theoretical works like that of Winograd, T. and Flores, F.: *Understanding Computers and Cognition — A new foundation for design*, Ablex Publishing Comp, 1986, and Dreyfus, H. and Dreyfus, S.: *Mind over Machine*, The Free Press, New York 1986.

53 Langefors, B.: *Theoretical Analysis of Information Systems*, Studentlitteratur, Lund 1966, and Lundeberg, M. et al.: *Systemering*, Studentlitteratur, Lund 1978.

54 Jackson, M.: *System Development*, Prentice-Hall, 1983.

55 Wittgenstein, L.: *Philosophical Investigations*, Oxford Press, 1953.

Professional experience with and knowledge of the labour process for which computer support is being designed are important in the design process.

With this degree of specification most people will probably agree with the statement, and at the moment we will just state that some of the theoretical arguments supporting it are the same as those mentioned above. We continue with a complementary thesis:

Professional experience with and knowledge of computers are important when designing computer support for a labour process.

This thesis too is probably rather uncontroversial. We do, however, include it, since it naturally leads, together with the one above, to the following thesis:

Design should be done with users, neither for nor by them.

Design with users is one way of fulfilling the two theses above, and we claim that the UTOPIA project is an example of its succesful implementation.

Design *for* users means that their professional experience with and knowledge of the labour process for which computer support is being designed are lacking. This means that the information aspects of the labour process get a dominating position and that the computer support tends to create unskilled jobs because the designers have no real knowledge of how to use and develop skills in the labour process in question. Among the arguments raised against design *with* users we will comment on two.

The first states that the users' knowledge about existing technology and practices makes them too conservative to participate in the design team. There is some truth in the statement, which should not be ignored. On the contrary steps should be taken to enhance the "technological phantasy" of participating users, this is discussed further below. The conclusion, however, that users should not participate in the design team, is totally wrong, first of all because it would have the consequences mentioned above, secondly because the feared user conservatism can be avoided or overcome. We believe that the UTOPIA project is an example of this. As a more striking example, also from the graphic area, one might take the invention of moveable type. Few, if any, would label Gutenberg as a "non-user technology-expert", instead they would consider him a skilled printer. In fact one might equally well apply the argument of conservatism to the designers. Again there is some truth in this, designers tend to solve problems by designing new computer systems, but getting rid of the designers is not the solution, as discussed below. Returning to the issue of user conservatism, one should keep in mind that in many cases the introduction of new technology implies deskilling, increased control, etc. In these cases conservatism, in the form of resistance to the changes, seems to be an appropriate answer.

The second argument against user participation concerns situations were no well defined user group exists, e.g. when developing production equipment to be sold on the market (as opposed to the situation where an edp department developes

a system to be used by the organization of which it is a part). In this case, it is argued, it would be un-democratic if users participated in the design. First of all this argument misses the (positive) aspects of user participation mentioned above, secondly difficulties in defining or identifying the user group can in no way justify the exclusion of users. An obvious choice would be to co-operate with the relevant trade unions.

The second alternative, design *by* users, is supported mainly by the following two arguments: It is more democratic than design with (or for) users and it avoids the use of systems designers, which is a costly and scarce resource. Both arguments are valid. But in most of the more interesting cases, the technical, design-oriented knowledge necessary exceeds that of the users. It is likely that vendors in the near future will market different kinds of fourth or fifth generation development tools with the claim that with these users can develop their own systems. The risk is, however, that these systems, instead of creating a more democratic situation, will limit the users to a narrow set of solutions.

Now let us return to the positive formulation of the thesis: design should be done with users, and the thesis that

mutual learning should be an important part of the work in a design group.

To prepare themselves and to overcome some of the problems discussed above concerning "conservatism", a design group should initiate a process of mutual learning, where users learn about technical possibilities and limitations of computers etc., and the designers learn about the professions and labour processes in question. Initially the group does not work on specification and construction but with building up a mutual understanding. In addition to discussions, visits to work-places with different "generations" of technology as well as visits to research laboratories and vendors are useful activities in the mutual learning process, as demonstrated by the UTOPIA project.

When, in the UTOPIA project, we shifted towards more design-oriented activities, we started out by using traditional, more or less formalized description methods ranging from scenarios to data flow. However, these methods did not function very well as a vehicle for communication for the graphic workers, i.e. the users. The situation was drastically improved when we built a mock-up to simulate computer supported page make-up, as discussed in the following thesis:

Design by doing.

To make it feasible for users, and designers,
* to draw on their tacit knowledge,
* to consider the labour process not only as an information process, and
* to consider not only describable aspects of the labour processes and computer support,

it is important that the design process is not based on textual descriptions only. The design group should employ tools and techniques which allow them to design

by doing, i.e. by simulating changed or new labour processes and the computer support. This implies that e.g. graphical workers can articulate their demands and wishes in a concrete way by actually doing simulated make-up work etc.

Some prototyping tools and techniques do this. But, in addition to being very costly, a prototyping tool, with its combination of hardware and software, imposes severe restrictions on the prototypes which may be constructed. As examples from the area of text and image processing one may take restrictions in screen size and resolution and lack of more than rudimentary graphics operations. In many cases simple mock-ups, made of paper, plywood etc., will allow the design group to simulate work with the computer support being designed. Obviously such mock-ups have their own limitations, but in fact by being non computer-based they can be very useful in highlighting limitations with current, and future, computer technology.

Finally a comment on our limited resources as designers. To really master the labour process of design may take a life time. In this respect the process of design has much in common with other professional labour processes, and since that is what we want to design, we conclude our list of general theses on design, by an advice:

Designers should restrict their activities to a few domains of application, and they should spend at least a year or two getting aquainted with a new area before doing actual design.

Conclusions

The collective resource approach to design for democracy and skill has been outlined in this paper. The main components of the approach are union controlled activities. Locally to influence new technology introduced at the work place. Centrally to improve the conditions for the local work through national agreements, improved education, and design projects which aim at broadening the scope of available technical solutions. Based on the experiences from such "utopian" design projects, where union members and researchers pursue union goals, we have also formulated some general theses concerning design. We have not, however, discussed democracy and skill in relation to the work of system designers "inside" the bulk of management controlled systems design today.

We claim that the practical impact of the fifteen years of research experiences in Scandinavia has been considerable, reaching also outside the Scandinavian borders. This is important, since participating in changes for democracy and skill is a key aspect of this kind of research. However, there has not only been progress. Retreats from gained positions is a considerable threat in times of recession and a new political conservatism. Not only has the role of the unions in reshaping technology and work been questioned, but also the very idea of industrial democracy. We strongly oppose these tendencies. However, an academic book is not the place were these struggles are fought.

But we also claim that the theoretical perspective the collective resource projects have contributed to, should be a challenge to anyone seriously and professionally interested in design for democracy and skill. However, theoretically it is an even more fragile plant than it is in practice. The theoretical perspective is interdiciplinary, and the methods used are unorthodox. Much still has to be researched, rethought and developed. Especially we would like to broaden the scope of the collective resource approach to cover systems design activities under less ideal conditions than those of projects like UTOPIA, and to treat the work of systems designers in more detail. Critique from researchers and practitioners is a necessary condition for this. We hope that this paper will contribute to the discussions within the collective resource approach as well as to the opening of a dialogue with those unfamiliar with the approach.