

NR 2005:5

Vision versus reality in organizational change

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ARBETE OCH HÄLSA | VETENSKAPLIG SKRIFTSERIE

ISBN 91-7045-746-8 ISSN 0346-7821



Arbetslivsinstitutet
National Institute for Working Life

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Department of Psychology
Göteborg University
ISSN-1101-718X
ISRN GU/PSYK/AVH--157--SE

ARBETE OCH HÄLSA

Editor-in-chief: Staffan Marklund
Co-editors: Marita Christmansson, Birgitta Meding,
Bo Melin and Ewa Wigaeus Tornqvist

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National Institute for Working Life
S-113 91 Stockholm
Sweden

ISBN 91-7045-746-8
ISSN 0346-7821
<http://www.arbetslivsinstitutet.se/>
Printed at Elanders Gotab, Stockholm

List of Papers

This thesis is based on the following papers:

I: Nonås K, Johansson J & Lindén G (1990) Work in Arc Welding Stations with High Technical Complexity. In Ferdows K & Karlsson C (eds.) Management and New Production Systems. *International Journal of Operations and Production Management*, Vol, 10, (2) 37–46.

II: Johansson J Å & Nonås K (1994) Psychosocial and Physical Working Conditions and Associated Musculoskeletal Symptoms among Operators in Five Plants Using Arc Welding in Robot Stations. *The Journal of Human Factors in Manufacturing*, Vol, 4, (2) 191–204.

III: Ingelgård A, Karlsson H, Nonås K & Örtengren R (1996) Psychosocial and physical work environment factor at three workplaces dealing with material handling. *International Journal of Industrial Ergonomics*, Vol. 17, no. 3, March 1996, 209–220.

IV: Nonås K & Gustafsson B (1995) *Modern work organization demands decentralized technical solutions*. P. 45–50. Proceedings of the 24th International Symposium on Industrial Robots, 4–6 October 1995, Singapore. Pub. International Federation of Robotics, Singapore Industrial Automation Association.

V: Gustafsson B & Nonås K (1995) *The operator's computer – a decentralized tool for building an efficient decentralized organization*. P. 63–68. Proceedings of the 24th International Symposium on Industrial Robots, 4–6 October 1995, Singapore. Pub. International Federation of Robotics, Singapore Industrial Automation Association.

Acknowledgement

First and foremost, I want to thank Professor Philip Hwang, my supervisor and mentor, for the interest you have shown in the importance of completing the work towards this thesis and for setting the right conditions for me to be able to do that. I've gone to our meetings with joy and curiosity to receive your critique – and always with the insight that you have given me that writing a doctoral thesis is a manageable challenge.

I also want to thank all my colleagues at the Department of Psychology, Göteborg University, and not least my colleagues in the Section for work and organizational psychology.

Many, many thanks to all my colleagues at the National Institute of Working Life, especially my fellow workers in the Researchgroup Organizational product and production development.

Thanks to my lunch companions, Agneta, Gunilla, Jesper, Karin, Karin, Kerstin, Kerstin & Sven, for letting me have a seat at your table, for support and encouragement and for all the things we laughed about.

A special thanks to my co-authors, Bertil Gustafsson and Jan Å Johansson Hanse, for the productive cooperation I've enjoyed with you throughout the years. I also want to thank my co-authors, Ander Ingelgård, Håkan Karlsson, Gunnar Lindén and Roland Örtengren.

Janet Vesterlund, I am indebted to you for your excellent help with the language in this thesis.

My gratitude to Docent Markus Selart for your examination and valuable comments to this manuscript.

Great thanks to my family, for always being there, Mamma, Pappa, Tina, Simon, Johannes, Jonatan, Michel, Tomas, Julia & Turid. I know that you're looking forward to returning to normal, everyday being together with each other as much as I am.

Kim and Jacob Kähäri, thanks for being so involved in the work I've done toward this thesis, and for bed and breakfast.

Birgitta Herloff, you have given me a most excellent role model. You have made a strong contribution to my going this far and defending my doctoral thesis.

Soly Erlandsson, I want to give you a special thanks for all your encouragement and advice during my long period as a doctoral student. You have contributed very strongly to my new start on the thesis before us here.

I also gratefully acknowledge all of you who work at the participating workplaces. This research would not have been possible without your active participation.

Finally, I would like to direct my thanks to the Working Life Fund, the Swedish Work Environment Fund and the Swedish National Board for Industrial and Technical Development for their financial support of this research.

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Introduction

Recent decades have brought great changes in the conditions in which industry operates, and many believe that the beginning of the 21st century marks a transitional period with particularly dramatic changes in how commerce and trade and work life are organized. Concepts such as a “third industrial revolution” (Magnusson, 1999), “knowledge society” (Senge, 1990) and “information society” (Forslin & Thulestedt, 1993) have been used to describe this period of transition.

Organizations are operating under ever increasing demands for change in a radically new market situation resulting from globalization, strong competition, technical development and a customer-driven market (Armenakis & Bedeian, 1999; Docherty et al., 2002; Docherty & Huzzard, 2003; Härenstam et al., 2004; von Otter, 2003). Demands for change have led to questioning, among other things, so called Tayloristic organization principles, principles that are characterized by a strict division of work with a detailed control system. In Tayloristically constructed organizations, employees are viewed as one of a number of production resources and are seldom seen as active parts with respect to problem identification or problemsolving in connection with change and development work (Norrgrén et al., 1996). The traditional Taylorism that was developed for mass production in large and stable markets meanwhile has little possibility to effectively manage today’s turbulent conditions (Morgan, 1999).

A high pace of change means that a differentiated production organization is needed that can rapidly be adapted to shifts in the market. This in turn requires organizational principles that are able to manage complexity and are based on the active responsibility and participation of all involved in watching over the market, problemsolving and development (Norrgrén et al., 1996; Pasmore & Fagans, 1992; Weick & Quinn, 1999). What can be added to this picture of a high rate of change and needs for competence in change and flexibility are research findings that show that many change projects and development programs produce unsatisfactory results (Beer et al., 1990; Beer & Nohria, 2000; Clegg & Walsh, 2004; Doyle et al., 2000; Gustavsen et al., 1996).

Has the broad wave of change that was characteristic of the 1980s and 1990s meant a transition from traditional Tayloristic organizations to new, flexible organizational forms in the 21st century? In Sweden, the understanding of organizational renewal was long founded on individual case studies. Only in more recent years has research been reported on organizations’ ways of meeting the ever increasing demands for change over time (Beer & Eisenstat, 1996; Norrgrén et al., 1996). Studies show that only a small number of Swedish workplaces can be described as flexible in terms of new management, group organization, development opportunities, decentralization of decisionmaking, change as an integrated part of everyday work etc. (Edling & Sandberg, 1996; Karlsson & Eriksson, 2000). The thesis that market changes and technical development are driving forces for development in more flexible companies has a certain empirical support. Flexible organizations are more common in companies that act in

situations characterized by a customer-adapted market, stiff competition and technical change. These are conditions that have long prevailed in the Swedish engineering industry, and it is at large workplaces in Swedish industry that new organizational forms have been pushed farthest (Edling, 2003; Karlsson, 2003). There is discussion of how sweeping the development of new organizational forms actually is, not only in Sweden but also in other parts of Europe and in the USA (Docherty & Huzzard, 2003; Osterman, 2000; Whittington, 1999).

It is against the background of increasingly tough competition and changes in knowledge requirements that demands for organizational renewal have been and still are of vital importance to the survival of organizations. These demands have also contributed to a gradual abandonment of Tayloristic organizational principals. Developing change strategies is a path toward adapting to the changes in business conditions that most organizations currently face. Questions nonetheless emerge about how deep the understanding of the need for change is and how effective organizational changes can be conducted. There are also questions about what goals are realistic in individual organizations, considering their internal and external conditions.

A number of models exist in the literature for processes for organizational change (Armenakis & Bedeian, 1999; Beer et al., 1990; Bennebroek Gravenhorst, 2003; Brown, 1997; Dunphy & Stace, 1993; Hendry, 1996; Norrgren et al., 1996; Orlikowski, 1996; Pettigrew et al., 2001; Whelan-Berry, 2003). They have several common features, although their terminology and details vary. Depending on the model used in a development process, a number of possible choices of change strategies follows.

The basis of one of the models is that organizational renewal takes place through planned, linear development. The aspiration is to reach new, stable conditions by mastering organizational, collective and individual inertia (Armenakis & Bedeian, 1999; Rendahl et al., 1996; Weick & Quinn, 1999; Whelan-Berry, 2003). Representatives of this approach see organizational change as episodic and drive change using a programmatic change strategy, that is, by employing centrally initiated, pre-established principles for development, e.g. in a detailed action program.

Another model is based on the belief that organizational renewal takes place through the integrated experiences of all the organization's members as concerns common development. The purpose is to achieve a continuous adjustment of goals and means via continuous revisions of the organization's position in relation to its surrounding conditions (Armenakis & Bedeian, 1999; Norrgren et al., 1996; Rendahl et al., 1996; Weick & Quinn, 1999). Spokesmen for this view of organizational change view development as continuous, and they drive change using a learning change strategy, i.e. by creating a series of arenas where in principle all employees participate and contribute to the development of improvement efforts.

In a third model, it is believed that continuous adaptation is the very essence of organizational renewal. Change takes place out of people's adaptation to experimentation in managing the challenges of their daily work. The model is based on a belief in people's inherent strength and efforts to make their everyday life com-

prehensible and being able to act consistently. Changes are based on action and are limited, slow and unintentional. Representatives of this model argue that changes have to do with creating space for individuals to experiment in their everyday work (Mintzberg, 1987; Nadler, 1999; Orlikowski, 1996; Stjernberg, 1993).

The concept in a fourth and last model is that organizational renewal takes place by visualizing individuals', and thus the organization's, "internal" thought models and values. As what is "internal" is not visible and is seldom the object of discussion in work life, this initially requires an open dialogue between all persons involved in an organization. The result of the dialogue here can enable collective problem identification, problemsolving and action toward a desired future, and the results of this are decisive for how lasting a change is. Representatives of this view of development question whether it is possible to plan or control change and argue that organizational renewal occurs by "exposing the foundation to understanding" in prevailing and future conditions (van Eijnatten, 2002). This can be described as walking the tightrope between structure and chaos (Brown, 1997; van Eijnatten, 2002).

In studies of companies undergoing change, it is rare that distinct individual change strategies can be linked to only one of the above models. A number of models are frequently used at the same time in an organization's change process (Gustavsen et al., 1996). Describing the different models is an attempt to conceptualize and simplify distinctive features in approaches and values. The first two models, the one concerning episodic change and the other continuous change, are well documented and hold basic concepts about the "nature of change" and thus also about what change strategies are possible. It is less certain that the third and fourth models can be seen as change models at all. They can possibly be a complement to the more established models (Orlikowski, 1996) or examples of what Norrgren et al. (1996) call "strategies in transition", where one view of the nature of change is on the ebb and another is on the rise (Walton, 1986).

The different models of organizational renewal have an impact on the more or less conscious choice of change strategies and thus also on what driving forces are mobilized in the change process. The research literature on organizational renewal and change strategies often puts the role of management in change against employees' participation (Stjernberg, 1993).

The role of the leader of change in a successful organizational change has been studied from a number of different aspects, among them in terms of management's significance in communicating visions and creating an understanding of the need of change, in implementing change processes and in process support (Arvonen, 2002; Brown, 1997; Buchanan & Badham, 1999; Caldwell, 2003; Cummings & Worley, 1993; Morgan, 1999; Norrgren et al., 1996).

The significance of the active participation of the people who are involved in organizational renewal is also emphasized in the literature and in theoretical models, although there are various understandings of what participation in fact means in changes in companies and organizations. There are also different ideas about what areas and to what extent different actors become involved in change

processes (Boonstra & Vink, 1996; Håkansson, 1995; Munduate & Bennebroek Gravenhorst, 2003; Pasmore & Fagans, 1992; Whelan-Berry, 2003).

The view of the nature of change can be decisive for what strategies appear to be possible in situations where there is a demand for new ways of thinking and development. At the same time, there are obvious difficulties in how to evaluate success and failure. Is it possible to guarantee that the efforts that are made will de facto lead to the desired results in a change process consisting of several phases during ongoing operations?

Examples are given below of how the concept of organizational change can be understood. This reasoning is followed by a selection of theories about organizational change. The theories discussed have acted as a source of guidance, both in terms of content and approach, in the empirical studies carried out in the present work. Different ways of managing change efforts are discussed against the background of theories on organizational change, i.e. what change strategies an organization employs to realize its visions of development. The application of a change strategy is made in an interaction between an organization's history, its current situation and its vision of the future, and this leads to the concept of change competence. Change competence is described here as the ability to manage changes in the environment and as a form of renewal that goes on continuously. Change competence has to do with choosing change strategies that agree with the experiences that an organization and its members have of change processes, that is, a competence that can be developed on both the individual and the organizational level. To experience change efforts, there must be an opportunity to participate in some form. Different researchers' perspectives on the significance of the involvement of those who are affected in the change process shed light on such questions as "who" participates, in which phases of a change effort they participate and what the arguments for involvement of these parties are.

Organizational Change

Definition of the concept of organizational change

Organizational change is a central and multifaceted concept in the literature on development processes in organizations. The way in which the concept of change is defined varies with the perspective and level of analysis. The ideas about change that dominate in an organization, a researcher or a consultant are probably decisive for the issues in the change process (what, who, where, why, when and how) that are placed in focus (Pettigrew et al., 2001). Some examples of how researchers define the concept of organizational change are given below.

Huber (1991) writes that change means a new position, or another position than earlier, in how an organization functions and how its members and leaders act. Porras and Silvers (1991) define change in terms of organizational development as

“a set of behavioral science theories, values, strategies, and techniques, aimed at the planned change of organizational work settings, with the intention of generating ... change in individual organizational members, leading to behavioral change and thus creating a better fit between the organization’s capabilities its current environmental demands, or promoting changes that help the organization to better fit predicted future environments” (Porras & Silvers, 1991, p. 62).

Here the emphasis is on the possibility of being able to plan organizational change. According to this definition, there are methods for changing the behavior of the members of the organization. This offers the possibility to create a better agreement between the capacity of the organization and the demands of the environment. It also indicates that the organization is able to exercise complete control over its development. These ideas about organizational change are founded upon linear logic (Gustavsen et al., 1996; Weick, 1999).

Martin (2000) expresses change somewhat differently:

“To change is to take different actions than previously. To take different actions than previously means to make different choices. Different choices produce change. The same choices produce sameness, a reinforcement of the status quo” (Martin, 2000, p. 452).

The emphasis on action and freedom of choice in the change process indicates an alternative approach to the possibilities there are to control organizational change and plan it in advance.

Communication is often allocated a key role in organizational change. It is a tool for conveying information and creating an understanding of the change process. Ford and Ford (1995) goes further and writes that

“... the change process actually occurs within and is driven by communication rather than the reverse. Producing intentional change is not a process that uses communication as a tool, but rather it is a process that is created, produced, and maintained by and within communication” (Ford & Ford, 1995, p. 544).

The intention to create and drive change by continuous testing in the form of a dialogue shows an openness toward adapting during the course of the process.

Norrgren (in Rehndahl, 1996) also defined the concept of organizational change and made a distinction between change, improvement and renewal. Change is here defined as a stepwise or fundamental change of conditions. Improvement is used in the sense of a stepwise change of existing conditions while renewal is used to describe a fundamental, radical change. Bartunek and Moch (1994) makes a similar distinction between the degree of change. First-order change covers smaller adjustments or adaptations within the prevailing value system, second-order changes are changes that mean that the prevailing value system is replaced with a new value system and third-order change is exposure and confrontation of the basic parts of an organization's value system to a very new system (Bartunek & Moch, 1994).

Orlikowski (1996) gives another and somewhat different view of the concept. She writes that organizational change "is often realized through the ongoing variations which emerge" frequently, even imperceptibly, in the slippage and improvisations of everyday activity (pp. 88-89). She also writes that an organization's renewal "is an ongoing improvisation enacted by organisational actors trying to make sense of and act coherently in the world" (p. 65). The emphasis here is on the significance of action and improvisation as things that go on continuously (although not necessarily consciously) in all everyday work situations.

Rendahl (1996), Bartunek (1994) and Orlikowski (1996) write that organizational change touches upon conditions that can only be expected in part and that thus can not be planned in detail. Notions about organizational change are then built upon interactive logic (Gustavsen et al., 1996; Norrgren et al., 1996; Weick & Quinn, 1999). This means that change is seen as a pattern of constant modifications of the work process and social interaction – modifications that come about on the basis of unexpected events in everyday work. It is assumed that it is impossible to create complete control over the organization's development; and thus neither is it possible to define an exact end result or path toward a result that has been planned in advance. Management and employees focus on creating a common picture of a desired future and test new approaches to achieve a desired goal. Attempts to test the effectiveness of different approaches are made by reflecting over strengths and weaknesses in the different change processes.

Discussions of organizational changes with representatives of different companies often show the following expression of what an organizational change is: "the only thing that can be predicted about a change is that no change follows its original plan." This is a popular definition of change that agrees well with Norrgren et al. (1996) and Weick and Quinn (1996), that is, that an organizational change is built upon interactive logic. Change follows an intention that is translated into action. As the consequences of the action become clear, it is adjusted, at the same time that a modification of the intention can take place. The organizational change grows in an interaction between plans, actions, reflections and modifications, and so on. This thesis shall be seen against the background of the ideas that organizational changes are a developing and continuous phenomenon

that this thesis. However, this does not mean that organizational changes are conducted without planning for the future. They rather express the plans that indicate a direction and allow space for reflection and modifications during the change process as a whole, i.e. a form of learning.

The thesis uses the concept of change and renewal synonymously. Organizational change means a developing, learning change, if no specific reference is made to a traditional, planned change.

The next section treats five theoretical perspectives that describe organizational change. Four of these perspectives have been developed primarily by behavioral scientists, while the so called manufacturing strategies have chiefly been developed and applied by engineers/technicians. The perspectives taken up here have dominated research in organizational change since the Second World War and still at this time affect ideas on organizational change.

Open systems theory

Organizations are seen as open, dynamic systems in a system theoretic perspective. This means that they are characterized by continuously ongoing processes of input, transformation and output interacting with a surrounding environment. To manage an organization's interaction with its environment, methods are developed for information, feedback, boundary crossing and transactions (Argyris, 1971; Katz & Kahn, 1987).

A system can be a work group, a company or an entire country. Concretely, this means that a change of some kind in the activity in a department in a company is assumed to have an impact on other departments and on the company as a whole. Thus, in each change, there must also at the same time be an awareness of and consideration to subsystems that are involved, both inside and outside the company.

Complete control over behavior can not be achieved in an open system because, among other things, of the constant effect of so called external forces. Organizations are dependent on their surrounding systems for access to raw materials, customer requirements, legislation etc. Insight into how external factors affect an organization can contribute to an understanding of a part of its internal behavior and can therefore also support change.

An open system is hierarchically constructed in the sense that a higher system level consists of subsystems. For example, a society consists of a number of organizations, which in turn consist of subsystems such as departments, groups of individuals and so on. While systems show great differences on different levels, for instance in terms of size and complexity, they also have several features in common. These common features are found at all levels of the system and contribute to an understanding that spans all levels of how open systems function. Table 1 lists characteristics of open systems (Katz & Kahn, 1987).

Table 1. Characteristics of open systems.

Energy import	open systems import energy from the environment, partly for their production and partly for their social organization
Transformation	activities in an open system transform energy, for example, into a new product or service
Output	open systems export the results of the transformation to the environment
Cyclical nature	open systems develop dynamic social structures via chains of actions that recur and are repeated
Negative entropy	an open system takes in more energy than it releases and builds up a reserve for situations of crisis
Feedback	information from outside the system for adaptation and as a foundation for decisionmaking for internal actions
Homeostatis or self-stabilization	change and activities that promote change
Differentiation	systems develop a structure over time and diffuse patterns are replaced by more and more specialized functions, which in turn require more complex integration systems
Equifinality	open systems can achieve the same goals on the basis of different initial conditions and via several different paths of action

System thinking makes it possible to study systems from several perspectives: holistic, relational and process. The holistic perspective means that it is possible to focus on different system levels individually, while at the same time taking consideration to each subsystem as being a part of the greater whole and in itself being constructed of smaller parts. The relation perspective focuses on how systems affect one another. If the relations between divisions in a concern, for example, are characterized by cooperation, the superior system (the concern) is independent in relation to its divisions. This also creates conditions for cooperation between other subsystems (departments). The greater the independence and ability to cooperate that a system has, the greater changes in its environment it can manage through self-organization. Self-organization means that the system, on the basis of the needs of the whole, is able to change the relations that exist between the different parts of the system. The process perspective focuses on the system's activity (energy import and transformation) and self-regulation (feedback and differentiation). Each process has a beginning and an end. With the process perspective, a course is followed regardless of the limits that must be passed.

System theoretical ideas about organizations have received great attention but have also been criticized. One thing that has been questioned is the assumption of homeostasis (Orlikowski, 1996). Neither is stability seen as a necessary condition for change to be possible (Cheng & Van de Ven, 1996; Mumford, 2003). An organization can manage chaos during periods of change, e.g. in the transition from one condition to another. Power is another aspect that has not been analyzed as a problem in the original theory on open systems (Huse & Cummings, 1985). It is implicitly assumed that those who do not have the power to influence accept and take on a subordinate position. The theory also assumes that there is a

common goal among all members of an organization, which can mean an underestimation of the dynamics between its members. Neither are conflicts handled in system theory. For example, issues about who has a true gain from achieving set goals are not discussed. Today, however, there are researchers who have attempted to meet this criticism. Senge in (Beer & Nohria, 2000) writes that each organization has a number of hidden issues. The reasons why they are not discussed can have to do with their implying a personal threat or quite simply that they question “undiscussable” assumptions about the organization. The research tradition that views organizations as open systems has had a great effect on other theories on organizational development. Sociotechnical systems theory is a theoretical perspective that has been influenced by systems theory.

Sociotechnical systems

The sociotechnical perspective was developed after the Second World War by psychotherapists, researchers and consultants at the Tavistock Institute of Human Relations in London who worked with recruitment and education issues and the psychological rehabilitation of soldiers injured in the war. Their feeling was that these experiences could also be applied in work organizations in industry. They also emphasized the connection between theory and practice and the integration of application and development of theories in an action research tradition (Johansson, 2004; Mumford, 2003). Action research has to do with mutual learning among researchers and members of an organization that is under study. Individuals are placed before the challenge of reflecting over what they do and do not do, for example in an everyday work situation. Their reflections can lead to an insight into alternative ways of acting and thus contribute to a change process (Boog, 2003).

The overall goal of sociotechnical systems is to optimize both social and technical systems, that is, to function in the most beneficial way through the weighing together of different factors that affect both people and production techniques. When new production systems are introduced and existing systems are developed, equally great consideration should be taken to the needs of people as to technical conditions. Sociotechnical tradition is characterized by basic assumptions. The first has to do with hidden and unconscious courses of events in the interplay between people in social situations. The second deals with viewing different parts of a system as being internally dependent. Table 2 summarizes the principles of how work should be organized according to sociotechnical theory and practice (Cherns in Mumford, 2003, pp. 24-25).

Table 2. Sociotechnical principles for work design.

Principle 1	Compatibility	The process of design must be compatible with its objectives.
Principle 2	Minimal Critical Specification	No more should be specified than is absolutely essential. But the essential must be specified.
Principle 3	Socio-technical Criterion	Variances, if they cannot be eliminated, must be controlled as close to their point of origin as possible.
Principle 4	Multifunctionality Principle	Work need a redundancy of functions for adaptability and learning.
Principle 5	Boundary Location	Boundaries should facilitate the sharing of knowledge and experience. They should occur where there is a natural discontinuity – time, technology change, etc.
Principle 6	Information	Must go, in the first place, to the place where it is needed for action
Principle 7	Support congruence	Systems of social support must be designed to reinforce the desired social behaviour
Principle 8	Human Values. High quality work requires	Jobs to be reasonably demanding. Opportunity to learn. An area of decision-making. Social support. The opportunity to relate work to social life. A job that leads to desirable future
Principle 9	Incompletion	The recognition that design is an iterative process

Sociotechnology has its theoretical origins in Lewinian field theory, psychoanalytic theory and systems theory (Pasmore, 1985) and has worked from its start for a humanization of work with a focus on the contents of the work and workplace democracy. The organization of work in groups that have a large measure of autonomy is a basis for the construction of sociotechnical theory and its application. Production systems must be formed such that work is intellectually stimulating and such that it enables the satisfaction of basic human needs. Employees must have an influence over how their own work and how their workplace is designed. According to sociotechnical theory, this is the most basic condition for high productivity.

A pioneer project in the sociotechnical school in Norway was started in the early 1960s and efforts toward industrial renewal and productivity through the development of good working conditions soon spread to other parts of Scandinavia. Sociotechnical theory came to have great importance in the Scandinavian countries for organizational development. Sociotechnically driven development work has a common value base and thus a clear message as to what people want to achieve. Sociotechnical principles were applied extensively in development programs for renewal in work life. A Swedish example is the Swedish Work Life Fund, which during the period 1990 to 1994 included 25,000 workplace programs whose purpose was to create better work environments and increase productivity (Gustavsen et al., 1996). In the international literature reference is still often made to a Scandinavian sociotechnical model (Landbergis et al., 1999; Mumford, 2003; Naschold, 1993).

Sociotechnical methods were originally characterized by the application of detailed, stepwise analyses carried out by external experts. Today, sociotechnology is a practice in organizational change, where employees and management develop new organizational forms on the basis of common, collective knowledge together with experts in supportive roles. Modern sociotechnical efforts are open, based on broad participation and focus to a great extent on the change process (Naschold, 1993).

Organizational changes according to sociotechnical principles have however not always lived up to expectations (Mumford, 2003). Efforts have often been time consuming and resource-intensive, and researchers and practitioners have faced difficulties in evaluating the actual effects in applications of sociotechnical principles for organizational change (Mumford, 2003; Scarbrough, 1995). Neither are aspects of organizational power integrated into the original construction of sociotechnical theory. It is possible that sociotechnical applications have also overestimated rational, effectivity-seeking aspects with respect to organizational behavior during change and underestimated the significance of power aspects. The democratic decisionmaking in work groups that sociotechnical theory assumes can according to some people constitute a threat against traditional organizational hierarchies. It is not an entirely natural thing for members of an organization to support change efforts that cut into their own control and power (Berger et al., 1995). Scarbrough (1995) argues that the representatives of sociotechnology have been driven by an ambition to develop guidelines and practical advice. Action research, which is the dominant research effort in the sociotechnical tradition, gives priority to practical and organization-specific applications, possibly at the cost of theoretical generalizability (a criticism directed not only at sociotechnical models). Adler and Docherty (1997) criticize sociotechnical ideas for taking insufficient consideration to economic and business conditions and to the dynamics of the sociotechnical system (Adler & CDocherty, 1997). These authors recommend a transition to a sociotechnical business system and emphasize the importance of learning and the capacity for change to a greater extent than was done in the original construction of the theory and its application.

Organizational Development, OD

The organizational development perspective is built on using the knowledge and experience in behavioral sciences to contribute to the formation of good working conditions and thus to quality of working life (QWL) and productivity. This requires planned change with an emphasis on people's resources, motivation and integration in organisations. OD is oriented toward changes in the entire organizational system and its relations with the environment.

The field of application and action research in OD has developed from a relatively uniform and limited area of knowledge to now cover a variety of theories, activities and methods. Huse and Cummings (1987) give the following picture of the development in OD. During the 1950s and 1960s, representatives of OD worked with process-oriented interventions such as sensitivity training, survey

feedback and group development. The interventions were built upon humanistic values and focused on organizations' social systems. During the 1970s, the area expanded to include structural aspects, issues concerning quality of working life (QWL) and financial results. Interventions focused on organisations' social, technical and structural systems. OD grew further in the 1980s to cover new aspects of organizational development, such as bonus systems, career planning, system planning and organizational culture. The original value base has expanded to include both internal organizational effectiveness and effectiveness in relation to the environment. Correspondingly, interventions have been broadened in order to be able to contribute to developments within organizations' social, technical, structural and strategic systems.

The following excerpts give examples of the breadth and development of OD over time:

“... as a system wide effort applying behavioural science knowledge to the planned creation and reinforcement of organizational strategies, structures and processes for improving organizations' effectiveness” (Huse & Cummings, 1985).

“... OD is now a normal part of management, the themes of structure and process have largely been integrated, and focus on culture may help integrate conflicting values ... See OD as a distinct, individual action research area with two central purposes: improving quality of working life and improving bottom-line performance outcome” (Sashkin, 1987).

“... a top-management-supported, long-range efforts to improve an organization's problem-solving and renewal processes, particularly through a more effective and collaborative diagnosis and management of organization culture – with special emphasis on formal work team, temporary team, and intergroup culture – with the assistance of a consultant-facilitator and the use of the theory and technology of applied behavioural science, including action research” (French & Bell, 1990).

Beer and Noria (2000) describe OD's value base and methods in the following way. Organizational development aims at developing organizations' capabilities to identify and solve work-related problems. The focus is on values that help to create emotional commitment starting in local experiences and knowledge. It has to do with making room for an organization's inherent capability for change. In other words, this means exploiting in a development process the natural dynamics in an organization, by encouraging experimentation with alternative solutions and taking responsibility for spreading experiences of the experimentation within the organization. This does not require a heavily planned, organization-wide change program. Bonus systems are adapted to and strengthen the growth of desirable organizational behavior. When external experts are involved in organizational development, their role is as a resource for facilitating the change process (Beer & Nohria, 2000).

The following are fundamental characteristics of change and development processes in OD (Berger, 1993; French & Bell, 1990; Huse & Cummings, 1985):

- A normative-educative strategy of change.
- Planned change based in part on facts about the current situation and an idea about the desired future. In part on assumptions about an organization's capability to solve its own problem (a data-based approach to planned change).
- Focusing goal setting and planning.
- An interactive process.
- Focusing activities on work teams.
- Using an empowerment model.
- Viewing organizations from a systems approach.

The clear focus on process that characterizes OD has its origins in part in action research, which is a vital starting point in most OD interventions.

While the OD tradition's assumptions about change processes in organizations have been very significant and have influenced organizations, they have also been criticized. Organizational development has not always lived up to expectations. Many organizational development efforts have not led to the intended changes; change efforts have occasionally even contributed to negative changes (Porrás & Robertson, 1992; Clegg & Walsh, 2004). Research within OD has traditionally been commissioned by management. Access to knowledge of behavioral science may hold a risk that the leaders of an organization exploit that knowledge to manipulate employees (Alvesson, 1993; Clegg & Walsh, 2004). A risk of manipulation of this kind can be expressed such that employees' attention is directed away from power conditions and issues about the organization's overall goals and toward issues of inter-personal relations. Ingelgård (1996), on the other hand, argues OD to be an example of an organizational theory in which economics and social psychology are integrated. The OD tradition has made a limited contribution to knowledge of how the change process is transferred from highest management to its accomplishment in organizations.

Communicative theories

Democratic dialogue is a communicative theory that was developed by Gustavsen during the 1970s. The democratic dialogue has been developed in change processes in working life and its point is to create good conditions for organizational change. Democratic dialogue is influenced by the so called Frankfurter school, that is, Apel and Habermas' theories on communicative skills (Gustavsen, 1990). A common language and common set of concepts are needed for people to be able to understand one another. Important conditions for being able to develop a common language are training, common experience and practice (Gustavsen, 1990). Representatives of the democratic dialogue assume that change processes in organizations are generated, coordinated and developed in a number of arenas. A change project is organized such that goals and tools can be developed in the

democratic dialogue between management and employees (Gustavsen, 1995). Democratic dialogue is thus a means for an indirect change effort.

A number of criteria have been formulated on the basis of experience in development processes in working life as an aid in creating conditions for an effective dialogue in organizational change (Johansson-Hidén, 1998). These criteria are not detailed instructions but rather a support for a normative orientation in initiating and realizing organizational change (Naschold, 1993). The criteria for a democratic dialogue (grouped according to the focus in the different criteria): 1) stress that group discussion is a form of argumentation, a process for an exchange of ideas and argument between the participants; 2) stress conditions and norms for the actual discussion, for example that all persons involved must be given the opportunity to participate; 3) stress the responsibility that each of the group participants has, e.g. all participants are responsible for actively expressing their own ideas and for contributing to make it possible for others to express themselves; 4) stress norms for an ongoing dialogue, e.g. the dialogue must continuously lead to agreements that create a basis for action (Johansson-Hidén, 1998; Naschold, 1993). Gustavsen correspondingly developed principles for how different forms of dialogue should be carried out (Boonstra & Bennebroek Gravenhorst, 1998; Gustavsen, 1990).

Democratic dialogue is founded theoretically on communicative theory but has also been influenced by traditions developed within system theory, sociotechnical theory and to a certain extent OD. Action research is the vital part of the application of democratic dialogue.

The communicative model focuses on dialogue and process. It has been criticized for giving little attention to issues concerning the interaction between behavioral and business aspects in development processes and the risk it may imply for weak process control (Ingelgård, 1998; Ingelgård et al., 1996). Johansson-Hidén (1998) criticizes the democratic dialogue for its indistinct connection between theory and practice.

Manufacturing strategies

Falling under the category of manufacturing strategies is a model for planned change, primarily in the manufacturing industry. A manufacturing strategy can be defined as the way in which a company manages and utilizes its manufacturing resources to support the competition strategy. A competition strategy is based on development possibilities and threats within the branch and on the strengths and weaknesses of individual companies. The competition strategy is developed following broad decisions about the means by which an organization chooses to compete. On the basis of these decisions, goals are defined that in turn can have to do with a number of factors, such as quality and cost. The goals are formulated in a number of action principles and rules for decisions for the manufacturing activity in question (Clegg et al., 2002; Hörte, 1991).

The overall goal of manufacturing strategies is to support the industry's management of conditions related to business and competition (Berger, 1993;

Clegg & Walsh, 2004). Research on manufacturing strategies has two primary directions: contents and process, where the contents includes manufacturing goals, plans and change policy within the structure and process is the formulation, implementation and establishment of the strategy (Tunälv, 1991).

A model cited in Berger (1993) states that the planning process, according to manufacturing strategy, should include the following steps: overall company goals and competition analysis, analysis of strengths and weaknesses in the competition strategy, manufacturing goals, and manufacturing structure and infrastructure. A suitable model for change is selected by the company on the basis of the prevailing conditions in the market, production volumes and production technology. The theoretical model is founded upon rational thinking, where the companies' strategic goals, choice of means of competition and efforts in manufacturing are viewed as being connected and mutually dependent.

The manufacturing industry has connections with system theory assumptions, sociotechnical principles and OD. The manufacturing strategy is also influenced by Japanese manufacturing philosophy about "changes for the better" (Kaizen), which forms the basis of "Just-In-Time" (JIT), Total Quality Management (TQM) and other aspects of lean production. The manufacturing strategy has been criticized for its overly distinct focus on planned change. It has a management perspective on change, where it is the management that is assumed to initiate, carry through and control changes. Employees that are affected by change efforts are seen as important for the results of a development effort, but their participation in the change process is given limited attention (Holman et al., 2000; Ingelgård, 1998; Ingelgård et al., 1996).

The boundaries between the different change theories are far from being as clear as they may appear in the above description. OD is possibly the theoretical school that most strongly affects perceptions of organizational change, particularly in the social sciences. At the same time, sociotechnical principles concerning the way in which work should be organized have been very important to organizational renewal. Sociotechnology has been a unifying link between different research and development disciplines (such as technology and behavioral science) during decades in which technological development has radically changed the conditions of industrial production. OD and sociotechnology share the same origins to a great extent and are highly influenced by assumptions in systems theory. OD and manufacturing strategies have been developed as a management support in change and have often been applied in the form of so called top-down efforts. Manufacturing strategies in turn have primarily to do with planned change and focus on production systems to a greater extent than the other change theories. Communicative models for organizational change have not been applied and documented as extensively as other theoretical endeavors, but it is indisputably the case that communication is of vital importance in all change efforts. Common to all the efforts that have been named here is their emphasis of methods and approaches for organizational change.

The attached work is in all cases strongly affected by system theory, OD and sociotechnical assumptions with respect to what characterizes good working

conditions and how production systems should be designed to satisfy basic human needs. In Papers I, II and III, the tradition in OD dominates in the sense that change efforts were carried out in close cooperation with management. Employees were to a great extent those who provided management, via researchers, with their experience – experience which then formed the basis for decisions on organizational change. Although all employees participated in discussions of results and conceivable paths of development, their active participation in problem identification and generating ideas was limited, both in the introductory planning and during implementation. The change process that is reported in Papers IV and V were to a large extent also influenced by the significance of the dialogue during the entire change process.

Strategies for Organizational Change

Questions about how and why organizations change have long been of central importance to many researchers in different disciplines (such as economists, sociologists, psychologists, technicians, researchers in leadership) and the result is an extensive knowledge base. In spite of this, it is difficult to explain the processes or sequences of events that steer organizational change in the desired directions. Both the individual researchers and the viewer's perspective are probably decisive for how changes and development are understood in organizations (Van De Ven, 1995; Weick & Quinn, 1999). The following section attempts to draw a picture of experiences of organizational changes in the way they are documented in the literature. The concepts of strategic planning and change strategy are first treated. The dominant change strategies are then given, followed by reasoning concerning what it means for individuals and organizations to have the capacity to manage changes. Finally, light is shed on the importance of the people who are affected by a change being participants and having influence during the change process.

Strategic planning

The word strategy has its origin in ancient Greece and means the "art of war". The concept of strategy is thus taken from military terminology and signify overall action plans that are broken down into a more short term tactical action. It is the meaning of learn term planning for the control of an organization's fate that theories and methods have been developed as support for strategic management. The following are examples of central questions in the area of strategy: "How do companies act? What are companies different? What function is filled and what values are provided by the headquarter's strategic management? What decides success or failure in an organization that works in an environment of international competition (Prahalad & Gary, 1994)?"

Strategy issues and strategic management have traditionally concerned the highest management, focused on economic results and in search of methods to realize pre-established plans. There is no generally accepted definition today of the concept of strategy (Roos et al., 2004). Chaharbaghi (1998) gives for example roughly fifty meanings of strategy. A strategy can be defined as a number of planned actions whose purpose is to achieve a particular goal or guidelines for managing a particular situation. The strategy is established in advance and is often documented in a plan. Strategy development takes places in a reiterative process that begins with an acknowledgement of where the organization currently stands and what it faces. A well formulated and well thought through strategy contributes to directing and distributing a company's internal competence and to identify changes in the environment and the measures that competitors have taken (Roos et al., 2004).

During the 1990s, strategic planning was employed to a lesser and lesser extent (Mintzberg & Westley, 1992). The connections between strategic planning and an

organization's results was then questioned in several studies (Mintzberg, 1990). An important reason for this was that business was becoming increasingly turbulent, which reduced the opportunities for long term planning and for setting up reasonable hypotheses about the future. The underlying assumption was that, since it is not judged to be possible with sufficient accuracy to predict future conditions, efforts should be put into learning more quickly and reacting better to changes. According to Roos et al. (2004) concepts of strategy and its applications in a company context developed from financial and prognosis-based planning to strategic management with a focus on an organization's resources. Strategy as a concept thus should according to these authors be seen more as a developing phenomenon where management and employees successively develop an understanding and a common frame of reference for action and less as a traditional, rational effort (Mintzberg & Westley, 1992; Roos et al., 2004). Strategic planning and management focus on the organizational change from the perspective of the highest management. It includes such actions as surveying the environment, developing visions, deciding about the direction of the change and allocating resources. Knowledge about strategic management is concentrated to a high degree on the relation between strategic planning and economic results (Miller, & Cardinal, 1994). Less attention has been given to the contents and process of the change (Yukl, 1998), a relationship that applies not only to the area of knowledge of strategic management.

Change strategies

The section above briefly treated the concept of strategy as a tool for the overall work of the highest management to achieve economic results, that is, with a company economic perspective of organizational change. The following gives an organization psychological perspective of organizational changes. A short history starting with the tradition in organizational development (OD) is given first, and then examples of change strategies as they have been identified in organizations. These examples are followed by a summary of what distinguishes different change strategies from each other.

Research reviews in organizational development show that there interest grew in the 1970s and 1980s in questions about issues having to do with organizational change (Alderfer, 1977; Beer & Walton, 1987; Faucheux et al., 1982; Friedlander & Brown, 1974; Porras & Silvers, 1991). Porras and Silver (1991) write

“Planned change that makes organizations more responsive to environmental shifts should be guided by generally accepted and unified theories of organizations and organizational change – neither of which currently exists” (Porras & Silvers, 1991, p. 51).

It is with few exceptions that planned change is found in the literature about organizational change during these years. One of the exceptions is in Beer and Walton (1987) who write

“as a field, organizational development will have to become concerned with the theory and practice of managing continual adaptation of internal organizational arrangements to changes in the external environment. In this capacity, intervention methods become episodes in a long-term process, and consultants become actors in a process orchestrated by general managers” (Beer & Walton, 1987).

This quote sheds light on the shifts in perspectives. First, the authors emphasize the importance of managing continuous adaptation between conditions in the organizations and conditions in the environment. Second, they stress that organizational change is carried out by the organization’s managers, possibly with the help of external consultants. The significance of putting responsibility change management internally must not be underestimated. This means that members in different positions in the organization receive experience of and an opportunity to learning with respect to organizational change – learning that has previously taken place to a great extent among external consultants.

The increasing interest in change brought with it an extensive development in knowledge in the area of planned change. In an attempt to get a broad view of the literature on organizational changes Van der Ven and Poole (1995) made a broad survey of change processes in organizations. They identified four basic process theories for organizational change: life cycle, teleological, dialectical and evolutionary. The authors argued that most of the theories on organizational development and change can be related to one or two of the four fundamental process ideals. Table 3 summarizes the authors’ classification of what they name the four basic theories of organizational change with regard to phases in the change process, activities, scope and perception of the type of change.

Table 3. Comparison of four ideal process-theories of change freely after Van der Ven and Poole, (1995, p. 14).

Ideal process-theories of change	Event sequence	Generative mechanism	Unit of change	Mode of change
Life cycle	Start-up, grow harvest, terminate, and start-up	Immanent program or regulation	Single entity	Deterministic, First-order change
Teleological	Envision/set goals, implement goals, dissatisfaction, search/interact, and envision/set goals	Purposeful enactment and social construction	Single entity	Deterministic, First-order change
Dialectical	Thesis/antithesis, conflict, synthesis, and thesis/antithesis,	Pluralism, confrontation and conflict	Interaction two or more entities	Emerges as the process unfold, Second-order change
Evolutionary	Variation, selection, retention, and variation	Competitive selection and resource scarcity	Interaction two or more entities	Emerges as the process unfold, Second-order change

The four change processes are characterized by the following. According to life cycle theories change develops in the phases: start-up, growth, harvest, interruption, start-up. The driving force is planned program or regulations. According to teleological theories changes develops in the phases: new idea/goal, implementation, poor satisfaction/failure, searching/interaction and new idea/goal. The driving forces are an intentional search for stability and new social constructions. When the change process is viewed from a life cycle and a teleological perspective, change is predetermined and aims at changes within the prevailing organizational structure (first-order change). According to dialectical theories, change takes place in the following phases: thesis/antithesis, conflict, synthesis and thesis/antithesis. The driving forces are pluralism, conflict and confrontation. Evolutionary theories state that change has the phases: variation, selection, retention and variation. The driving forces here are competition and limited resources. When the change process is seen from a dialectic or an evolutionary perspective, changes take form during the course of the process and are aimed at changing the prevailing organizational structure.

Van de Ven and Poole's (1995) distinction between change process as predetermined in detail or as phenomena that develop during the course of the process can be compared with other concepts used to describe differences in basic perceptions of organizational change, such as planned and developing (Pettigrew et al., 2001), episodic and continuous (Beer & Walton, 1987) or programmatic and learning (Norrgrén, 1996). Weick and Quinn (1999) establish in their review of the literature that an important development during the 1990s has to do with just those differences between organizational change being seen as an episodic process (episodic, discontinuous and intermittent) or as a continuous process (continuous, evolving and incremental).

A question that comes up in comparing the two different ways of viewing organizational change is whether it is possible at all to reach success in change and development efforts in complex and turbulent environments, if change is managed as a planning problem. It is also justifiable to discuss the basic assumption about what change can imply against the background of discouraging results of many change efforts (Beer & Russel, 2000; Clegg & Walsh, 2004; Ingelgård, 1998). The pace of change has led to extensive experience of change projects. Some experience has had to do with failures with respect to achieving the intended changes. This has made the following question increasingly interesting: what change strategies contribute toward the desired results? The next section treats change strategies starting from the above review of the most recent decades' view of organization change as evolving, continuous and planned, episodic.

Strategies for emergent and continuous and for planned and episodic organizational change

Change strategy is treated here as a question about how an organization manages different phases of change work, that is, a collective expression of how an organization attempts to realize its visions of survival and development (Norrgrén et al., 1996). In other words,

“the change strategy is a developed pattern of behaviour towards the nature and organization of a change project as regards the opportunities for participation and insight on the part of those affected” (Håkansson, 1995, p. 225).

A number of researchers contrast episodic, planned change and continuous, emergent change from dimensions such as organizational metaphor, time perspective, analytical frame of reference, intervention theory and the role of the change agent (Dunphy, 1996; Munduate & Bennebroek Gravenhorst, 2003; Weick et al., 1999). Table 4 summarizes the differences between episodic and continuous changes with respect to underlying assumptions about the organization, pace of change, nature of change and activities for driving change and the role of the change agent.

Table 4. Episodic and Continuous Change, freely after models by Munduate and Bennebroek Gravenhorst (2003, p. 4) and Weick och Quinn (1999, p. 366).

	Episodic	Continuous
Metaphor	Reach new equilibrium	Constant adjustment and growth
Tempo	Short time-span development of radical change	Sequence of events in the development of incremental change
Analytic framework	Change is intentional and has dramatic impact	Change is a pattern of endless modification in work processes and social practice
Intervention	Change is created by intention and Lewinian: linear and requires outsiders intervention	Change is a redirection of what is already under way, and cyclical, without an end state
Change agent	Role: Prime mover who creates change, replacement Focus on inertia and seeks points of central leverage. Builds coordination and commitment	Role: Sensemaker who redirect change, attraction Recognize, makes salient, and reframes current pattern. Unblocks improvisation and learning

Episodic, planned and emergent, continuous changes show differences in how organizations are thought to develop (Munduate & Bennebroek Gravenhorst, 2003; Weick & Quinn, 1999). Both Munduate and Bennebroek Gravenhorst (2003) and Weick and Quinn (1999) write that, implicit in the ideas that changes are episodic are assumptions about inertia in organizations and about members of the organization being unwilling to change. Change in this kind of organization seldom comes frequently and intentionally. What contributes to episodic changes is that the organization seeks an equilibrium. The driving force for change lies in taking measures against failures that have been caused by poor agreement between internal and external demands and what the organization can achieve within the existing structure. An antithesis to the metaphor above about changes being episodic is the picture of organizations as emergent and self-organizing, where change is seen as constant, creating development and cumulative.

The tempo of change is another important dividing line between different change strategies (Munduate & Bennebroek Gravenhorst, 2003; Weick & Quinn, 1999). The tempo of change can be understood as “the characteristic rate, rhythm,

or pattern of work activity” (Weick and Quinn, 1999, p. 365). The authors describe how episodic changes often mean conducting radical adjustments in a relatively short period of time and thus as taking place under conditions of great uncertainty – unlike emergent, continuous changes that imply that a number of small events together lay the foundation for change over a relatively long time period.

A third dimension is how extensive an analytic framework is, where, according to Munduate and Bennebroek Gravenhorst (2003) and Weick and Quinn (1999), episodic on the one hand and emergent, continuous change strategies on the other show differences. Episodic changes often are radical changes with dramatic consequences in each unit in an organization during a relatively short time period. In general, an episodic change is planned in detail from an initial to a final phase and is supported and driven by a change agent. Emergent, continuous changes are rather smaller adjustments and improvements in daily activities. The driving force on the individual level can be that the change process offers attractive tasks combined with greater freedom to choose a new approach.

How changes are carried out is a fourth dimension in which planned, episodic change and emergency, continuous organizational change demonstrate differences. An episodic change strategy is often based on stepwise interventions in agreement with the assumptions developed by Lewin in the 1950s. To make change possible at all, there must be an unfreezing of prevailing ideas, e.g. organization members’ personal defenses, group norms or organizational culture. Only then can change be carried out. In a final step of change, the changes that have been made must be frozen. Even when an extensive change has been conducted, with respect to the original three-step model, the basic assumptions are still valid (Armenakis & Bedeian, 1999; Kotter, 1999; Morgan, 1999). Other assumptions by Lewin’s about episodic change are also still used.

“a) linear assumption (movement is from one state to another in a forward direction through time; b) progressive assumption (movement is from a lesser state to a better state; c) goal assumption (movement toward a specific end state); d) disequilibrium assumption (movement requires disequilibrium); and e) separateness assumption (movement is planned and managed by people apart from the system)”, (Marshak, 1994 cited in Weick and Quinn, 1999, p. 372).

When change is seen as emergent and continuous, interventions do not have to do with creating the conditions for change by affecting prevailing ideas but with making ongoing processes visible and leading them in the desired direction. Marshak (1994) writes that continuous changes have the following assumptions as their points of departure:

“a) cyclical assumption (patterns of ebb and flow repeat themselves); b) professional assumption (movement involves an orderly sequence through a cycle and departures cause disequilibrium); c) journey assumption (there is no end state); d) equilibrium assumption (interventions are to restore equilibrium and balance); e) appropriateness assumption (correct action maintains harmony);

and f) change assumption (nothing remains the same forever)” (Marshak, 1993, cited in Weick & Quinn, 1999, p. 379).

Finally, Munduate and Bennebroek Gravenhorst (2003) and Weick and Quinn (1999) shed light on the role of the change agent in episodic and in emergent, continuous organizational changes. In episodic change, it is the change agent’s responsibility to create the actual change. This contrasts with emergent, continuous change, where the change agent’s role is to contribute toward creating understanding and space for common interpretations of ongoing change. Dialogue is a way to achieve this. Dialogue in terms of

“interaction focused on thinking processes and how they are performed in past experience, enables groups to create a shared set of meanings and a common thinking process” (Weick and Quinn, 1999, p. 381).

All persons affected by a change initiative should understand the foundations of the change (Cheng & Van de Ven, 1996; Schweiger & Denish, 1991). A change agent, regardless of whether he is an internal manager or an external consultant, has a great responsibility for how employees are affected and how the change process takes place (Munduate & Bennebroek Gravenhorst, 2003).

The assumption about inertia can be decisive for whether a change is seen as episodic or emergent and continuous (Weick & Quinn, 1999). Resistance to change (an expression of inertia) has been the object of research for decades among representatives of the understanding that organizational change is of an episodic nature. This resistance has been viewed as a natural, psychological reaction to renewal initiatives. There are alternative explanations for negative reactions to change efforts that have to do with how change processes are run (Armenakis & Bedeian, 1999) and there are examples of how negative reactions have been interpreted as resistance to change when the primary focus of the resistance has been the actions of the change agent or the highest management and not the change itself. This is probably not an uncommon reaction in a so called top-down approach (Bennebroek Gravenhorst, 2003; Doyle et al., 2000).

There is a great deal of knowledge about organizational change that stems from assumptions that development is episodic and about the risks of this view (Bartunek & Moch, 1994; Strakey, 1998; Dunphy & Stace, 1993). Successful organizations risk neglecting routines, people and structures that are not factors in earlier successes (Miller, 1993, 1994). The collective knowledge on development seen as an emergent, continuous and non-episodic change process is less extensive (Orlikowski, 1996; Pettigrew et al., 2001). The following section gives examples of change strategies that have developed from the differing perceptions about what characterizes change.

Strategies in organizational change during the 1990s

Four examples of organizational change are take up here. Three are taken from research in Swedish organizations and one from organizations in the U.S. The four examples vary somewhat in their set of concepts but they have in common

that they emphasize the importance of learning in organizational change. Change work is seen as a learning process where analyses of the present situation are put together with successive decisions and carrying out the change. Learning among employees is an important part of the goal in the change work. Broad participation of the employees affected by the change work is consequently stressed.

The first example is an investigation of change processes in Swedish organizations, where Gustavsen et al. (1996) found the following five change strategies: expert-driven strategy, concept-driven strategy, technology-driven strategy, design-driven strategy and communication-driven strategy. Change strategies that are expert- and concept- driven can be said to be analytical extremes in terms of the intensity, participation, scope, knowledge base, goals etc. of the change work. In concept-driven change processes, communication is of central importance for how change processes are run. The emphasis is on extensive organizational change or parallel and simultaneous changes of all main functions in an organization. It is a relatively new phenomenon to drive organizational change in broad development efforts. Behind the idea of concept-driven is also a search for Scandinavian change patterns in cooperation and participation through dialogue between employees and management. Concept-driven change processes were represented in 28 of the 93 case studies covered in this investigation (Gustavsen et al., 1996). Expert-driven change processes are initiated and driven by people who are experts in a particular area. Change processes of this kind were found in 17 of the 93 cases studies in that investigation (Gustavsen et al., 1996).

In addition to concept-driven and expert-driven change strategies the authors found the following three strategies: a technology-driven change strategy built on the organization having learned from earlier experience when new technology was introduced. One thing learned is usually that new technology, in order to function well, places demands on organizational development, both from the perspective of problems and possibilities; design-driven change strategies are often developed from a technology-driven strategy. With experience of a number of introductions of new technology, an organization can have built up knowledge about how an integration of people-machine systems is developed. When these earlier experiences form the foundation for the next technology and organizational development, one can speak of a design-driven change process. Design in this context can be understood as design of work, workplaces or entire organizations.

Finally, communication-driven change strategy is based on the communication between management and employees being one of the important purposes of the change work. Communication-driven change strategy includes broad participation on the part of employees throughout the change process. This change strategy is closely related to the concept-driven change strategy in the sense that the communication between management and employees is the driving force in the development. The differences between concept-driven and communication-driven change strategy lies according to Gustavsen et al. (1996) in the communication-driven strategy lacking the strong policy structures that characterizes a concept-drive change strategy.

About a third of the organizations that Gustavsen et al. (1996) studies had a concept-driven change strategy. This is probably a larger portion than was the case in all the organizations that carried out change work during that time, as the selection of organizations can be seen as positive. The Work Life Fund steered the projects it supported in a direction toward adopting broad strategies.

In the second example of change strategies in Swedish organizations, Håkansson (1995) identified the following four change strategies: expert project (traditional change strategy), problem-oriented change strategy, process-oriented strategy and adoption of a broad strategy. The study was a questionnaire survey of 336 randomly selected workplaces in all branches in Sweden. Characteristic of the first change strategy, which the author called “expert project” is that it is generally started to meet a development need and that the initiative is taken by the highest management. Work is run in an expert group with a limited number of participants who propose and carry out the change. The expert project is limited in terms of the number of areas that are focused upon. A tenth of the 336 organizations in Håkansson’s study (1995) carried out change work in the form of expert projects, that is, on the basis of a traditional change strategy. What characterizes the second change strategy, which the author calls “problem-focused change strategy”, is that it is generally at the initiative of the highest management in order to manage problems that have emerged. The change work is often conducted in some form of expert group. The change work covers a number of problem areas and often also leads to change in other respects than were originally in focus. The participation of employees who are affected in change work is limited. Slightly more than half of the organizations in Håkansson’s study (1995) carried out change work using a problem-focused change strategy. Characteristic of the third change strategy, which the author calls “process-oriented change strategy” is that it can be initiated both by the highest management and on lower levels. In this change work priority is given to the process (that is, the number of arenas to which employees have access) over the contents. The change work covers a broad participation in problemsolving within a limited number of problem areas. Only three percent of the 335 organizations in Håkansson’s study (1995) carried out change work on the basis of a process-oriented change strategy. Characteristic of the fourth change strategy – called “broad strategy” – is that it can be initiated by both the highest management and lower levels. The change effort covers a number of areas and there is broad participation among employees as early as in the introductory problem analysis and planning. Employees on different levels in the organization are also given responsibility for carrying out change work. More than a third of the organizations in this study conducted change work in this way.

When an organization’s choice of change strategy agrees with its own development level, there is a good potential for achieving the goals of a change process. Organizations in Håkansson’s study (1995) that ran change work using change strategies based on an expert project or broad strategies showed a balance between the complexity in what the organization intended to change (contents) and process (i.e. how it was done) in the organizational change.

The results of Håkansson's study (1995) are based on a random selection of organizations in all branches and probably reflects the extent to which the different change strategies were applied in Sweden at the beginning of the 1990s. The process-oriented change strategy was used least frequently. This can be said to be close to an emergent, continuous change strategy. At the same time, only a tenth of the organizations carried out change work in the form of expert projects. This is the change strategy that most closely agrees with a planned, episodic change strategy. One can possibly speculatively ask whether the majority of organizations were in different stages of a transition between running change work according to an episodic change strategy and an emergent change strategy (Walton, 1985; Norrgren et al., 1996).

Håkansson (1995) finds a counterpart to what Gustavsen et al. (1996) call the expert-driven change strategy at workplaces that run change work in the form of expert projects. This is not surprising, as expert-based change projects are the traditional model for organizational development. There are also great similarities between what were described in previous sections as episodic, planned change, expert projects and expert-driven change strategy. In the same way, there are parallels between concept-driven change strategy (Gustavsen, 1995), process-oriented and broad strategies for organizational change (Håkansson, 1995) and emergent, continuous change.

A third example of change strategies in Swedish organizations during the 1990s is a study of the effectiveness of change strategies in 69 organizations (Norrgren et al., 1996). The authors describe a programmatic change strategy and a learning strategy for change, based upon characteristics in change work. The programmatic change strategy uses the assumption that it is possible to identify in advance a desired future condition, a final result of the change process and the path that leads to them. Management and expertise focus often on copying one of other proven strategies to carry out changes. Certain adaptations may possibly be made to an organization's specific conditions. If proven methods are used in the right way, it is expected that they will lead to the desired effects. In a programmatic view of development, needs for change are seen as an expression of inequilibrium in the organization's natural balance. Imbalance is seen to be a result of the organization having failed to adapt itself to changes in the environment. It is also said that the organization can exercise complete control over its development. Expert knowledge and formal power among those who make the decisions about change work are expected to reduce uncertainty in the face of and during the change work. In an effort to control the change process, the focus is put on individual aspects, such as work design or the introduction of new technology or competence. A limited number of tools are used to assist in conducting the change. In general, a project group of a small number of people is appointed to have responsibility for seeing to it that the planned change is carried out. It is assumed that, with a small number of persons directly responsible for the change process, the risks that the change will develop in an unexpected direction are limited.

In the learning strategy for organizational change, change is seen as a pattern of constant modifications to the work process and social interaction that arises in active management of unexpected events in everyday work. It is assumed that it is impossible to create complete control over the organization's development. Thus neither is it possible to define an exact final result or a path toward it in advance. This does not mean that a learning strategy for change takes place without planning; it rather has to do with balancing between improvisation and a clear plan. Management and employees focus on creating a picture of a desired future and testing new approaches for reaching a desired condition. The task of management is to create the conditions for the active participation of employees. The broad change effort applies both in problemsolving and in the direction and carrying out of change. The learning strategy is based on the interaction between different groups of actors with different wills and knowledge leading to acceptance and understanding of the change. Driving organizational changes by means of a learning strategy often means a great breadth with respect to what will be changed, such as work design, introduction of technology and competence. A number of areas are managed simultaneously and with the help of a number of different tools. Table 5 shows what characterizes a programmatic change strategy and a learning strategy for change.

Table 5. Programmatic and learning strategy for change (Norrgrén et al., 1996).

	Programmatic change strategy	Learning strategy for change
Logic/Metaphor	Linear Discontinuous Deductive Driven by external examples Standardized methods Reach new equilibrium	Interactive Continuous Inductive Driven by a vision Strategic dialogue Broad problem definition
Process	Top-down Expert-driven Delimited (few persons involved) Focus on planning	Top-down / Bottom-up Empowerment Almost every employee involved Successive broadening Balance between plans and improvisation
Content	Concentration on a single or a few aspects Using demarcated range of tools	Pluralism and simultaneous focus on a wide range of aspects Simultaneous use of a wide range of tools

In a study of the effectiveness of change strategies in 60 organizations in Sweden, Norrgrén et al. (1996) found that over half of the organizations used programmatic and learning strategies at the same time in their change processes. These researchers further found that a learning strategy for change was more successful in achieving gains in effectiveness than was a programmatic change strategy. The measure of effect was based on two indices – one index covering subjective estimation of the extent to which the change work had influenced productivity,

quality level, delivery assurance, lead time and cost level and the other dealing with the extent to which the improvement work had contributed to e.g. a better work climate, greater involvement in work and increased work content.

Norrgren et al. (1996) drew the following conclusions, among others:

“Effective change is achieved when the majority of employees form an understanding themselves of *why* change is necessary and have great influence on *how* the change is carried out ... The programmatic change strategy did *not* show any relation at all with effective change work” (p. 24) ... the effectiveness of the learning strategy is partly dependent on the involvement of higher management and good process control ... the programmatic strategy’s weaknesses can not be remedied by the involvement of higher management or process control (p. 25)”.

There may possibly be a Swedish (Scandinavian) change strategy based on things long known about organization renewal. Swedish organizations are relatively democratic and often allow open discussions among the organization’s members of questions of strategy and the direction of the organization (Naschold, 1993; Norrgren et al., 1996).

Although the terminology is different, there are in terms of content great similarities between programmatic and episodic, planned change strategies and between emergent and continuous and learning strategies for change (see table 4 and table 5). An example will finally be given of organizational change in organizations in the U.S. (Beer et al., 1990). The authors studied organizational change in six large organizations during a period of four years. They discuss a change strategy that, in contrast to a more programmatic change strategy, is based on employees’ work roles, areas of responsibility and cooperation in formulating the change strategy. Successful change initiatives focus on learning in the actual work and not on abstractions such as participation or organizational culture. It places demands on the ability to create a vision about the future cooperatively between management and employees. However, it also requires the ability to find connections between the organization’s goals and employees’ personal goals. Beer (1990) suggests task alignment as an example of how a vision can be made concrete and be translated into action in order to facilitate an understanding of the condition in the organization during different phases of a change process. In Beer’s vocabulary, task alignment is a change strategy that stands in contrast to a more programmatic change strategy. Task alignment means how the employees’ roles, responsibilities and cooperation are redefined to be able to achieve both the organizational and the individual goals. Table 6 shows what characterizes programmatic change and task alignment.

Table 6. Contrasting assumptions about change (Beer, 1990, p.161).

Programmatic change	Task Alignment
Problems in behaviour are a function of individual knowledge, attitudes, and beliefs	Individual knowledge, attitudes, and beliefs are shaped by recurring patterns of behavioural interactions
The primary target of renewal should be the content of attitudes and ideas, actual behaviour should be secondary	The primary target of renewal should be attitudes and ideas should be secondary
Behaviour can be isolated and changed individually	Problems in behaviour come from a circular pattern, but effects of the organizational system on the individual are greater than those of the individual on the system
The target for renewal should be at the individual level	The target of the renewal should be at the level of roles, responsibilities, and relationships

It is managers in the line that have the prerequisites and responsibility for contributing to the development of self-reinforcing cycles of commitment, coordination and knowledge development. Beer (1990) summarizes experiences of effective change processes and writes that renewal is supported in the following process in six phases: 1) Mobilize commitment to a change effort by making a common analysis of the business and obstacles to development in temporary development teams; 2) Develop a common vision of how the unit shall be organized and led. The work in this phase is also done in temporary teams; 3) Develop consensus on a new vision. Define the competence needed to manage new work roles and a cohesion for continued development. A clear leadership is central in this phase; 4) Spread new work methods to surrounding units. There are generally strong relations of dependency between units in organizations. New ways of thinking in a delimited unit require a parallel development in surrounding units. If a change effort is meant to create cross-functional teams in a production workshop, there must be new thinking as applies to work roles and cooperation between the construction department, materials suppliers etc. Experience shows that the good example is seldom spread as rings on the water (Norrgren, 1996; Pettigrew, 2003). Beer (1990) recommends that each unit is allowed to “invent the wheel” so to speak; 5) Clarify and secure successes in the renewal process by formalizing structures, support systems and action principles. When new work roles and areas of responsibility have been tested and found to work, it is crucial to update formal systems and structures so that these support the renewal. Beer (1990) stresses the importance of not changing support systems (e.g. information, control and bonus systems) before the actual needs in a new organization are clear (Clegg & Walsh, 2004; Holman et al., 2000); 6) Pay attention to reactions during the course of the change process and adapt strategies to obstacles that have arisen. According to Beer (1990) the purpose of organizational change is to develop a new organizational resource – a gradually increasing capacity to continuously adapt and learn from this. This is not only the responsibility of management. Continuous exami-

nation of change processes is a task that must be shared by all members of the organization.

The examples emphasize the significance of:

- transferring abstract visions into concrete action;
- giving the responsibility for change to those who carry out the change;
- learning on all levels in the organization.

A number of studies (Armenakis & Bedeian, 1999; Beer & Eisenstat, 1996; Beer et al., 1990; Beer & Nohria, 2000; Ingelgård, 1998) point out that the majority of traditional change programs, based on programmatic or episodic change strategies, fail to achieve lasting change. There are even examples of change efforts being contraproductive in relation to the desired effects (Beer & Eisenstat, 1996; Norrgren et al., 1996). Few organizations limit themselves to running change work according to a pure change strategy. Most combine different strategies or possibly find themselves in a transition between different strategies (Beer & Nohria, 2000; Norrgren et al., 1996; Walton, 1985). It may seem wise to try to combine planned, episodic and emergent, continuous strategies for change, or in the terminology in the examples, a programmatic and a learning strategy for change, in order for the different strategies to combine values that are central to all organizations. At the same time, according to Beer and Nohria (2000), this is associated with great difficulties in leading change on the basis of different change strategies and still maintaining credibility, as they rest on diametrically different fundamental assumptions.

With one exception (Beer et al., 1990), it is fleeting pictures based on case studies that are used in the above examples of organizational renewal. The following section adds to these fleeting pictures four examples of long term efforts in studies of organizational change.

Longitudinal efforts

The collective knowledge on organizational changes rests to a great extent on experiences of change projects that have been run with distinct start and end points. This means for instance that if evaluations are made of the outcome of the change work, this has often taken place in a short term perspective. A number of researchers emphasize the need of knowledge about long term effects of different change efforts (Armenakis & Bedeian, 1999; Pettigrew et al., 2001).

In the first example of more long term results of organizational change, Orlikowski (1996) focused on a number of unintentional or unplanned changes after two years of studying the introduction of new technology at a department for software support. The unexpected changes were great in terms for example of work distribution, information dispersion and interaction patterns among employees. She calls these unplanned changes “situated change” and describes them as “a new pattern of organizing in the absence of explicit a priori intentions” (Orlikowski, 1996). New behavioral patterns were gradually developed in everyday work among all employees at a unit, which was a development that did not

have an expressed or conscious driving force. During a period of two years, local variations in how everyday work was done had contributed to great changes beyond what was planned in connection with the introduction of the new technology. Orlikowski (1996) questions whether organizational changes must take place intentionally, but also challenges established ideas about radical changes occurring rapidly, delimited in time and in a series of leaps. The conditions under which an action-based change perspective is useful remain to be established, according to this author. The way in which different organizational and technological conditions affect possibilities for development via improvisations in everyday work and the management strategies that are necessary are interesting questions for further research. It may be doubted that a two-year study is actually longitudinal. However, it is an interesting example of unexpected results of an organizational change and the significance of being open for the unexpected.

The second example of long term effects of organizational change is taken from the U.S. In one study, 20 organizational units in an international concern were followed for a period of seven years. Beer and Eisenstat (1996) cooperated in a change process intended to support “strategic alignment” and develop an organization’s ability to learn – a change process that was to facilitate the identification of systemic change critical to the development of the organization. This speaks against one-sided change initiatives and emphasizes the importance of focusing on both strategy and organization, structure and behavior, analysis and feeling, internal relations and the organization’s external context, a change process that would contribute to greater organizational openness. These ideas challenge prevailing assumptions, values and norms in terms of business strategy and management and are seldom the subjects of open discussion in organizations. Without a discussion about difficulties, the conditions for reaching a common vision for a development effort are limited, a change process that was intended to facilitate cooperation between all relevant actors. Beer and Eisenstat (1996) showed that the change process was successful in relation to all set goals in the short term perspective. However, the process had not raised the organization’s ability in learning, which was the long term goal. The change effort was not as successful in the seven-year perspective as it was in the shorter perspective.

The third example of long term effects of change processes is taken from the car industry in Sweden. During the 15 years between 1973 and 1988, researchers closely studied Volvo’s activities in Skövde and Vara (Forslin, 1990). This covered a 15-year-long phase from traditional hierarchical control on the basis of position and power via control based on expert strategies to control via values. The author describes a development from an authoritarian management tradition and forms of work built upon craftsmanship, via a mechanical organization to an effort for an organic organization. In a mechanistic organization, work is strictly structured and formalized. The foundation for showing desirable behaviour, i.e. obedience, is laid by its very nearly necessity of controlling structure in extreme detail. It is doubtful whether there is any actual commitment among employees; it has sooner to do with an alienated adaption. In a moderately mechanistic organization, it is possible to achieve adaptation among employees by compensating

strict demands on work with material rewards, which leads to a calculating behaviour in the organization. People do what they are paid to do, neither more nor less. According to Forslin (1990), this is a way of describing the development in the motor division in Skövde up to 1969/1970.

At the beginning of the 1970s the mechanistic organizational structure was questioned for several reasons. The conditions for industrial work were debated both as regarded the psychosocial and the physical environment. There were difficulties in recruiting and keeping personnel, and this was costly and affected effectiveness. Information about sociotechnical organizational forms spread from Norwegian industry. The Norwegian experiences showed the possibility of uniting satisfying psychosocial conditions with maintained effectiveness of production. Efforts for an organic organization were developed against this background. An organic organization was characterized by a goal-oriented, informal structure. Adaptation among employees takes place in attractive work tasks that contribute to personal satisfaction. The commitment of employees is built upon the possibility for a spontaneity that can contribute to problem-solving behaviour. This kind of commitment was most clearly shown in the units studied during periods of participation in changes, e.g. at times of new installations and working on run-ins. It was more difficult to maintain commitment during normal operations. Forslin writes that

“the goal has been and is to be able to create and maintain this commitment in everyday work by a more organic organizational structure” (Forslin, 1990, p. 278).

The fourth example of a longitudinal effort in studies on organizational changes is also taken from Sweden. This example is observations made during a period of over 20 years (the 1970s, 1980s and early 1990s) of organizational forms and the courses of organizational changes (Stjernberg, 1993). The author describes the organizations (21 organizations, of which 16 were industries) as traditional and clear in their first contacts during the 1970s. At that time, organizational development was run with expert strategies for change. Two decades later, the picture of these same organizations was completely different. Stjernberg (1993) calls them polyform, that is, ambiguous and difficult to describe. The expert strategies in the change work had been replaced by learning strategies for change. The author summarizes his conclusions in 20 theses that together represent experience from about 20 courses of change and constructs a process perspective of change. Its focus is on how change work should be driven more than how the organization should be designed. Strategies in which employees are involved and learn from the change work remained in focus. One of the theses reads

“efforts for the development of competence are at the center in more comprehensive and complex changes in the organization of work and new technology” (Stjernberg, 1993, p. 267).

There is a clear analogy between basic assumptions about organizations among representatives of planned, episodic or programmatic change strategies and

notions about organizations as traditional and mechanistic. In the same way there are similarities between basic assumptions about organizations among representatives of emergent, continuous learning strategies for changes and ideas about organizations as being organic and polyform.

The examples given show both lasting long term results of the course of change (Forslin, 1990; Stjernberg, 1993) and results that were never achieved (Beer et al., 1990), as well as unexpected results of changes (Orlikowski, 1996). Decisive are probably both the individual researcher's and the observer's perspective for the way in which changes and development of organizations are perceived (Van De Ven, 1995; Weick & Quinn, 1999).

In the descriptions above a picture begins to form of organizations in constant change. There are also implicit assumptions about experiences of changes being cumulative, i.e. that members in different positions in the organization receive experience of and possibilities for learning in terms of organizational change. This has to do with each change project being expected to increase the ability to carry out changes in individuals and thus in organizations, that is, with developing competence for change. A number of researchers studied what it may mean that an individual or an organization has the ability to manage change, i.e. to have competence in change. The section below deals with change competence and how it is viewed in the literature.

Change competence

An emergent, continuous and learning strategy for change is recommended in the literature for managing change in organizations. Change competence can be seen as the ability to manage changes in the environment and as a continuously on-going self-renewal. Individual and organizational development can not be viewed as separate phenomena in relation to organizational change, according for example to Pasmore and Fagans (1992a). They argue that individual and organizational development are synonymous and complementary. They write,

“when we approach these activities together, ... we tap into the emotional energy that is the required catalyst for all human change to occur and use that energy to support organizational transformation. ... the potential for a synergistic reinforcement of one another that can produce truly significant and last change in the thinking, feeling, and sense-making of individuals as well as the practices, structures, processes and arrangements or organizing” (Pasmore & Fagans, 1992).

It is difficult to argue against this, at the same time that there is relatively limited knowledge about actual phases in change processes' movement between the organizational level, group level and individual level. Whelan-Berry (2003) writes that change processes on the individual and group levels are “embedded” in an organization's change process. The researcher questions what takes place when the initiative in a change process is moved from the organizational level to group and individual levels, but considers also what an analysis of individuals' and

groups' change processes can contribute to the understanding of an organizational change process. When the people affected by a development can affect what it is that will be changed, there are clear connections between increased change competence and practical action. Broad support for the ideas behind a change effort is decisive for the degree to which new behavior, actions, routines and so forth become stabilized and grow to be enduring new conditions. Participation in the change process and stabilization of new behavior also touch upon questions concerning individuals'/groups' acquisition of competence in different processes.

Lipshitz (1999) describes the differences between individual learning and organizational learning. According to this author, individual learning is primarily a cognitive process that takes place "inside people's heads" while organizational learning is a complex interpersonal process that occurs via structural mechanisms in a social arena. Individuals' learning leads to individual insights and changes of habits, competence and action. Organizational learning leads to changes in norms, doctrines, production processes and culture.

To understand the phenomenon of change competence, Aronsson et al. (1995) made a study of change competence at nine workplaces in Sweden. Table 7 summarizes the results of the study of change competence on the individual level. The model shows personality aspects that contribute to an individual approach in development work and that thus also affect an individual's change competence.

Table 7. A preliminary model of change competence on the individual level, after Aronsson et al. (1995, p. 45)¹.

Parts of personality	Driving forces	Counter forces
Cognitive	to see possibilities	"blind to defects"
Emotional	self-confidence	feeling of insecurity
Belief/expectation	belief in the future	resignation
Will/Claim	demand for change	adaptation
Values/attitude	Appraisal ability	Instrumental attitudes

Change competence on a group level contributes to the dynamics of an organization. According to Aronsson et al. (1995), this has to do primarily with developing self-controlling cross-functional work groups with broad areas of responsibility, see Table 8. It creates conditions for groups to quickly react to changes in customer demands, but also in initiating and driving work for improvement. Social support, task orientation and resources for competence development and group activities are important organizational conditions for the development of change competence on the group level.

¹ Parts of the translation after Ingelgård (1997).

Table 8. Change competence on the group level, after Aronsson et al. (1995, p. 58).

Phenomenon	Prerequisite in the organization	Activities
"Feeling of togetherness"	shared group responsibility	organizational development
Task orientation	individually responsibility	competence development
Balancing individual and collective needs	equal group relations	planning project activities
Shared problemsolving	all-round competence	exchange of experiences
Interaction	possibilities to influence	temporary teams
Communication	time for group meetings	mentorship
Open atmosphere	social support	mentorship

According to Aronsson et al. (1995) development of change competence on the organizational level is characterized by group organization, openness, communication and the ability to manage conflicts. The authors argue that decentralization, exploitation of new technology and high and clear demands on effectiveness and quality contribute to the development of organizational change competence. Unlike e.g. Aronsson et al. (1995) and Pasmore (1999), Håkansson (1995) refers change competence only to a workplace's or an organization's collective ability. Håkansson (1995) defines an organization's change competence as its ability to manage theory and method in parity with the organization's actual level of development. She argues that change competence develops in a stepwise manner. Each step up in development means a higher competence level and thus a better ability to manage change. According to Håkansson (1995), these steps in development cover three levels: project as expedient, where a limited problem is managed on the basis of earlier experiences of change; program as expedient, a complex pro-active problemsolving that includes a number of units and/or problem areas; and strategy for problemsolving, a complex, pro-active problem-solving goes on in several projects simultaneously and continuously in an organic organizational structure.

When an organization's choice of change strategy agrees with its own development level, there is good potential to achieve set goals in a change process; according to Håkansson (1995) the organization has change competence. Change competence is thus seen as a relative concept, which means that it is only in relation to the situation and condition of the organization in question that it is possible to speak of change competence (Aronsson, 1995; Håkansson, 1995).

Taken together, there is good agreement between different researchers' ways of viewing change competence –even though the knowledge about the way in which the ability to manage change is built up and developed between individuals is less clear.

Development of change competence is argued to be closely connected to action (Beer & Eisenstat, 1996) in the same way that change often means some form of re-interpretation in a recognized situation (Mintzberg & Westley, 1992; Norrgren et al., 1996). There is also a good foundation for stating that learning becomes effective and of lasting usefulness if those involved in a change process participate in the processes of analyzing, problemsolving and interpreting (Argyris &

Schön, 1996; Beer & Russel, 2000; Pasmore & Fagans, 1992). The next section brings up the participation and influence of those who are affected in change work.

Participation and influence

In the extensive and multifaceted knowledge that exists today on organizational changes, the participation or influence of those who are involved is argued to be a condition for successful change work. Change work is also often seen as a learning process in which employees' learning is an important part of the goal of the change work. Organizational democracy, power, employee involvement, participation, empowerment, influence and control at work are examples of concepts used to describe organizations' routines for interpersonal and hierarchical relations in change processes (Aronsson, 1995; Hörte, 1991; Kim, 1993; Lanningen, 2001; Pasmore & Fagans, 1992; Quinn & Spreitzer, 1997; Rubenowitz, 1984).

Weick (2000) expresses the importance of involvement in the following way,

“change is emergent change laid down by choices made in the front line ... Management doesn't create change. It certifies change (Weick, 2000, p. 238).

The significance of involvement and influence for the outcome of change processes has been studied since the 1930s when Kurt Lewin developed theories about conditions for learning at work. A basic assumption was that participation in problemsolving, formulating goals and decisionmaking increases involvement and thus has the effect of giving motivation to the people involved for the changes that will be made. Other theoretical models assume that active participation in itself has positive effects on results in terms of performance and work satisfaction. Today the great potential of involvement is said to be that it creates conditions for better sensitivity to new demands, first and foremost in the exchange of ideas and knowledge between individuals who otherwise do not exchange information (Wall, 2002). A high level of flexibility is necessary to meet needs for continuous change, and this is possible by involving the majority of employees.

There is some agreement in the literature on organizational change as to the significance of how an implementation is made and that this implementation requires the active participation of presumptive users (Van de Ven, 2000; Beer, 2000). Beer suggests two different ways of viewing the role of the researcher in organizational change. Beer (2000) cites Vande der Ven (2000):

“Of course, it is one thing to document research evidence, and quite another to suggest how to implement the solution...The development of a realistic implementation plan typically requires that potential users become actively to identify promising way to interpret and apply research findings ... the most appropriate ways to involve users are unknown (because it is done too infrequently)” (Van der Ven in Beer & Nohria, 2000, p. 432).

This is an understanding of the role of researcher in the change process that differs radically from the researcher role formulated in the tradition in action research that Argyris represented (in Beer & Nohria, 2000). Argyris gives the following formulation:

“Description is a necessary first step. But the description should be in the service of action, especially in the domains of leadership, learning, change and commitment ... if researchers are concerned only with describing the universe as it is, their fundamental strategy is, in effect, a normative strategy of remaining in the status quo.” Argyris p. 424 (Beer & Nohria, 2000).

These two quotations shed light on different efforts to understand involvement in change processes, some of which is research that attempts to contribute to the development of management practice in organizational development on a more overall level and others that represent research on the means and methods that contribute to knowledge about how successful development is done, where the concrete changes take place. The quotations also show differences in basic values in the area of knowledge we call “organizational change”. Norrgren et al. (1996) expresses this such that the question of *how* a change is made in certain respects is more important for organizational learning than the question of *what* will be changed. If we simplify somewhat, theories and models for management practice are attributed to an American research tradition, while focusing on methods that deal with involving people who are affected to a greater extent is a Scandinavian tradition.

The view of the researcher’s role may be important to the extent to which the people whose work will be changed participate and be able to influence their future work situation. The next section treats current organizational research on broad participation as a means and a method in change processes, i.e. gives examples of how changes have been carried out. The emphasis is on the participation of people who are affected in carrying out the change. This also includes managers on different levels as well as to a lesser degree employees’ participation as a strategic tool for the highest management.

Levels of participation

Participation is seen both pragmatically and ideologically as a measure to support effectiveness, work satisfaction and development, and as being morally correct in democracies (Mumford, 2003). The foundations of participation are activities that serve twin purposes – to transform social systems (organizations) and to develop or transform participating individuals. Pasmore (1992) writes that participation can be seen as a continuum that runs from the lowest activity or action level for participation – joining and conforming to a system – to the highest activity or action level – creating a system or even abandoning a prevailing system to create a better environment and thus an alternative system. What exists on the levels between these extremes is contributing: contributing to the improvement of the existing system; challenging: trying to adjust the system while preserving the structure and distribution of power; collaborating: seeking to involve others or

supporting others who work to change the system while maintaining their basic characteristics. On each of these five levels of participation, higher demands are placed on participants with greater risks but also with greater possible benefits. According to Pasmore (1992), most change efforts are limited to the two lowest change levels. Changes are sanctioned by those in power, and it is not common that change efforts include changing the foundations of the system or the distribution of power within the system.

Ashkin (1987) distinguishes between four forms of participation: participating in setting goals, making decisions, solving problems and making changes in the organization. The author argues that employees' participation and influence have positive effects in terms of performance productivity and their own satisfaction. These positive effects, he continues, are a result of participating satisfying three basic human work needs, i.e. increased autonomy, increased meaningfulness and decreased isolation. Locke et al. (1986) limit their definition of the concept of participation to covering influence in decisions. Depending on the situational conditions participation is more or less suitable. They emphasize the importance of distinguishing between authoritative decisionmaking (bosses make decisions on their own), delegation (an employee or employees make the decision alone) and participation (joint decisionmaking, a boss and an employee or a boss and a group of employees make the decision together).

Heller (1998; 2003) similarly suggested six degrees of influence (Influence and Power Continuum): 1) not involved (no or a minimum amount of information is shared), 2) informed beforehand, 3) informed beforehand and can give an opinion, 4) opinion is taken into consideration, 5) taking part in decisions with equal weight (decisions are made jointly or through consensus) and 6) deciding on my own (a person or a group is given a degree of autonomy or control).

Norrgren (Rendahl et al., 1996) stress the significance of connecting change work with the company's competitive situation in the starting phase of development work, for example by giving employees a mandate to directly contact customers and suppliers. They further speak of employees who have an influence over work processes also being those who should have the continuous responsibility for change. The relationship between those whose everyday work will change and experts should be characterized by dialogue and cooperation. Rendahl et al. (1996) adhere to the humanistic view also expressed by Argyris (1982), a view based on people's inherent desire for and ability to constructively affect both the current situation and future situations.

The examples given thus far shed light on the individual in the organization and his or her possibilities to decide and influence the work situation him/herself. Today's industrial production requires a rapid ability to react to changes in the environment. This means that there is a need for new and more complex competence to manage uncertainty and risks. At the same time, the effect of Tayloristic organizational principles is still alive in many modern production systems. This effect is significant for example in structures in which the decisionmaking space is limited to the highest management and in relations in which position and status have a stronger emphasis than experience and competence. The principles have to

do with basic values concerning the view of the individual in the organization (Pasmore, 1991; Norrgren, 1996; von Otter, 2003). Participation places demands on individuals' ability to communicate, but they must be met by structural conditions for exchanging information and experience in their everyday work. This means having locations or physical spaces in which to meet as well as having time and a situation in which part of the work is made up of learning via for example exchange of experiences between colleagues. This is important in the change process, as conflicts of interest are present in all change. Conflicts of interest are not limited only to managers and employees but also take place between employees on different hierarchical levels and in different functions. There is a risk for conflict for instance between the influence of the individual and the collective. Most people are dependent on colleagues and fellow employees in some way. To be able to manage conflicts of interest, they must be discovered, brought to light and discussed. Conflicts between different groups in an organization can be very constructive. They often lead to discussion about what can be done to achieve a goal. Successful change strategies place requirements on allowing space for different interests. Methods that contribute to identifying conflicts of interest and allow space for seeking solutions often contribute to a change process that the majority either welcome or at least do not actively fight against. Participation and influence during the change process offer these opportunities.

Broad participation is more time consuming than other approaches in the design phase, but making the change takes less time and is easier. Participation can be expressed in many ways but always has to do with relations between individuals and their work environment. In order for individuals to have control over their work situation there must be conditions, self-confidence, competence and methods that support both self-esteem and knowledge development at work (Mumford, 2001). Representatives of emergent, learning strategies for change stress the importance of a top-down process and a bottom-up process taking place at the same time. Their argument is that the pace and complexity of changes are too high to be handled and driven one-sidedly by management (Bamford, 2003; Quinn & Spreitzer, 1997).

It has been argued in the literature with few exceptions that people who are affected by a change should participate in change work (Berger, 1995). The critical dimensions of change work, such as why change is necessary, what must be changed and by what methods the change should be made, are often described as being dictated by the situation, while participation is often described as being independent of the situation – it is wholly positive and compulsory (Buchanan, 1994).

Dunphy and Stace (1990) are examples of researchers who question participation as a model for all change work. They state that the nature of the change and the access to resources can motivate a direct exercising of power in changes. They argue that cooperative strategies are suitable in two types of situations – when smaller changes will be made and resources exist (time and broad support) in the organization (participative evaluation) and when larger changes will be made and

there is support in the organization (charismatic transformation). Accordingly, the authors (Dunphy & Stace, 1990) argue that directive strategies are suitable and necessary in two types of situations – when a smaller change is necessary and there is time but also conflicting opinions about the change in different interest groups (forced evolution) and when comprehensive changes are necessary but time and resources are lacking (dictatorial transformation). Their reasoning is illustrated in Table 9.

Table 9. Typology of situational change management. Freely after Dunphy and Stace, 1990, p. 908; Berger, Hart and Lindberg, 1995, p.3.

Strategy	Incremental/ small-scale change	Transformationell/radical change
Collaborative strategy Consultative/ participative	Participative evolution	Charismatic transformation
Directive strategy Force & power	Forced Evolution	Dictatorial transformation

There are other researchers who question whether participation and influence are wholly positive from the perspective of employees. They raise questions about whether employees can receive too much influence and whether there in that case is an optimal level of influence (Theorell, 2003; Thylefors & Persson, 2004).

In summary, the differences between the dominant change strategies as they are described in the literature have to do with the very view of organizational renewal as either a detail in a controllable process or a phenomenon that develops during the course of the process. In the first view organizational change is seen as episodic and planned and is run by means of a programmatic change strategy. The development efforts then have to do with using principles for development that have been established in advance, such as in a detailed master plan. In the second view organizational change is seen as continuous and emergent and is run by means of a learning change strategy. The development efforts then have sooner to do with making ongoing processes visible. A normative shift took place during the 1990s from programmatic to learning strategies for change. One reason for this is that many traditional change programs based on a programmatic change strategy failed to achieve lasting change.

The question is whether a corresponding shift has taken place in terms of applications of the different strategies in general. There are examples of organizations that drive change using a traditional programmatic strategy and other that drive renewal with a learning strategy. At the same time, there are organizations that do not limit themselves to carrying out change work according to one pure change strategy but combine different strategies or perhaps find themselves in a transition between different strategies.

Effective learning processes must exist for a learning strategy for change to work. These include reflecting over new approaches and the strong and weak sides of the change work. If the learning processes are effective, there will be an increase in change competence, that is, there will be a greater ability to manage

changes in the environment and a continuously ongoing self-renewal. There is good agreement between different researchers' ways of viewing change competence, although knowledge about how the ability to manage change is built up and how it develops between individuals, groups and organizations is less clear.

Change work is often also viewed in and of itself, as a learning process in which employees' learning is an important part of the goal of the change work. This emphasizes the importance of most of those who are affected by the change participating in both work on a vision and on identifying and solving problems. The foundations for participation are activities that serve two purposes, transforming social systems (organizations) and developing or transforming the individuals that participate in them.

Summary of Empirical Findings

Introduction

The work reported here focuses on models and strategies for organizational change and technical renewal in Swedish industry. The overall purpose of the thesis is to shed light on experience of change processes in integrated development of production techniques and organization for competitiveness and good work environment in the Swedish manufacturing industry. The more specific purposes are to study:

- Change processes and leadership in turbulent circumstances.
- Adaptation of advanced production technology to human needs and capabilities.
- The relationship between psychosocial/physical stressors and musculoskeletal symptoms in industrial workplaces with technically complex production.
- The relations between psychosocial work climate and the psychic work environment in the field of materials handling.
- The importance of considering organizations' requirements for change.
- The creation of crossfunctionally composed working groups.
- Approaches to translating abstractions such as target-oriented group, integration, delegation, decentralized, continuous training into understandable symbols and tools.

This section presents the aims, methods and empirical findings of the appended papers. Papers I, II, IV and V studied the manufacturing industry. Paper III was carried out in three stores selling alcoholic beverages. A brief description of methods used in Paper I and Paper II is first given. The background, method and approach in the project described in Paper I and Paper II are presented.

Paper I. Work in arc welding stations with high technical complexity

Paper II. Psychosocial and physical working conditions and associated musculoskeletal symptoms among operators in five plants using arc welding in robot stations

The Swedish research program entitled "People-Computers-Work" (known as the MDA Project, after its Swedish acronym) was initiated to promote the development of computer technology adapted to human needs, capabilities and requirements. The program was a joint undertaking on the part of the Swedish Work Environment Fund and the Swedish Board for Industrial and Technical Development and ran from 1987 to 1992.

Papers I and II report parts of the results of MDA project 8, "Augmented operator roles in welding automation" (Eklöf, et al., 1990, 1991; Johansson et al., 1991). The work situation of robot operators was charted in a joint project invol-

ving the Department of Psychology at Gothenburg University and the Swedish Institute of Production Engineering Research (IVF).

The overall purpose of the MDA project entitled "Augmented operator roles in welding automation" was to gather knowledge about how technical and organizational conditions co-varied in work in highly automated arc welding plants. The questions were studied against the background of technical complexity. Work conditions were related to historical and current organizational solutions as well as to ideas about future conditions. The project also covered charting, analyzing and proposing training models for welding robot operators in order to develop and test technical tools for welding robot plants.

Aims

The aims of Paper I were to study the change process in a turbulent environment and to evaluate the extent to which changes in the production process affect decision-making and the delegation and supervision of work.

The aims of Paper II were first to describe the psychosocial work environment and assess the prevalence of musculoskeletal symptoms among operators working with arc welding in robot stations. A second (and main) purpose was to investigate the relationships between psychosocial/physical stressors at work, individual variables and technical complexity on the one hand and musculoskeletal symptoms on the other.

Materials and methods

The MDA project was carried out in five companies whose production involves technically advanced arc welding plants. The five companies constituted the leading edge in terms of the technical level of the equipment and all had several years of experience of advanced technology. Four of the companies had over 100 employees and one was smaller. Paper I reports work carried out in one of the companies. Paper II included all five companies in the MDA project.

The charting process covered 19 white collar employees (plant manager, manufacturing manager, production manager, supervisors, instructors, production engineers, programmers) and 32 operators working directly at ten robot stations in the plants. The white collar workers participated in an interview. Each operator answered a questionnaire and participated in an interview.

Paper I included 11 white collar employees (manufacturing manager, production manager, supervisors, instructors, production engineers, programmers) and 12 male operators. This included all the operators working with arc welding in the four robot stations at the plants.

Paper II covered 30 operators, all men. This included all operators working with arc welding at the ten robot stations in the five plants.

Three different interview questionnaires were used depending on the positions of the persons interviewed. A fourth questionnaire was used for so called "company descriptions" as concerned activities, economy, market, organizational structure, production processes, personnel policy, visions of the future in terms of technological and organizational development, change leaders etc. The interview

questionnaires consisted of questions with fixed answers and questions with open response alternatives.

The interviews with the operators dealt with individual characteristics, job tasks, basic knowledge about the functions of the technical system, work distribution and job requirements. Participative observations were made of the product flow at the stations in order to describe technical disruptions and identify job requirements.

The operators also completed a questionnaire on quality of working life (QWL) called "Psychosocial work environment charting" (Rubenowitz, 1984, 1989), the primary elements of which are as follows: influence and control of work; supervisory climate; stimulus from work itself; relationships with fellow workers; and psychological workload.

The interview guide for operators and the questionnaire on quality of working life were used in the work reported in Paper I and Paper II.

On the basis of the interviews and observations of the production process, the robot plants investigated were classified according to technical complexity (CTC) into three classes (Eklöf et al., 1990):

- Class I: Robot(s) with external axis.
- Class II: Robot(s) on a travel track or on a moving gantry.
- Class III: Robot(s) with an integrated material handling system with automatic loading.

The higher the class, the greater the number of component units and thus the more advanced the programming. Programming was common in conjunction with redesigns and modifications of existing products.

This classification of technical complexity according to the robot stations was made in Paper I and Paper II.

In the study in Paper II questions had to do with the physical work environment and physical workload; questions on musculoskeletal symptoms were added to the interviews with the operators. Measures of the physical environment were based on items concerning lighting, noise and vibrations. The items had five fixed response alternatives.

The operator's estimation of the physical workload was based on three items in the interview: "Do you in your work often have to.....?": 1) "...lift heavy loads?", 2) ".....make monotonous movements?", 3) "...make sideways turns/hold twisted postures?". The items had five fixed response alternatives.

The main question about the operators' experiences of musculoskeletal symptoms was: "Have you had symptoms (pain, stiffness) that are related to work: ..." in the most recent 12-month period". This was followed by questions specifying whether the symptoms were related to the neck, shoulder or back. Each item had five fixed response alternatives.

The work described in paper II compared the study sample with reference data from industry (Rubenowitz & Schaller, 1992) with regard to the five factors that should be satisfied at work in order to meet a person's fundamental needs. The

reference data include 2,394 blue collar workers collected in seven different research studies in the manufacturing industry in Sweden.

Statistical methods

The relationship between different variables in the results in Paper I was studied using Pearson's product moment correlation coefficient (with two exceptions in which the relationship was studied with Spearman's rank order correlation). All the relationships reported were significant on at least the 5 percent level. Differences between groups were statistically tested with the t-test or analysis of variance. Analysis of variance was used in comparisons between more than two groups, while the t-test was used in comparisons of two groups. In Paper II, the *t*-test (two-tailed) was used for comparisons of mean values between the study sample and the psychosocial reference data. Several nonparametric techniques were used in the analyses (Chi-square, Mann-Whitney *U*-test, Kruskal-Wallis one-way analysis of variance, the Spearman Rank Order Correlation Coefficient and the Friedman two-way analysis of variance by ranks). The level of significance was set at $p < 0.05$.

Results

Paper I

The company studied in Paper I was characterized to a large extent by traditional structures and procedures. The development of the production technology had been made on the grounds of one production engineer's personal belief in new technology. His position at the plant went from work with traditional production preparations to a one-man investigation on technical innovations in the manufacturing industry. The top management had vague ideas about the needs of investments in new technology. There were no strong connections between the top management's strategic goals and the production engineer's ideas. Since that time, long-term strategies and plans for further investments in technical equipment in different departments in the plant have been coordinated and integrated in the company. Technical expertise had previously been responsible for changes in production technique. The effects of implementing new technology had not been considered according to existing activities, the organizational structure or the consequences it would have for employees at different levels. Step-by-step adjustments were made to the existing situation at the plant and there was a readiness for further investments in production machinery. Introductory and training programs were available to employees in the welding shop, but they had not been completed owing to the production situation.

The technical complexity of the four robot stations was classified as follows: the first two installations were grouped in the lowest level of class I (one robot, one two-station turntable); the third installation was grouped in the first level of class II (one robot, two positioners or a large positioner for large objects, at least two external axes); and the fourth installation was grouped in the second level of class II (one or more robots, one or more positioners, at least three external axes). Thus, the technical complexity increased with each new installation.

The findings according to technical complexity were that the higher the technical complexity, the greater were the possibilities of finding operators trained in “robot techniques”. The differences in training levels between the stations occurred over time according to need, and were not planned.

In the implementation phase, the training schemes were almost identical at the four stations. As the complexity of the robots increased, however, it became blatant that general knowledge was needed about the machinery, the welding procedure and the steering systems. Further training was provided to reduce stoppages and disruptions at the newer robot stations. Another finding with respect to technical complexity was that, with greater technical complexity, the time spent in unwatched welding increased, that is, there was a decrease in machine-paced work. The possibilities for job enlargement thus increased.

Positive correlations were found between training for work at robot stations and “togetherness”. “Togetherness” refers to the need for affinity that is deeply rooted in almost all people. Belonging to a team in the workplace means, among other things, that one can reflect and test feelings and opinions in trusted fellow workers and receive emotional and instrumental help when needed.

New technology can imply an opportunity to develop good working conditions, if the opportunity is indeed taken. That is very much a question of leadership. A job that is experienced as interesting and stimulating provides space for a person’s abilities and knowledge and offers manageable challenges. There were positive correlations between the leadership climate and job stimulation. Furthermore, a good leadership climate correlates in a positive direction with the operator’s opinions about a feasible workload. A job with an optimal workload can be characterized as one that is not too heavy, demanding or stressful in its physical and psychological aspects.

Potential changes were proposed on the basis of the results of the comprehensive interview survey. This applied to both technical and organizational changes, such as work organization, technical solutions, workplace layout and increases in competence. The ability of computers to act as aids was tested within a decentralized organization. The need for training activities was also specified and the introduction of automated plants was discussed.

Paper II

Examinations reported in Paper II of the differences between the welding operators and reference data according to the psychosocial work environment showed that there were more positive values in the study sample than the comparison group. That is, with regard to the factors “supervisory climate”, “stimulus from work itself” and “relationships with fellow workers”, the welding operators were more satisfied with their work than the comparison group. The factor “influence on and control of work” included the item “technical control” (i.e. the extent that machinery influenced the operator’s job). That item had the least satisfying value in the factor. Sixty-three percent of the operators answered that they were dissatisfied with the way the robot (s) influenced their jobs.

The highest frequency of self-reported musculoskeletal symptoms among the welding operators was in symptoms in the back; 47 percent reported that they “sometimes“ or “often“ had back symptoms. Back symptoms were significantly associated with heavy lifting and unsuitable work postures.

Associations between fundamental job aspects (five psychosocial factors and four physical factors): the psychosocial factor “supervisor climate” was significantly associated with six variables out of eight (shown in table x). “Stimulus from work itself” correlated significantly with three of four psychosocial factors and one physical job stressor out of four. Significant relations were found between symptoms in the back and three psychosocial factors out of five, and two physical job stressors out of four. Symptoms in the back were associated mainly with physical stressors. The analyses also demonstrated that high psychological workload, heavy lifting and unsuitable work postures were all significantly associated with symptoms in the back.

Table 10. Associations (rho coefficient corrected for ties) between job aspects and musculoskeletal symptoms among operators (n=30) working with arc welding robots. Note that decimal points are omitted.

Job aspects	Back	Shoulders	Neck
<i>Psychosocial job factors</i>			
Low influence and control of work	27	03	21
Bad supervisory climate	45*	28	25
Low stimulus from work itself	48**	27	25
Poor relationships with fellow workers	09	05	02
High psychological work load	66***	31 ⁺	32 ⁺
<i>Psychosocial stressors</i>			
Heavy lifting	56**	37*	51**
Monotonous movements	34 ⁺	30	42*
Unsuitable work postures	46*	32 ⁺	38*
Exposed to vibrations	34 ⁺	34 ⁺	20

Note: +p<0.10; *p<0.05; **p<0.01; ***p<0.001

No significant differences were found between the “scores“ of the three classifications of technical complexity as regards individual characteristics, the psychosocial work environment, the physical work environment or physical workload.

Changes in work organization, technical solutions and workplace layout and competence augmentation were recommended on the basis of the results of the study.

Conclusions

Paper I

Some results were obtained concerning the extent to which changes in the production process affect decision-making and the delegation and supervision of work. In the studied plant it may be concluded that the leadership climate is important for operators’ job stimulation and workload. In planning and implementing new technology one must be aware of its impact on existing structures and make parallel development plans for the systems that are affected.

Furthermore, the difficulty of considering all factors of importance increases with technical complexity. The conclusion drawn is that interdisciplinary and joint solutions are prerequisites for successful investments in new technology.

Plans were made for organizational changes in the robot stations including autonomous groups, decision-making, a different delegation and supervision of work, a new wage system, a broadening of tasks and job rotation. The change was supported by traditional education and on the job training. Decisions were made to make the changes on the basis of the results of this case study and other case studies in the project.

Paper II

The results of the present study demonstrate that, in preventing work-related musculoskeletal symptoms among welding operators, attention should be paid to both the psychosocial and the physical workload. This is an urgent task for managers, supervisors, industrial engineers, safety controllers and occupational health service groups. One weakness in the present study was the lack of power to randomize. However the study is strong in realism and the participation rate among the operators was very high.

Paper III. Psychosocial and physical work environment factor at three workplaces dealing with material handling

Aims

The main aim of this study was to investigate the relations between the psychosocial work climate and the physical work environment in the area of material handling. A second purpose was to introduce and evaluate a method for assessing the subjective perception of psychosocial work factors, musculoskeletal discomfort and workload.

Material and method

The field study was carried out in three shops selling alcoholic beverages in a region in western Sweden. The researchers visited each shop several times, and all employees were asked to complete a questionnaire. The questionnaire consisted of three different sets of standardized questions concerning the employees' attitudes to their jobs in terms of quality of working life and physical work environment, i.e. musculoskeletal symptoms and perceived workload.

The quality of working life was measured using the "Psychosocial Work Environment Charting", the primary elements of which were as follows: influence on and control of work, supervisory climate, stimulus from work itself, relationships with fellow workers and psychological workload. The questionnaire was developed by Rubenowitz (1984, 1989).

Musculoskeletal symptoms were measured using the Nordic questionnaire for musculoskeletal symptoms (Deakin, 1994; Kuorinka et al., 1987). In the third part of the questionnaire, the subjects were asked to estimate perceived workload. Perceived workload was measured in three questions about the physical work

environment taken from the Nordic questionnaire for musculoskeletal symptoms (Deakin, 1994; Kuorinka et al., 1987).

A Musculoskeletal Discomfort Index was formed (MDI). This was calculated as the ratio between the number of yes answers and the total number of questions on perceived symptoms during the most recent 12 months in four body regions (neck, shoulders, hands/wrists and lower back).

A Work Load Index (WLI) was formed based on three questions in which employees estimated their physical workload, i.e. uncomfortable work postures, heavy weights and monotonous working postures/movements. The WLI was calculated as the ratio between the number of yes answers and the total number of questions.

Results

The 61 employees in the shops were asked to complete a questionnaire. A total of 45 participated (73%). The prevalence of musculoskeletal discomfort during the most recent 12 months in the studied group was high in the neck, shoulders, hands/wrists and lower back. The shoulder region was the most common region in which discomfort was perceived (62%). Satisfaction with the psychosocial work environment was generally high. The highest value was given to the factor “relationships with fellow workers”.

The relationships between the physical and the psychosocial factors were low or non-existent. There were few if any significant correlations between psychosocial factors and the Musculoskeletal Discomfort Index. There were few correlations between the Work Load Index and the Musculoskeletal Discomfort Index. Taken together, the results point in various directions and it is not possible to show significant correlations with a high predictive power between psychosocial work environment factors, physical workload and perceived musculoskeletal discomfort.

Background factors such as sex, number of working hours per week and number of work tasks seem to have an impact on the subjective perceptions of the physical and psychosocial work environment. There was a significant difference in musculoskeletal discomfort between men and women, women scoring higher than men.

The study sample was divided into three groups according to working hours per week: 8-20 hours/week (n = 14), 24-32 hours/week (n = 13) and 40 hours/week (n = 13). A significant difference between the groups was found for the psychosocial factor “stimulus from work itself”. The group that worked 40 hours /week showed the highest satisfaction according to “stimulus from work itself”, followed by the group working 8-20 hours/week. The group working 24-32 hours/week showed the least satisfaction. The groups working 40 hours/week and 24-30 hours/week also showed a difference in the factor “relationships with fellow workers”, where the group working 40 hours/week was most satisfied.

Three groups were formed on the basis of the number of work tasks included in the job: 1-6 (n = 14), 7-8 (n = 16) and 9-15 (n = 15). Significant differences were found between the groups in the psychosocial factor “psychological workload”. The group with 9-15 work tasks gave the lowest values for satisfaction. Finally

there was a difference between the groups with 1-6 and 7-8 work tasks with respect to “supervisory climate”, where the group with 7-8 work tasks was the least satisfied.

To create a work situation with a balanced combination of tasks, consideration must be given to the qualitative aspects of a job. At the workplaces studied, there was a pronounced desire to give employees the opportunity to learn new tasks. However, there were difficulties in reaching this objective while at the same time meeting fluctuations in sales and the unpredictability in the flow of goods.

Conclusions

This study shows that the relationships between psychosocial factors, physical work environment and perceived musculoskeletal discomfort are relatively complex and that there are no obvious or easy explanations. One explanation for the low or non-existing relationships between physical and psychosocial factors may be that the studied group was rather heterogeneous, e.g. in terms of the number of work hours per week.

Paper IV. Modern work organization demands decentralized technical solutions

Aims

The overall aims of the Welding Workplace 2000 project were to bring production technology up to date and to create a modern work organization based on cooperation and task-sharing. Another purpose was to break the centralized decision-making processes and the traditional boundaries between design and production and between various skill groups at the production level. A further objective was to develop the contents of “physical hooks” (understandable symbols or tools) in close collaboration with the people, who on the one hand should be symbols for new attitudes and behaviours and on the other hand needed tools in their (new) daily work with advanced production technology. The final objective was for the robot group to reflect a cross-section of the entire shop with respect to educational background, work experience, age and length of employment in order to be able to serve as a good example for others and for future development in the organization.

Materials and methods

Analyses were made of the current situation in order to understand what was required to bring about organizational change. Data were collected in interviews and questionnaires during the initial months of the project. The project employed a written leadership test to assess the degrees of control and psychological support (a short form of Hersey and Blanchard’s Situational Leadership Style Assessment). The test consists of 12 fictitious management situations. The respondent states how he/she believes that he/she would behave in a certain situation. Eight supervisors, seven line managers and project leaders completed the self-assessed questionnaire on leadership styles.

The psychosocial work environment was operationalized by the use of a questionnaire developed by Rubenowitz (1984, 1989), where it is possible to distinguish five important psychosocial factors that should be satisfied at work in order to meet a person's fundamental needs. With these five factors, it was possible to make comparisons between the study sample and reference data consisting of 32 robot operators in five manufacturing companies in Sweden.

Ninety-seven employees in the plate and fabrication workshop were asked to complete the questionnaire on the psychosocial work environment and 91 did so.

The attitudes to change and stability were assessed using a "standardized" questionnaire developed by Ekvall and Arvonen (1991). Thirty-four employees from three different groups in the plate and fabrication workshop were asked to complete the questionnaire. These employees were members of the robot group, supervisors, plate workers and welders in a temporary project. The questionnaire is comprised of 20 statements in which respondents choose one of four alternatives. The lowest possible value is 20 and the highest 80. Positive attitudes to change are characteristic of innovative organizations. It is possible to make comparisons between the study sample and reference data from industry (Ekvall & Arvonen, 1991). The reference data consist of employees on different levels (n=128) in a medium-sized industry in Sweden.

Recruitment to the robot group among the approximately 130 shop floor employees in the plate and fabrication workshop was done on three occasions. The criteria for selection were voluntary choice, interest in new technology, a willingness to work in new ways and in groups, and a willingness to learn and to teach.

At an early stage the operator's computer and the target board gave a simple description of the work areas for the future cross-functional robot group. Each work area was broken down during the project into concrete work tasks that comprised the work of the group and provide support for the actual carrying out of the work. Future work tasks were defined, thus providing insight into existing knowledge levels. This enabled the planning of necessary training and development of competence.

Results

There was a general insight as to the necessity of change at the shipyard. The Karlskrona Shipyard was in a situation of greater competition than ever before in its existence. Ideas were proposed about an organization and work groups that function as self-regulating systems, capable of learning, that could meet the needs expressed for a continuous adaptation to new demands, flexibility and short decision-making paths. There was less agreement on how a modern organization with high technical complexity should be developed. One line manager expressed his experience in and uncertainty about organizational change in the following way: "it's like entering a black hole. I don't know how we're going to come out, only that sooner or later we will."

The members in the robot group were not young people. Most of them had an educational background of seven to nine years of school followed by two years of

apprenticeship at the Karlskrona Shipyard. The majority had spent their entire working lives at the shipyard. With few exceptions the operators and supervisors had no prior experience of computers, advanced production technology or group organization as encountered in the project. The staff members of the robot group were younger than their other colleagues at the shipyard. All had higher secondary education and several were university graduates. They all had prior experience of computers.

The management style at the shipyard was characterized by control and issuing orders, which encouraged neither flexibility nor individual development. The satisfaction with the psychosocial environment was generally high and higher than in the reference group in four of the five factors. It was only in their perceptions of the supervisory climate that the employees at the shipyard did not differ from the reference group. The predominant attitude to change was to keep a distance. At the shipyard there was a resistance to change because people preferred the stability and security of what was familiar. This resistance to change was higher among the employees at the shipyard than in the reference company. On the basis of the results of the analyses of the state of the organization, the project applied a “step-by-step” strategy, emphasizing the entitlement to training and acquisition of skills grounded in each individual’s need, regardless of organizational level.

The number of details welded by the robot group after 18 months was more than planned (and more than anyone had dared hope for). The quality was fully in line with the customer’s stringent requirements. All this was accomplished in this group of middle-aged plate workers and welders, without prior experience of advanced technology, running programs they themselves had created.

Conclusions

In part the success of the project may be explained by the following factors: it started from the company’s level of technical and organizational maturity; the selection of personnel for the robot group was based on voluntary application; broad basic training was followed by specific training in skills based on each individual’s needs; and the operator’s computer concept was an aid in matching modern technology to the needs and capabilities of its users, providing genuinely decentralized assistance in its applications. The development of the Welding Workplace 2000 project was the result of the active participation of all concerned, partly for reasons of motivation and quality and partly because it is impossible for external experts to impose a change in an organization.

Paper V. The operator’s computer – a decentralized tool for building an efficient decentralized organization

Aims

The overall aims of the Welding Workplace 2000 project were to bring production technology up to date and create a modern organization based on cooperation and task-sharing. This meant among other things ensuring a dialogue between theory

and practice through the creation of a cross-functional working group. A second purpose was to break the centralized decision-making processes and the traditional boundaries between design and production and between various skill groups at the production level. That includes the challenge of translating abstractions such as cross-functional target-oriented group, integration of design and production, delegation of responsibility and authority, decentralized computer strategy, continuous training, modern management etc. into understandable symbols and tools or “physical hooks”. A third crucial objective was to develop the content of these “physical hooks” in close collaboration with the people who on the one hand should be symbols for new attitudes and behaviours, and on the other hand needed tools in their (new) daily work with advanced production technology. The final objective was that the robot group should reflect a cross-section of the shop as a whole with respect to educational background, work experience, age and length of employment in order to be able to serve as a good example for others and for future development in the organization. The most important physical hooks in the project were: the operator’s computer, the target board, a two-story office building and the robot station intended primarily for training, development and research. Paper II concentrates on the development of the contents of these physical hooks.

Materials and methods

This paper is based on a combination of knowledge from the manufacturing industry, including Karlskrona Shipyard, other researchers’ experience of action research in the sociotechnical tradition and the author’s prior experience of simultaneous organizational changes and technology development in the manufacturing industry. The development of the change processes relied heavily on the active contribution of different groups in the organization, from the initial preparation phase through the change process.

Results

The first “physical hook” was the operator’s computer. At the core of the operator’s computer is that the use of custom computer support for shop floor workers operating technically advanced production tools can help to enhance their work by adding more advanced and interesting duties. Furthermore, using the computer as a common information carrier opens new routes for liaisons with other categories of workers. The operator computer that was selected for the Welding Workplace 2000 project had programs for 14 functions. It also showed the relevant skills in a traditional organization as the starting point for the change process. The process integrated and reshaped skill roles. The new operator’s work included tasks that old metalworkers had not carried out previously. The foreman’s role was radically changed, while production planning tended to be split between and integrated into the work of designers and operators.

The second “physical hook” was the target board. The target board illustrates how such disparate working groups as designers, engineers, planners, foreman and shop floor workers can be brought together. The target board consisted of 14

circles. Each circle was analogous with one of the 14 functions in the operator's computer. The circles in the model represent not only the computer programs (supporting the functions); each circle also represents a working area. In addition, the circles can be broken down into skills levels possessed by more than one person. With the help of the operator's computer and the target board, the cross-functional group not only had its duties described, but could also obtain help in performing them. The model has the major advantage of being able at an early stage in a process of change to describe new work contents at the group and individual levels. The model can furthermore attribute to future learning and training among members in a group.

The third "physical hook" was the robot group office. By placing the office in the middle of the workshop, the various abstract ideas were given a concrete form and it was made clear that the new arrangements were intended to replace the old, established social patterns. The ground floor contains several computers, where designers, production engineers, foreman and operators work together, exchanging experiences and learning from each other. The building represented a materialization of the new ideas, giving the new era's pressure for change a clear physical symbol.

Intimate contact with practical aspects of the production process is vital, as there are undeniably certain differences between modelling reality and actually dealing with it. One lesson learned was to make use of the "physical hooks" that investments in new production equipment offer to transform abstractions into more specific symbols and work methods. Experience from the Welding Workplace 2000 project emphasizes the importance of a comprehension, among all concerned and at an early stage in the development, that change is necessary and why it is necessary.

Discussion

Paper I

New technology demands new organizational structures and procedures and a new relationship and better communication between leaders and subordinates. With an awareness of the threats and possibilities of sociotechnical approaches in planning new production systems, alternative organizational solutions can always be found. That is, there is no absolute determinism in the new technology.

Instead of giving a traditional discussion, some important points in the work reported in Paper I will be highlighted below:

- Strive to achieve a non-hierarchical organization with smooth and informal contacts between different sections and organizational levels. In times when technical change is rapid, a climate of cooperation, characterized by the ability to disseminate knowledge and information quickly to all those concerned, is vital.
- Analyze which specialist and managerial functions are indispensable and which can be delegated. It is important that no professional group feels that their work content is being depleted, as this can be expected to lead to such things as reinforced territoriality and fear of change.
- Augment the operators' spheres of competence and responsibility in the fields of programming, documentation of programs, production planning, preparation, division of labor, repairs and maintenance. In short, give operators varied and skilled duties. This provides increased control and makes their work more interesting. Furthermore, an influence on the rate of production and product selection at any given time means that the production process can quickly be adapted to emerging situations. Increased control and an enhanced general view of the situation can prevent operational disturbances. Analyze which skills will be required of the operators and other personnel and adapt training and other skill developing measures accordingly. An analysis of this kind should comprise welding skills, programming, maintenance, repairs, servicing, finance, design, preparation, production planning and knowledge of problems associated with group cooperation and leadership.
- In designing the equipment, the experience and views of those who will handle it should be taken into account. This should be done in such a way that all people concerned are given genuine opportunities to make their voices heard. Expressions of uncertainty and anxiety in the face of with new technology should be treated with the utmost seriousness.
- Design the technology in a way that gives operators an opportunity to leave the immediate operation of the robot station. When producing objects with short cycle times, class III robot stations are preferred, as automatic materials handling systems contribute to releasing the operators from the constant responsibility of having to load/remove objects. In plants with manual loading/removing (classes I and II), only objects with long cycle times should be welded.

- Make the most of opportunities to learn in everyday work. Adapt technology, division of labour and authority in a way that allows both a time and a place for learning. This may for example mean that operators are not constantly tied to production processes.

Paper II

The findings reported in Paper II have several implications. Consistent with previous reports (Johansson, 1992a; Rundcrantz, 1991) they confirm the significant relationships between the psychosocial environment (such as psychological workload) and musculoskeletal symptoms. The results also underline differences in the magnitude of the associations between psychosocial stressors and different anatomical regions. The data indicated that symptoms in the back were associated with three psychosocial factors out of five (poor supervisory climate, low stimulus from the work itself and high psychological workload), whereas symptoms in the neck and shoulders were not associated with any psychosocial stressor.

The results furthermore demonstrate that symptoms in the back, aside from being associated with psychosocial stressors, were also associated with physical job stressors (heavy lifting, unsuitable work postures), whereas symptoms in the neck were associated mainly with physical job stressors (heavy lifting, monotonous movements, unsuitable work postures). Generally speaking, these findings agree with findings in a study of assemblers by Johansson et al. (1993) where low back symptoms were mainly associated with psychosocial variables and neck/shoulder symptoms principally with high physical work load (Johansson, et al., 1993).

In the present study, a relatively more satisfying psychosocial work environment was reported by welding operators as compared with industrial blue collar workers with respect to the factors “supervisory climate”, “stimulus from work itself”, and “relationships with fellow workers”. In general it is important that work with advanced manufacturing technology does not lead to isolated work tasks for the operators. This study showed that the work was organized rather well so that the operators had opportunities for contact with fellow workers. According to Johansson (1985) social support is an important buffer between stress and ill health (Johansson, 1985).

Even though the factor “influence and control of work” did not differ significantly from the reference data in industrial blue collar workers, it is interesting to note that the item “technical control” (i.e. the extent that machinery influences the operator’s job) had the lowest satisfaction value in the factor; 63 percent of the operators answered that the technology influenced their job in an unsatisfying way. This suggests the need for, among other things, job enrichment in order to avoid tightly controlled and machine-paced jobs – a work situation that is a predictor of health problems.

The study shows that several psychosocial factors and physical workload variables were significantly inter-correlated. It seems evident that these variables describe a very complex interplay that should be taken into consideration in preven-

tive health work. An interesting finding in the study is that the factor “supervisory climate” was significantly associated with six variables out of eight in the matrix. Generally speaking, the result is consistent with other studies (Börjesson, 1991; Johansson, 1991; Rubenowitz et al., 1990), indicating that managers and supervisors play an important role in the organization and the well-being of operators working with advanced manufacturing technology.

The absence of significant differences between the three classes of technical complexity concerning psychosocial work environment, physical work environment, physical workload and musculoskeletal symptoms among the operators may indicate that the level of technical complexity is of little consequence for these variables. However, it may also indicate that the categorization was inadequate for the purpose of this study. Future studies should include more measures that concern the interaction process between the operator and the robot.

The psychosocial work environment measurements used in the present study are reproducible in different samples and the internal scale reliability as assessed by Cronbach’s alpha coefficient is also acceptable (Johansson, 1992a, 1992b; Rubenowitz & Schaller, 1992). Several studies show that these scales have a good convergent validity (Johansson, 1992b; Rubenowitz et al., 1990) and other researchers have noted a good convergent validity in similar psychosocial measures (Karasek & Theorell, 1990).

In general, estimation of physical workload through direct questioning shows an acceptable, good reliability (Liew & Kilbom, 1985; Wiktorin, et al., 1991) but rather poor agreement could result from vague descriptions of activities, from movements that are not characteristic (Wiktorin et al., 1991) or assessments of postural load (under certain conditions) (Burdorf & Laan, 1991). There are contradictory results concerning the validity of self-reported exposure to physical workload. The correlation between self-reports and reference measurements (e.g. inclinometer, posimeter, observation methods) is generally not very high (Burdorf & Laan, 1991; Kuorinka & Kilbom, 1990; Wiktorin et al., 1993). However, in a review study of 11 observations methods by Kilbom et al. (1986), the authors conclude that “descriptions of methods and tests of validity and reliability in many cases are incomplete.” (op. cit., p. 84). Wiktorin et al., (1993) also point out some sources of error in observation methods; they found that trunk rotation, head rotation and head bent forward were difficult to estimate (under certain conditions) with observation methods, and concluded that “... the self-report may then be more valid than the reference measurements ...” (op. cit., p. 213). In addition, the three items used in the present study among welding operators show an acceptably good validity regarding the ability to discriminate between occupations rated as physically heavy or physically light work (Johansson, 1992a). Taking the above into consideration and the fact that any misconceptions (e.g. vague descriptions) on the part of the operator were discussed during the interview, it is reasonable to assume that these three items offer sufficient accuracy in the present study. Moreover, an interview (or questionnaire) fulfils the criteria for estimating exposure in general and not only on one specific day (which is often the case in observation methods).

Paper III

The analysis of the relation between psychosocial factors and Musculoskeletal Discomfort Index showed few correlations. This may be because the questions that have to do with self-reported musculoskeletal symptoms do not distinguish between work-related symptoms and other symptoms, as was the case in the other two parts of the questionnaire.

The low correlation between psychosocial factors and the Work Load Index suggested that a higher workload correlated with a less satisfactory psychosocial work environment. This was especially true for the psychosocial factors “psychological workload” and “influence and control of work”.

The positive, although weak, correlation between the Work Load Index and the Musculoskeletal Discomfort Index was consistent with expectations. The results indicate that there is a weak relation between the level of the physical workload and the perception of musculoskeletal discomfort. The reason for this weak correlation may be the variation in exposure to the work environment in question. For example, there was a large number of part-time workers in the sample who only worked a few hours per week.

Women perceived a higher level of musculoskeletal discomfort than men. This can be due to the fact that most women worked part-time, i.e. during stressful hours or at delivery peaks when the physical workload was high. As their physical strength is most often lower than that of men, the women may be forced to work at a relatively higher level of effort (Ayoub & Mital, 1989). However, musculoskeletal discomfort symptoms can have been caused by work at previous jobs or by second jobs in other types of work.

The number of work hours per week influenced the perception of psychosocial environment and physical workload. The group that worked 24-32 hours per week seemed to be the group that was most exposed, perceiving a less satisfactory psychosocial work environment and having the highest physical work load. This might be a result of the fact that these people worked during the most intense hours when the workload was highest. As this group worked fewer hours per week, they were given fewer responsibilities and administrative work tasks as compared to the full-time workers. This may contribute to an increased risk of physical discomfort and less satisfaction with the psychosocial work environment.

On the other hand, it was found that the group with the highest number of work tasks perceived the psychosocial factor “psychological workload” as less satisfactory than the groups with fewer work tasks. It seemed as though too great a number of different work tasks may be stressful. The groups that had 1-6 and 7-8 different work tasks seemed to be the most satisfied, indicating that employees prefer a balanced combination of work tasks. Another interpretation can be that the employees with the largest number of work tasks did not have the necessary time to perform adequately during hours when there was a great deal to do, which may be perceived as stressful.

The use of a questionnaire that takes into account both quality of work life and aspects of the physical work environment is highly recommended, as a full picture

of the workplace provides data that can be used to improve companies' efficiency in terms of higher productivity and increased quality.

Consequently, a possible approach toward arriving at more distinct results would include a Work Load Index that has a higher degree of resolution and is sensitive to different individual workload situations as well a Musculoskeletal Discomfort Index based on data that distinguish between reports of symptoms having to do with the work situation and those related to non-controlled circumstances, i.e. other occupations, leisure time activities etc.

Paper IV

The Welding Workplace 2000 was a leading-edge project, whether seen with respect to the structural changes that were introduced at the shipyard or from the viewpoint of the individuals involved. At the time the project started, Karlskrona Shipyard was in the throes of change between old shipbuilding traditions where work was done in conjunction with a large dominant customer and a new civil market exposed to the cold wind of competition.

The general turbulence, which can have a number of causes, including shortcomings in overall planning, partly explains the scepticism in the face of such major changes that was expressed in the initial analyses of the company.

Due to the attitudes to change and stability at the shipyard, a "one step at a time" strategy was used; that is, before bringing something new into action, it was necessary for everyone to feel safe and understand prior actions. For the same reasons very strong priority was given to the functioning of the technical equipment.

The principle of including key persons from other departments of the shipyard was applied throughout the project in response to the general organizational climate and the predominant management style. No matter how good the intentions, a limited group cannot develop entirely new working procedures unless other mutually dependent units are involved in the new way of thinking. The different training/learning occasions have included employees from different traditional skill groups and from different organizational levels.

The objective that the robot group should reflect a cross-section of the shop as a whole in order to serve as a good example for future organizational changes was not achieved with respect to the staff members in the robot group. They were younger and had higher education than their colleagues in the plate and fabrication workshop and the white collar workers at the shipyard.

In some respects, the project did not maintain the original time schedule. Not all members of the robot group have been trained or acquired work experience to the extent that was planned, for several reasons. This included delays in delivery both of production materials and at the second robot station, which was intended for use in training. In addition, unforeseen production peaks caused by a general upturn in the economy reduced the time available for training at the robot station. However, it must be pointed out that the initial delay in the delivery of the materials meant that the first operators acquired about two months' effective training in

programming. This can explain the robot programs being bug-free when production finally started and the outstanding work of the first operators as guides for their colleagues.

Change competence can be substantial in processes when carefully defined and with adequate allocations of resources.

Paper V

By far the most important element of the changes introduced at Karlskrona Shipyard was the need to link a comprehensive training program with methods and tools that facilitate the breakdown of attitudes and evaluations based on old social patterns.

A thought-provoking event occurred at the start of the project. Karlskrona Shipyard sent a group of engineers, production planners, foremen and shop floor workers to a materials course that had been specially designed to increase the understanding of current and future work with high-strength steels, high-grade stainless steel and aluminium. The course experiment showed that the shop floor workers not only enthusiastically received the theory of what happens with material structures when these are worked in various ways, but also demonstrated this through the results of tests which participants took on completion of the course. The highest points and the best test results were achieved not, as might have been expected, by university educated engineers but by the shop floor workers. The impact of this concrete example brought home to many the immense power of training and development. Without falling into a simplistic and romantic view, it must be recognized that a motivated staff provides a potential for improvement of previously unrecognized magnitude. A major point to be considered in the future is how this potential can be realized.

The most important lesson we learned is to make use of all the various “physical hooks” that investment in new production equipment gives personnel a place to hang their valuations and methods of working. For Karlskrona Shipyard, this investment in robot welding represents a major step forward in technology. No one working with the company has been able to avoid thinking about the resulting substantial change.

The design and location of the robot group office was found to be not entirely uncontroversial. By placing the office in the middle of the workshop, the various abstract ideas were given a concrete form and it was made clear that the new arrangement was intended to replace the old established social patterns. The ground floor contains several computers, where designers, production engineers, foremen and operators can work together, exchanging experience and learning from each other.

The building represented a materialization of the new ideas and gave the new era’s pressure for change a clear physical symbol. The operators’ computer, which was one of the important new “physical hooks”, formed the hub of much of the communication circles, both between persons and via the computer. The computer became a common tool to all the different groups.

Experiences from the Welding Workplace 2000 project emphasize the importance of explaining to all concerned, at an early stage in the development process, why change is necessary. If the objectives can be formulated jointly with all those involved, much will be put into practice so that it can be clearly seen whether those involved are pulling in the same direction. Particular importance needs to be attached to overcoming resistance from personnel at intermediate levels in the old hierarchical organizational structure.

Competence development and a search for solutions under which everyone has something to gain by participating in the change process are essential for success. However, these evaluations are expressions not primarily of knowledge but of attitudes. If a change process such as the one at Karlskrona Shipyard is to be possible, attitudes will have to be altered. One possible line of attack is to create a number of “physical hooks” that make it possible for various persons involved to secure new attitudes and methods of working. The computer enables white collar and blue collar workers to be melded into one unit.

Concluding Remarks

The collective knowledge on how work can be organized in order to fulfill both the organization's and the individual's needs is very extensive. Industrial development from the time after World War II to the middle of the 1990s shows many examples of how sustainable changes are supported by change strategies that are based on organizations' and individuals' learning (Armenakis & Bedeian, 1999; Beer & Nohria, 2000; Ingelgård, 1998; Norrgren et al., 1996; Quinn & Spreitzer, 1997; Walton, 1985). During this same period Swedish workplaces became increasingly democratic (Theorell, 2003).

The empirics in this thesis represent examples of how psychological issues in organizations are managed in change processes in Swedish industry. Table 11 summarizes the participating companies, project times, project focuses and three aspects of change that are treated in the five papers.

Table 11. Summary of the five papers according to companies, subjects, project time, focus and three aspects of change.

	Paper I	Paper II	Paper III	Paper IV	Paper V
Subjects	1 industry, AMT ² 11 blue collar 12 white collar	5 industries, AMT 31 blue collar	3 shops 45 employees	1 industry, AMT 15 leaders 88 blue collar 34 blue collar	as in Paper IV
Year	1990-1992	1990-1992	1993	1993-1995	
Focus	Test & tip technic, organization and learning -CTC ³ -Management roles -QWL -augmented operator roles	Test & tip technic, organization and learning Relationships between -QWL ⁴ -Physical work environment -Physical work- load -Musculoskeletal symptoms	Materials hand- ling & ergonomics Relationships between -Individual background -QWL -Physical work environment -Physical work- load -Musculoskeletal discomfort	AMT/QWL/ New technic, crossfunctional organization and learning -Historical heritage -Management roles -QWL -Attitudes to change	AMT/QWL/ New technic, crossfunctional organization and learning -Translation of abstraction into concrete physi- cal hooks -Operators computer -Target board -Office
Influence	Top-down & bottom-up process	Top-down & bottom-up process	Unknow No change	Top-down & bottom-up pro- cess Participative	Top-down & bottom-up process Participative
Role of researcher	Leader supportive expert to facilitator	Leader supportive expert to facilitator	Expert	Process facilitator	Process facilitator
Change Strategy	Planned, episodic & programmatic via transitional towards emerging/learning	Planned, episodic & programmatic via transitional towards emerging/learning	Unknown No change	Emerging, continuous and learning	Emerging, continuous and learning

² AMT: Advanced Manufacturing Technology

³ CTC: Classes of Technical Complexity

During a long period several companies developed according to what is often called Scandinavian sociotechnical principles. This was also found in the development efforts in the empirical part of the thesis. Questions concerning how technology and organization could be optimized, with good work conditions, creation of knowledge and productivity as the result, were central. Broad participation among all the actors in the organizations in formulating goals and in problemsolving and the change process were starting points in the development work. The role of the researcher was developed from that of an “objective expert” to include the role of the process facilitator as well. Change strategy with the ability to manage continuous demands for adaptation and change was developed in parallel with an ever increasing pace of change. These were questions that were broadly treated by many organizations until the middle of the 1990s, when the trend broke.

What happened in the 1990s? During the first half of the 1990s, growth increased, unemployment decreased and the deficit in the public sector was turned around to become a surplus. Productivity in Swedish trade and economy increased markedly from the middle of the 1990s. At the same time, work life changed. Sick leave and work injuries increased. The number of previously permanent and long term employment positions fell, to be replaced by temporary positions and positions that were limited to a certain time period (Lennerlöf, 2000). Employees experienced that they had less opportunity to influence the conditions of their own work (Thylefors & Persson, 2004). The character of work also changed throughout the industrialized Western world. Landsbergis’ (1999) review of studies in the automobile industry, other manufacturing industries and health care shows how concepts for lean production led to a higher work pace and generally higher demands in the automobile industry (Landbergis et al., 1999). This increase was not compensated for by greater responsibility or competence development. A corresponding connection could not be seen in other manufacturing industries or in health care. There is great reason to pay attention to what takes place in the car industry. This was the first to meet and react to changes in the environment that in a later phase would also affect other activities (Christmansson & Nonås, 2003). Today many industrial companies are returning to more Tayloristically oriented systems. Production lines are being re-introduced in assembly operations. This is possibly taking place at the cost of good work conditions and often without true comparisons with alternatives (Engström et al., 1995, 2005; Kihlberg et al., 2005). There are varying and somewhat conflicting ideas of what kinds of work organizations are created in these systems and how the contents of the work and the quality of working life are being affected.

It is also important to question how conditions for the development of operations have been affected. Demands for effectiveness and productivity must not become a threat to people’s need of healthy and secure work that allows them to develop. The transformation of the 1990s took place quickly and, according to Lennerlöf (2000),

⁴ QWL: Quality of Working Life

“today’s great challenge is to find out how the interplay between good work conditions and effectiveness can be made secure and steered toward visions in which social values and growth are not placed opposite one another. Belief in the future and security, even in change, require that people dare to rely on and act according to their certainty that they will have a place in a dynamic activity that will carry over through the next balancing of the books, the next evaluation, the next report of results, the next contract, the next swing in the economic situation. Only then can we speak of sustainable work systems in all their different senses” (Lennerlöf, 2000, p. 6, free translation).

The organizational changes that are necessary have fundamental psychological consequences for individuals. These consequences have only been the object of systematic study in certain areas (Johansson, 2005). It is scarcely possible at this time to distinguish what are the consequences of the changes themselves and what are the results of completely new conditions.

An important source for making predictions of an organization’s future behaviour is a study of its previous behavior. This can mean that earlier change processes should be analyzed before a new organizational change is made, from the perspectives of both what processes developed with desired results and what processes did not. At the same time, there must be a focus on the insight that it is hardly possible to predict behavior under radically changed conditions on the basis of behavior under historical conditions – regardless of whether the discussion has to do with an individual, a group or an organization.

In the work reported in Paper IV that studied the project “Welding Workplace 2000”, the robot group at the Karlskrona Shipyard was to be a reflection of the total group of employees in the plate and welding workshop and not only consist of the “elite”, i.e. of those whose competence and skill were well known. The reason for this was that Karlskrona Shipyard was facing further organizational changes and wanted as much as possible to exploit the learning gained here in coming change processes. Despite this, at the selection of members for the robot group, there were several who argued for a group consisting of only the “elite”. In the discussions concerning creating a work group that the majority of the employees could identify with, the following picture was used as a counterargument.

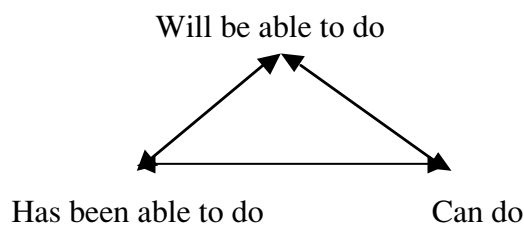


Figure 1. Three perspectives on people (free after Forslin, 1990).

It is often clear in an organization what an individual has been able to do and what he or she can do. This often makes us believe that it is possible to predict what an individual will be able to do in other conditions. The example from Karlskrona Shipyard showed that it is not obvious that a previous time and the present time are good bases for drawing conclusions about future abilities.

There are many strategies for meeting contradictions and changes in the environment, one of the most important being in fact a psychological response. This has to do with an ability to see events in another perspective than before – not necessarily to eliminate the contradictions but sooner to view them as aspects having to do with living and acting. For the contradictions in life to be manageable challenges, we must learn to live with them. How can this be done? It can require an insight that there are no simple answers to inherently complex problems and an understanding that each process that has a desired effect also has unexpected effects that can indeed be powerful. This may mean that we must accept that in many situations it is not possible to predict the course of events and thus not either to plan for anything other than attention to what is going on now and, in spite of that, use planning tools. There is much in the world that has not changed. For example, complicated but predictable human reactions to uncertainty and needs for change have not changed to any great extent for centuries.

Further knowledge is needed about how we as individuals and a collective in organizations in fact are able to live in continuous change and what psychological consequences this has for individuals and organizations. Correspondingly, greater knowledge is needed about what applications of lean production mean for work conditions and for change strategies in Swedish industry.

Summary

Nonås, K. (2005). *Vision versus reality in organizational change*. Arbete och Hälsa 2005:5, National Institute for Working Life.

The work reported here focuses on models and strategies for organizational change and technical renewal in Swedish industry. The overall purpose of the thesis is to shed light on the experience of change processes in integrated development of production techniques and organization for competitiveness and good work environment. Five papers form the foundation of the thesis. They are all empirical studies, four of which were carried out in the manufacturing industry and one in three stores selling alcoholic beverages. The results are based on interviews, questionnaires and participative observations.

Paper I focuses on change processes and leadership in turbulent circumstances and an adaptation of advanced production technology to human needs and capabilities. It is a case study, including 12 operators and 11 white collar employees in different positions. The findings shows that new technology can imply an opportunity to develop good working conditions, if the opportunity is indeed taken. In implementing new technology one must be aware of its impact on existing structures and make parallel development plans for the systems that are affected. Furthermore, the difficulty of considering all factors of importance increases with technical complexity.

Paper II and Paper III focus on the relationship between psychosocial/physical stressors and musculoskeletal symptoms in industrial workplaces with technically complex production. Paper II comprises five industries and 30 operators working at robot stations. Paper III comprises three shops and all their employees (n = 45). The results of Paper II demonstrate that, in preventing work-related musculoskeletal symptoms among welding operators, attention should be paid to both the psychosocial and the physical workload. The results in Paper III show that the correlations between psychosocial factors and different measurements of physical workload in industrial settings are applicable in planning for a good work environment in other settings, that is in shops. It can furthermore be concluded that the relationships between psychosocial factors, physical work environment and perceived musculoskeletal discomfort are relatively complex and that there are no obvious or easy explanations.

Paper IV focuses on the importance of considering organizations' requirements for change and the creation of crossfunctionally composed working groups.

Paper V, finally deals with approaches to translating abstractions such as target-oriented group, integration, decentralized, continuous training into understandable tools and "physical hooks". These studies were carried out in one industry (Karlskrona Shipyard) and comprises 15 leaders and 122 blue collar workers in the plate and welding workshop. The result in Paper IV show that the management style at the shipyard was characterized by control and the issuing of orders. There was a resistance at the shipyard to change because people preferred the stability and

security of what was familiar to them. On the basis of the results of the analyses of the state of the organization, one applied a “step-by-step” strategy, emphasizing the entitlement to training and acquisition of skills grounded in each individual’s need, regardless of organizational level. In Paper V three “physical hooks” were developed to facilitate the change process; these were the operator’s computer, the target board and the robot group office.

Further knowledge is needed about how we as individuals and a collective in organizations in fact are able to live in continuous change and what psychological consequences this has for individuals and organizations. It is also clear that greater knowledge is needed about what the different applications of lean production mean for work conditions and for change strategies in Swedish industry.

Keywords: Organizational change, change strategy, industry, applied research

Sammanfattning

Föreliggande arbete fokuserar på modeller och strategier för organisatoriskt förändring och teknisk förnyelse, inom svensk verkstadsindustri. Avhandlingens övergripande syfte är att belysa erfarenheter av förändringsprocesser vid integrerad utveckling av produktionsteknik och organisation för konkurrenskraft och god arbetsmiljö. Avhandlingen bygger på en litteraturgenomgång och fem studier. Samtliga är empiriska studier, fyra av dem genomförda i verkstadsindustri och en i tre av systembolagets butiker. Resultaten är baserade på intervjuer, enkäter och deltagande observationer.

Studie I rör förändringsprocesser och ledarskap under turbulenta förhållanden samt frågor om hur avancerad teknik kan anpassas till mänskliga behov. Det är en fallstudie som omfattar tolv operatörer i svetsrobotstationer och elva tjänstemän i olika positioner. Resultaten visar att ny teknik kan skapa förutsättningar för att utveckla goda arbetsförhållanden, om möjligheterna tas till vara. Vid införande av ny teknik krävs stor medvetenhet om effekter på existerande strukturer och samtidig utveckling bör genomföras för omgivande system. Dessutom ökar svårigheterna att förutse organisationseffekter med ökad teknisk komplexitet.

Studie II och III handlar om sambandet mellan psykosociala/fysiska stressorer och muskuloskeletala symptom, dels i industriarbete med tekniskt avancerad produktion, dels i arbete i systembolagets butiker. Studie II omfattar fem industrier och samtliga operatörer som arbetar i robotstationer (n = 30). Studie III omfattar tre butiker och samtliga anställda (n = 45). Resultat från Studie II visar att uppmärksamhet måste riktas både på psykosocial och fysisk arbetsbelastning för att förebygga arbetsrelaterade muskuloskeletala besvär bland operatörer i svetsrobotstationer. Resultat från studie III visar att sambanden mellan psykosociala faktorer och olika mått på fysisk belastning hämtade från anställda inom industri, också gäller för anställda inom vissa delar av detaljhandel. Det är alltså möjligt att dra nytta av erfarenheter från industriella miljöer i förebyggande arbetsmiljöarbete inom andra verksamhetsområden.

Studie IV fokuserar dels betydelsen av att utgå från en organisations förutsättningar för förändring inför en organisationsutveckling, dels utvecklingen av en tvärfunktionellt sammansatt arbetsgrupp vid införande av avancerad robotteknik.

Studie V, slutligen, handlar om hur man kan översätta abstrakta begrepp som målstyrd arbetsgrupp, integration, decentralisering, kontinuerlig kompetensutveckling med mera till konkreta verktyg eller "fysiska krokar". Studie IV och V genomfördes i en industri (Karlskronavarvet) och omfattar 15 chefer och 122 anställda i varvets plåt- och svetsverkstad. Nulägesanalyser i studie IV visar bland annat, att den dominerande ledarskapsstilen kännetecknades av kontroll och ordergivning. Det fanns också en påtaglig osäkerhet inför förändring bland anställda på varvet. Utgående från nulägesanalyser, tillämpades en steg-för-steg strategi inför den integrerade organisations- och teknikutvecklingen. Under förändringsprocessen bemöts varje enskild individs upplevda behov av ytterligare information, kompetensutveckling och träning, oberoende organisationsnivå. I studie V

utvecklades tre ”fysiska krokar” för att underlätta förändringsprocessen; nämligen operatörsdatorn, måltavlan och robotgrupprummet.

Hur vi som individer och kollektiv i organisationer påverkas av att leva med kontinuerliga förändringar och vilka psykologiska konsekvenser det får för individer och organisationer är frågor som behöver studeras närmare. På motsvarande vis behövs samlad kunskap om vad de olika tillämpningarna av resurssnål produktion innebär för arbetsförhållanden och förändringsstrategier i svensk industri.

References

- Adler, N., & Docherty, P. (1997). *Bringing business into sociotechnical theory and practice*. Stockholm: IMIT 1997:92.
- Alderfer, C. (1977). Organizational Development. *Annual Review of Psychology*, 28, 197-223.
- Alvesson, M (1993). *Organisationsteori och teknokratiskt medvetande*. Stockholm: Nerenius & Santérus förlag.
- Argyris, C. (1971). *Individen och organisationen* (H. Bökstedt, Trans.): Aldus.
- Argyris, C. (1982). *Reasoning, Learning and action: Individual and Organizationa*. San Fransisco: Jossey-Bass.
- Argyris, C., & Schön, D. (1996). *Organizational learning II - theory, method and practice*. Reading: Addison-Wesley.
- Armenakis, A., & Bedeian, G. (1999). Organizational change; A review of theory and research in the 1990's. *Journal of Management*, 25(3), 293-315.
- Aronsson, G., Svensson, L., Leksell, K., & Sjögren, A. (1995). *Förändringskompetens: projektledares erfarenheter från 300 Arbetslivsfondsprojekt*. Solna: Arbetslivsinstitutet.
- Arvonen, J. (2002). *Change, production and employees : an integrated model of leadership*. Doctoral thesis, Department of Psychology, Stockholm University, Sweden.
- Bamford, D. R., & Forrester, P., L. (2003). Managing planned and emergent change within an operations management environment. *International Journal of Operations & Production Management*, 23(5), 546-564.
- Bartunek, J., M., & Moch, M., K. (1994). Third-order Organizational Change and the Western Mystical Tradition. *Journal of Organizational Change*, 7(1), 24-41.
- Beer, M., & Eisenstat, R. (1996). Developing an organization capable of implementing strategy and learning. *Human Relations*, 49(5), 597-619.
- Beer, M., Eisenstat, R., & Spector, B. (1990). Why change programs don't produce change. *Harvard Business Review*, November-December.
- Beer, M., & Nohria, N. (2000). *Breaking the code of change*. Boston Massachusetts: Harvard Business Scholl Press.
- Beer, M., & Russel, E., Eisenstat. (2000). The Silent Killers of Strategy Implementantion and Learning. *Sloan Management Review*(Summer, 2000), 29-40.
- Beer, M., & Walton, A.-E. (1987). Organizational change and development. *Annual Review of Psychology*, 38, 339-367.
- Bennebroek Gravenhorst K, M. (2003, 14-17 May). *A different View of Resistance to Change*. Paper presented at the Power Dynamics and Organizational Change, IV Symposium at the 11th EAWOP Conference, Lisbon, Portugal.
- Bennebroek Gravenhorst, K. M., Werkman, R. A., Boonstra, J. J. (2003). The change capacity of organisations: General assessment and five configurations. *Applied Psychology: An International Review*, 52(1), 83-105.
- Berger, A. (1993). *Organising manufacturing development. Traditions, Assumptions and Managerial Implications*. Göteborg: Chalmers University of Technology: Department of Industrial Management and Economics.
- Berger, A., Hart, H., & Lindberg, P. (1995). *Ständiga förbättringar. Ännu ett verktyg eller en del av arbetet i målstyrda grupper* (No. 95:1). Göteborg: Core, IMIT, CTH.
- Boog, B. W. (2003). The emancipatory character of action research, its history and the present state of the art. *Journal of Community and Applied Social Psychology*, 13(6), 426-438.
- Boonstra, J., & Bennebroek Gravenhorst, M. (1998). Power dynamics and organizational change: A comparison of Perspectives. *European Journal of Work and Organisational Psychology*, 7(2), 97-120.

- Boonstra, J., & Vink, M., J. (1996). Technological and Organizational Interventions: A Dilemma of Fundamental Change and Participation. *European Journal of Work and Organizational Psychology*, 5(3), 351-375.
- Brown, S., L. & Eisenhardt, K., M. (1997). The art of continuous Change: Linking Complexity Theory and Time -paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42, 1-32.
- Buchanan, D. (1994). *Theories of Change*. Loughborough University, Business School Research Series, Paper 1994:5.
- Buchanan, D., & Badham, R. (1999). Politics in Organizational Change: The Lived Experience. *Human Relations*, 52(5), 609-629.
- Burdorf, A., & Laan, J. (1991). Comparison of methods for the assessment of postural load on the back. *Scandinavian Journal of Work Environment and Health*, 17, 425-429.
- Börjesson, S. (1991). Work organization in FMS: two case descriptions. *The International Journal of Human Factors in Manufacturing*, 1, 75-86.
- Caldwell, R. (2003). Models of Change Agency: a Fourfold Classification. *British Journal of Management*, 14, 131-142.
- Chaharbaghi, K., & Willis, R. (1998). Strategy: the missing link between continuous revolution and constant evolution. *International Journal of Operations & production Management*, 18(9/10), 1017-1027.
- Cheng, Y.-T., & Van de Ven, A., H. (1996). Learning the innovation journey: Order out of chaos? *Organization Science*, 7(6), 593-664.
- Christmansson, M., & Nonås, K. (2003). Trender och förändringar i fordonsindustrin. In: C. von Otter eds. *Ute och inne i svenskt arbetsliv. Forskare analyserar och spekulerar om trender i framtiden arbete*. Stockholm: Arbetslivsinstitutet: Arbetsliv i omvandling 2003:8.
- Clegg, C., Wall, T., D., Pepper, K., Stride, C., Woods, D., Morrisson, D., et al. (2002). An international study of the use and effectiveness of modern manufacturing practices. *Human Factors and Ergonomics in Manufacturing*, 12, 171-191.
- Clegg, C., & Walsh, S. (2004). Change Management: Time for a change! *European Journal of Work and Organizational Psychology*, 13(2), 217-239.
- Cummings, T., G., & Worley, C., G. (1993). *Organizational development and change*. St. Paul: MN, West.
- Deakin, J. M., Stevenson, J.M.; Vail, G.R. & Nelson, J.M. (1994). The use of the Nordic questionnaire in an industrial setting: A case study. *Applied Ergonomics*, 25(3), 182-185.
- Docherty, P., Forslin, J., & Shani (Rami), A., B. (2002). *Emerging work systems: from intensive to sustainable*. London: Routledge.
- Docherty, P., & Huzzard, T. (2003). Marknads-, management- och medarbetartrender 1985-2005. In C. von Otter (Ed.), *Ute och inne i svenskt arbetsliv. Forskare analyserar och spekulerar om trender i framtidens arbete* (Vol. 2003:8, pp. 393). Stockholm: Work life in transition.
- Doyle, M., Claydon, T., & Buchanan, D. (2000). Mixed results, Lousy Process: the management Experience of Organizational Change. *British Journal of Management*, 11(Special Issue), 59-80.
- Dunphy, D. (1996). Organizational change in corporate setting. *Human Relations*, 49(5), 541-552.
- Dunphy, D., & Stace, D. (1990). *Under New Management: Australian Organisations in Transition*. Sydney: McGraw-Hill.
- Dunphy, D., & Stace, D. (1993). The strategic management of corporate change. *Human Relations*, 46(8), 905-921.
- Edling, C. (2003). Nya ledningsstrategier i Sverige: en empirisk belysning. In Å. Sandberg (Ed.), *Ledning för alla?: perspektivbrytningar i arbetsliv och företagsledning* (pp. 353-373). Stockholm: SNS.

- Edling, C., & Sandberg, Å. (1996). "Är Taylor död och pyramiderna rivna? Nya former för företagsledning och arbetsorganisation", i Carl le Grand, Ryszard Szulkin & Michael Thålin (Red.): *Sveriges arbetsplatser - organisation, personalutveckling, styrning*. (Second ed.). Stockholm: SNS.
- Eklöf, M., Lindén, G., Lundin, R., & Nonås, K. (1990). *Arbetsutformning i dagens och morgondagens robotiserade bågsvetsstationer* (No. 5). Göteborg: Psykologiska Institutionen.
- Eklöf, M., Lindén, G., Lundin, R., & Nonås, K. (1991). *Om utbildning av svetsrobotoperatörer* (No. 2). Göteborg: Psykologiska Institutionen.
- Ekvall, G., & Arvonen, J. (1991). Change-centered leadership: An extension of the two-dimensional model. *Scandinavian Journal of Management*, 7, 17-26.
- Engström, T., Johansson, J., Å., Jonsson, D., & Medbo, L. (1995). Empirical evaluation of the reform assembly work at the Volvo Uddevalla plant: Psychosocial effects and performance aspects. *International Journal of Industrial Ergonomics*, 16, 293-308.
- Engström, T., Jonsson, D., & Medbo, L. (2005). *Alternativ montering. Principer och erfarenheter från fordonsindustrin*. Stockholm, Sverige: Metallindustriarbetare Förbundet.
- Faucheux, C., Amado, G., & Laurent, A. (1982). Organizational Development and Change. *Annual Review of Psychology*, 33, 343-370.
- Ford, J., D., & Ford, L., W. (1995). The role of conversation in producing intentional change in organizations. *Academy of Management Review*, 20(3), 541-570.
- Forslin, J. (1990). *Det klippta bandet. En Volvo-industri byter kultur*. Stockholm: Nordstedts Förlag.
- Forslin, J., & Thulestedt, B. (1993). *Lärande organisation. Att utveckla kompetens*. Stockholm: FA-rådet.
- French, W. L., & Bell, J., C. H. (1990). *Organization Development. behavioral science interventions for organization improvment*. (4th ed.). New Jersey: Prentice-Hall.
- Friedlander, F., & Brown, D. L. (1974). Organizational Development. *Annual Review of Psychology*, 25, 313-341.
- Gustavsen, B. (1990). *Vägen till ett bättre arbetsliv*. Falköping: Arbetslivscentrum.
- Gustavsen, B. (1995). The design of conferences and the evolving role of democratic dialogue in working life. In O. Eikeland, H. Finsrud, Dons., & B. Gustavsen (Eds.), *Research in action: Forskning och handling: sökelys på aksjonsforskning* (pp. 103-123). Oslo: Arbeidsforskningsinstituttet.
- Gustavsen, B., Hofmeier, B., Ekman Philips, M., & Wikman, A. (1996). *Concept-driven development and the organization of change: an evaluation of the Swedish Working Life Fund* (Vol. Dialogues on Work and Innovation). Amsterdam: Benjamins.
- Heller, F. (1998). Influence at Work: A 25-Year Program of Research. *Human Relations*, 51(12), 1425-1456.
- Heller, F. (2003). Participation and Power: A critical Assessment. *Applied Psychology*, 52(1), 144-163.
- Hendry, C. (1996). Understanding and creating whole organizational change through learning theory. *Human Relations*, 49(5), 621-641.
- Hersey, P., & Blanchard, K. (1988). *Management of organizational behavior. Utilizing human resources*. Fifth Edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.
- Holman, D., Axtell, C., Clegg, C., Pepper, K., Waterson, P., Cantista, I., et al. (2000). Change and innovation in Modern manufacturing Practices: An Expert Panel Survey of U.K. Companies. *Human Factors and Ergonomics in Manufacturing*, 10(2), 121-137.
- Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organizational Science*(2), 88-115.
- Huse, F., Edgar., & Cummings, T., G. (1985). *Organizational Development and Change*. St. Paul, Minnesota: West Publishing Co.

- Håkansson, K. (1995). *Change strategies in working life*. Unpublished Monograph, University of Göteborg.
- Härenstam, A., Rydbeck, A., Karlkvist, M., Waldenström, K., & Wiklund, P., and the MOA Research Group (Eds.). (2004). *The Significance of Organisation for Healthy Work* (Vol. 13). Stockholm: National Institute for Working Life.
- Hörte, S.-Å., (red). (1991). *Tillverkningsstrategier i Sverige 1982-1989*. Göteborg: IMIT, Chalmers Tekniska Högskola.
- Ingelgård, A. (1998). *On macroergonomics and learning strategies in improving working conditions*. Göteborgs University, Göteborg.
- Ingelgård, A., Karlsson, H., Nonås, K., & Örtengren, R. (1996). Psychosocial and physical work environment factors at three workplaces dealing with materials handling. *International Journal of Industrial Ergonomics*, 17(3), 209-220.
- Johansson, G. (2005). Arbetspsykologi. In P. Hwang, I. Lundberg, J. Rönnerberg & A.-C. Smedler (Eds.), *Vår tids psykologi* (pp. 658): Natur och kultur.
- Johansson, J., Å., Lindén, G., & Nonås, K. (1991). *Psykisk och fysisk arbetsbelastning bland svetsrobotoperatörer vid fem företag* (No. 1). Göteborg: Psykologiska Institutionen.
- Johansson, J., Å. (1992b). Arbetsmiljö och sjukfrånvaro. In J. Shcaller, Johansson, J.Å. (Ed.), *Ledarskap och arbetsmiljö* (pp. 133-144). Göteborg: Akademiförlaget.
- Johansson, J., Å. (1992a, September, 9-11). *Psychosocial factors, physical load and symptoms from the neck, shoulders and back among home care workers*. Paper presented at the First International Congress on Occupational Health Care Workers, Freiburg, Germany.
- Johansson, J., V. (1985). *The effects of control and social support on work related strain and adverse health outcomes*. University of Stockholm, Stockholm.
- Johansson, J., Å. (1991, May 27-28). *Management style and work organization in an assembly plant with an advanced technology*. Paper presented at the 3rd international production management conference on management and new production systems, Göteborg.
- Johansson, J., Å., Kadefors, R., Rubenowitz, S., Klingenstierna, U., Engström, T., & Johansson, M. (1993). Musculoskeletal symptoms, ergonomic aspects and psychosocial factors in two different truck assembly concepts. *International Journal of Industrial Ergonomics*, 12, 35-48.
- Johansson, R., C. (2004). Applied participation and empowerment at work - methods, tools and case studies. In C. Johansson, R., A. Frevel, Geissler-Gruber, Brigitta. & G. Strina (Eds.), *Applied Participation and Empowerment at Work - Methods, Tools and Case Studies*. Lund: Studentlitteratur.
- Johansson-Hidén, B. (1998). *Analyzing talk in the workplace group: Dynamics, dominance and coherence*. Unpublished Monography, Göteborg, Göteborg.
- Karasek, R., & Theorell, T. (1990). *Healthy work. Stress, productivity and the reconstruction of working life*. New York: Basic Books.
- Karlsson, J., Ch. (1997). Flexibilitet i praktiken. In S. Åke (Ed.), *Ledning för alla?: Om perspektivbrytningar i arbetsliv och företagsledning*. Stockholm: SNS.
- Karlsson, J. C., & Eriksson, B. (2000). *Flexibla arbetsplatser och arbetsvillkor. En empirisk prövning av en retorisk figur*. Lund: Arkivförlaget.
- Katz, D., & Kahn, R., L. (1987). *The social psychology of organisations*: Wiley international Edition.
- Kihlberg, S., Franzon, H., Fröberg, J., Hägg, G., Johansson Hanse, J., Kjellberg, A., et al. (Eds.). (2005). *Ett produktionssystem under förändring - ergonomisk och teknisk utvärdering* (Vol. 2005:1). Stockholm: National Institute of Working Life.
- Kim, D., H. (1993). The Link between Individual and Organizational Learning. *Sloan Management Review*, 35(Fall), 37-50.
- Kotter, J. P. (1999). *The eight steps to transformation. The leader's change handbook*. San Francisco: Jossey-Bass.

- Kuorinka, I., Jonsson, B., Kilbom, Å., Vinterberg, H., Biering-Sørensen, F., Andersson, G., et al. (1987). Standardised Nordic Questionnaire for the analysis of musculo.skeletal symptoms. *Applied Ergonomics*, 18(3), 233-237.
- Kuorinka, I., & Kilbom, Å. (1990). *Självrapportering av arbetsställningar och arbetsmetoder samt deras relation till muskuloskeletala besvär*. (No. 10). Stockholm: Solna: NIOH, Arbetsmiljöinstitutet.
- Landbergis, P., A., Cahill, J., & Schnall, P. (1999). The Impact of Lean Production and Related New Systems of Work Organization on Worker Health. *Journal of Occupational Psychology*, 4(2), 108-130.
- Lanningen, H. (2001). *Planning and implementing change in organizations - A construct for managing change projects*. Helsinki University of Technology, Helsinki.
- Lennerlöf, L. (2000). *Avveckla eller utveckla? En antologi om verksamhetskonskvenser i magra organisationer*. Uppsala: Ord & Vetande AB.
- Liew, M., & Kilbom, Å. (1985). *Två metoder för bedömning av fysisk belastning i yrkesarbete - fortsatt metodutveckling och reliabilitet* (No. 34). Stockholm, Solna: NIOH, Arbetsmiljöinstitutet.
- Locke, E., A., Schweiger, David, M., Latham, Gary, P. (1986). Participation in Decision Making: When should it be used? *Organizational Dynamics*, 14(3), 65-79.
- Marshak, R. J. (1993). Lewin meets Confucius: a review of the OD model of change. *Journal of Applied Behavioral Science*, 29, 393-415.
- Martin, R. (2000). Breaking the Code of Change: Observations and Critique. In M. Beer, Nohria, Nitin. (Ed.), *Breaking the Code of Change* (pp. 449-473). Boston: Harvard Business School Press.
- Miller, C., C., & Cardinal, B., L. (1994). Strategic Planning and Firm performance: A synthesis of More tha Two Decades of Research. *The Academy of Managerial Journal*, 37(6), 1649-1665.
- Miller, D. (1993). The architecture of simplicity. *Academy of Management Journal*, 18(1), 116-138.
- Miller, D. (1994). What happens after success: The perils of excellence. *Journal of Management Studies*, 31(3 May), 325-358.
- Mintzberg, H. (1987). Crafting strategy. *Harvard Business Review*(July-Aug), 66-75.
- Mintzberg, H. (1990). The design school: reconsidering the basic premises of strategic management. *Strategic Management Journal*, 11, 171-195.
- Mintzberg, H., & Westley, F. (1992). Cycles of organizational change. *Strategic Management Journal*, 13, 39-59.
- Morgan, G. (1999). *Organisationsmetaforer*. Lund: Studentlitteratur.
- Mumford, E. (2003). *Redesigning Human Systems*: Idea Group Publisher Inc.
- Munduate, L., & Bennebroek Gravenhorst, K., M. (2003). Power dynamics and organisational change: An introduction. *Applied Psychology: An International Review*, 52(1), 1-13.
- Nadler, D. A., Tushman, Michael. L. (1999). Strategic Imperatives and Core Competencies for 21 st the Century. *Organizational Dynamics*, 28(1), 45-60.
- Naschold, F., Cole, E., R., Gustavsen, B., & van Beinum, H. (1993). *Constructing the New Industrial Society* (Vol. 3). Assen/Maastricht: Van Gorcum.
- Norrgrén, F., Hart, H., & Schaller, J. (1996). *Förändringsstrategiers effektivitet*: Center for Organizational Renewal at CTH.
- Orlikowski, W., J. (1996). Improvising Organizational Transformation Over Time: A situated Change Perspective. *Information Systems Research*, 7(1), 63-92.
- Osterman, P. (2000). Work Reorganization in an Era of Restructuring: Trends in Diffusion and Effects on Employee Welfare. *Industrial and Labor Relations Review*, 47(2), 175-188.

- Pasmore, W., A. (1985). Social science transformer: The socio-technical perspective. *Human Relations*, 48(1), 1-22.
- Pasmore, W., A., & Fagans, M., R. (1992). Participation, Individual Development and Organizational Change: A Review and Synthesis. *Journal of Management*, 18(2), 375-397.
- Pettigrew, A., M., Woodman, R., W., & Kim, S., C. (2001). Studying organizational change and development: Challenges for future research. *Academy of Management Journal*, 44(4), 697-713.
- Porras, J., & Silvers, R., C. (1991). Organization development and transformation. *Annual Review of Psychology*, 42, 51-78.
- Prahalad, C., K., & Gary, H. (1994). Strategy as a Field of Study: Why search for a New Paradigm? *Strategic Management Journal*, 15(Summer,1994), 5-16.
- Quinn, R., E., & Spreitzer, G., M. (1997). The road to empowerment. Seven questions every leader should consider. *Organizational Dynamics*(Autumn), 37-49.
- Rendahl, J-E., Hart, H., Lawler, E. E., Ledford, G. E., & Norrgren, F. (1996). *Att förändra och leda morgondagens arbete*. Stockholm: VIS Strategi.
- Roos, G., von Krogh, G., Roos, J., & Slocum, K. (2004). *Strategi - en introduktion*. Lund: Studentlitteratur.
- Rubenowitz, S. (1984). *Organisationspsykologi och ledarskap*. Göteborg: Akademiförlaget.
- Rubenowitz, S. (1989). Management and job organizations in progressive Swedish industries. *Reports from the Department of Applied Psychology*, 12(1).
- Rubenowitz, S., Olsson, A., & Steen, B. (1990). The new roles of management in plants with advanced CNC-technology. *International Journal of Operation & Production Management*, 10, 26-36.
- Rubenowitz, S., & Schaller, J. (1992). *Standard data. Analyses of psychosocial quality of working life factors*. Unpublished manuscript, (Department of Psychology, University of Göteborg, Sweden).
- Rundcrantz, B.-L. (1991). *Pain and discomfort in the musculoskeletal system among dentists*. University of Lund, Sweden.
- Sashkin, M. (1987). Content and process in O.D. intervention: The message from research. *Organization Development Journal*, 5(3), 60-63.
- Scarborough, H. (1995). Review article of The Social Engagement of Social Science: A Tavistock Anthology. *Human Relations*, 48, 23-33.
- Schweiger, D., M., & Denish, A., S. (1991). Communication with employees following a merger: A longitudinal field experiment. *Academy of Management Journal*, 34(1), 110-135.
- Senge, P., M. (1990). *The Leader's New York: Building Learning Organizations*. *Sloan Management Review*, 32(1).
- Stjernberg, T. (1993). *Organisationsideal - livskraft och spridning*. Falköping: Norstedts Juridik, C.E Fritzes AB.
- Strakey, K. (1998). What Can We Learn from the Learning Organization? *Human Relations*, 51(4), 531-545.
- Theorell, T. (2003). *Är ökat inflytande på arbetsplatsen bra för folkhälsan?* (No. 2003:24). Stockholm: Statens Folkhälsoinstitut.
- Thylefors, I., & Persson, O. (2004). *Det handlar om samverkan - en studie av inflytande, delaktighet och egenkontroll i fyra statliga verksamheter* (No. 502895): AMS Närservice.
- Tunälv, C. (1991). *Manufacturing Strategies in the Swedish Engineering Industry*. Chalmers University of Technology, Göteborg.
- Wall, T., D., Cordery, John, L., Clegg, Chris, W. (2002). Empowerment, Performance, and Operational Uncertainty: A theoretical Integration. *Applied Psychology*, 51(1), 146-169.
- Walton, R., E. (1985). From control to commitment in the work place. *Harvard Business Review*, 63(2), 77-84.

- Walton, R., E. (1986). A Vision-Led Approach to Management Restructuring. *Organizational Dynamics*, 14(4), 5-16.
- Van De Ven, A., H., Poole, Marshall, Scott. (1995). Explaining development and Change in Organizations. *Academy of Management Review*, 20(3), 510-540.
- van Eijnatten, F., M., van Galen, M. (2002). Chaos, dialogue and the dolphin's strategy. *Journal of Organizational Change Management*, 15(4), 391-401.
- Weick, K., E. (1999). Theory construction as disciplined reflexivity: Tradeoffs in the 90s. *Academy of Management Review*, 24(4), 797-806.
- Weick, K., E., & Quinn, R., E. (1999). Organizational change and development. *Annual Review of Psychology*, 50, 361-386.
- Weick, K., E., Sutcliff, K., M., & Obstfeld, D. (Eds.). (1999). *Organizing for high reliability: Processes of collective mindfulness*. Stamford, CT: US: JAI Press Inc.
- Whelan-Berry, K. S., Gordan, J. R., et al. (2003). Strengthening organizational change processes. *The Journal of Applied Behavioral Science*, 39(2), 186-207.
- Whittington, R., Pettigrew, A., Peck, S., Fenton, E., Conyon, M. (1999). Change and Complementarities in the New Competitive Landscape: A European Panel Study, 1992-1996. *Organization Science*, 10(5), 583-600.
- Wiktorin, C., Karlqvist, L., Nygård, C. H., & Winkel, J. (1991). *Design and reliability of a questionnaire for estimation of physical load in epidemiologic studies*. Paper presented at the Designing for Everyone. The Eleventh Congress of the International Ergonomics Association.
- Wiktorin, C., Karlqvist, L., & Winkel, J. (1993). Validity of self-reported exposures to work postures and manual materials handling. *Scandinavian Journal of Work Environment and Health*, 19, 208-214.
- von Otter, C., (Red.). (2003). *Ute och inne i svenskt arbetsliv* (Vol. 8). Stockholm: Arbetslivsinstitutet.
- Yukl, G. (1998). *Leadership in organizations* (Fourth Edition ed.). NJ: Prentice-Hall Inc.