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The team as a learning strategy:
Three cases of team-based production in the Swedish manufacturing industry

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Abstract:

Purpose*:* To increase our understanding of how the introduction of a team-based work organization can affect the opportunities to learn at work two research questions are addressed: (a) what conditions are important for learning and competence development in a team-based work organization, and (b) to what extent does a team-based work organization support and enhance favourable learning conditions for team members?

Methodology/Approach: Investigations are based on longitudinal case studies of work-based learning and the development of a team-based organization in three manufacturing companies.

Findings*:* Results demonstrate that there are no straightforward or linear relations between the introduction of team-based production and the expansion of learning conditions. The study also identifies several challenges and dilemmas organizations meet when they introduce a team-based production.

Practical Implications*:* Several conditions important for learning in a team-based production are emphasized; the needs for challenging work tasks; the development of a team leadership and the significance of supportive learning conditions, etc.

Originality/Value: The study contributes to an understanding of organizational change and development as a non-linear process which can be understood as a complex interplay between actors and internal and external organizational conditions.

Keywords: Team-based production, learning, learning conditions, learning strategy.

Paper Type: Research paper

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Introduction

Questions about learning, education and competence development in working life have been given increased importance in recent years and there is a widespread belief among decision makers and researchers that learning and competence development are essential for productivity, competitiveness and innovation in organizations (Lundvall & Archibugi, 2001, Maskell, et al, 1998). The increasing need to handle changing external conditions and to develop company operations, however, have called for less hierarchical ("flatter"), process-oriented and team-based organizations within the economy (Porter, 1985; Schumann, 1998) and a shift towards more independent forms of work organization (such as a team-based organization), which is considered to create potentials for favourable learning conditions for employees (Beer et al., 1990; Clark & Clegg, 1998).

Nevertheless, almost twenty years since the rapid increase of empirical and theoretical research on these "new" organizational forms, the nature of the outcomes resulting from an introduction of flatter and more independent forms of work organization are still discussed. The outcomes resulting from an introduction of a team-based organization have been characterized in various ways; ranging from overwhelmingly optimistic, such as "high commitment" (Applebaum & Batt, 1994), "high performance" (Manz & Sims, 1995), "learning organization" (Thomas & Allen, 2006) and "innovative organization" (West et al., 2004), to more critical as "concertive control" (Barker, 1999) "normative control", (Knights & McCabe, 2000) and "intensified work systems"(Docherty, et al., 2002).

In this paper the research interest is focused on the introduction of a team-based production in three manufacturing companies and how this may affect the employees' opportunities to learn in work. Generally, companies and organizations use several

methods to meet the need for learning and competence development. In this regard, two different approaches can be distinguished: (1) increased training and competence development efforts and (2) reorganization of the whole or parts of the organization. These two alternatives are not mutually exclusive but can be regarded as complementary methods to increase the competence among employees and in the company/organization and both alternatives are used regularly. The outcomes resulting from a change to the work organization, however, are not straightforward and the question of whether the introduction of a team-based work organization is favourable to the employee's opportunities to learn in their work has no obvious answer.

The purpose of this paper is to increase our understanding of how the introduction of a team-based work organization effects the opportunities to learn in work and is based on case studies of the introduction and development of a team-based organization in three manufacturing companies. More specifically, the following two questions will be addressed:

(a) what conditions are important for learning and competence development in a team-based work organization?

(b) to what extent does a team-based work organization support and enhance favorable learning conditions for team members?

Theoretical Framework

In a discussion on the need for a renewal of work and organization, Schumann (1998) describes two basic lines, or forms, of work organization, which can be viewed as possible outcomes of efforts to change the organization of work. The two perspectives capture important aspects of the ongoing discussion of merits and pitfalls of a team-based work organization and may serve as a frame of reference, what possible effects a reorganization of work towards a team-based organization can result in. "The Structurally Conservative Model" refers to a work organization based on a low integration of work tasks, both horizontally and vertically, and is exemplified by Japanese transplants to the US (cf. Adler & Borys, 1996). The other model is "The Structurally Innovative Model", characterized by an integration of work tasks both horizontally and vertically, and based on a high degree of autonomy and self regulation.

Using Schumann's categorization it is possible to identify at least two broad perspectives, or possible outcomes, resulting from the introduction of a team-based work organization. (1) In accordance with "The Structurally Innovative Model", the introduction of a team-based work organization can constitute a basis for learning and competence development for employees, based on flexible work, substantial autonomy, increased self regulation and control, etc. (Cohen & Bailey, 1997; Dyer, 1995; Manz & Sims, 1995; Mohrman, et al, 1995). This perspective is denoted as "team as a learning strategy". (2) The other perspective lies within the same territory as "The Structurally Conservative Model". From this perspective the introduction of a team-based work organization merely represents efforts by the management to intensify the work, based on a softer form of control. The introduction of team-based work in this form does not represent any substantial break with traditional hierarchical modes of control; consequently the opportunities to learn in team-based work are restricted (Barker, 1993; Delbridge et al, 2000; Knights & McCabe, 2000; Smith, 1997). This perspective/outcome may be denoted as "team as a control strategy".

The introduction of team-based work organization in a company is not necessarily and/or primarily based on explicitly declared motives; it seems reasonable to understand motives and objectives as implicit, multifaceted and related to different positions and interests (Mintzberg, 1994). The change from an existing work organization, based on work in functional units, towards a work organization based on work in teams, is here viewed as a strategy that is potentially capable of meeting increased demands for learning and development (a learning strategy). The notion of strategy is used in the sense proposed by Mintzberg (1994), that is, as referring to strategies as emergent patterns of practices within a certain context, irrespectively of the extent to which these practices are the result of deliberate processes of planning and decision-making. From this usage it is possible to distinguish between different forms of strategies, i.e. "intended strategies" and "realized strategies". An intended strategy may be based on plans and explicit intentions, while a realized strategy can be based on plans and intentions, as well as emerge from experiences and previous actions, or be a combination of both. The usage of a "learning strategy" or "a control strategy" refers to one or a combination of the measures mentioned above. Thus, a realized strategy can be

described as a "result" of the interaction between intended and emergent strategies. Using these terms, and making the former distinction between learning and control strategies, the three companies studied have intended strategies that may lead to the realization of team-based production, which may have the capacity to meet demands for learning and development.

Team-based Work Organization

Definitions of teams have been influenced by different group concepts in psychology and social psychology (Hackman, 1990). Several concepts with similar meanings are widespread, such as; self-directed work groups, self-regulating work groups, self-managing work groups, semi-autonomous work groups, etc. (Benders & Van Hootegem, 1999; Mueller, et al., 2000).

Here, a team is characterized by the following characteristics:

it is a permanent group with a limited number of members (about 5-12);

the team as a collective has responsibility for work tasks and active co-operation within the team;

the team has the responsibility and authorization for planning, executing and evaluating the results of the team's work;

the team works towards objectives set at the team level and the members participate in the formulation of team objectives;

the team work supports the exchange and dissemination of experience and competence, both within and between teams.

Whether teams in general fulfil these criteria is an important question for empirical research. Teams can unquestionably demonstrate a certain variation concerning these characteristics. Teams which fulfil these qualities to a high degree can be denoted as more developed teams and can, in addition, be considered as having a work organization that offers favourable learning conditions. Teams which fulfil these qualities to a low degree can be considered as offering less favourable learning conditions (cf. Yeatts & Hyten, 1998).

Learning Activities

An important point of departure for this paper is that a team-based organization, in order to be regarded as a learning strategy, should support and facilitate learning activities at work and contribute to increased competence among employees. Learning activities are here understood as any activity or process that supports learning (cf. Marsick & Watkins, 1990). These activities can occur with or without the learner's awareness or intention to learn. In this matter, a distinction is often made between formal and non-formal or informal learning activities (Eraut, 2000; Marsick & Watkins, 1990). Formal learning activities are typically planned, organized, classroom-based, institutionally sponsored and award a qualification or credit (Eraut, 2000), while informal learning activities are less planned, more incidental, experience based and include learning from fellow workers - "sitting next to Nellie" (Colley et al., 2002). The learner (the "actor" or the "learning subject") can be a team or an individual member of a team. Here, learning at the team level was studied from the aspect of the work of the individuals in the team, who were involved in learning processes that might lead to a change in competence, not only for particular individuals, but also for the team in its entirety. This means that learning was not studied "directly," but through the learning activities in which individuals and the team were involved, such as handling production disturbances and working on continuous improvements.

Learning Conditions

Learning activities are framed and embedded in a certain context; a context which is more or less specific and which differed between the companies studied. The context can be described as an external organizational context consisting of branch conditions, competitors, legislation, etc. Focusing on conditions and relations within an organization, we can talk of an inner organizational context, comprised of social, economic and technical systems (Jackson & Schuler, 1995¸ Salas & Cannon-Bowers, 2001). The outer and inner context "surrounds" and affect the actors' subjective understanding and shapes different situations. Important conditions related to the inner context in this study are work tasks, technical equipment, work methods, the design and structure of the team-based production, leadership, etc. (Ellström, 2002).

Learning conditions are here distinguished as important aspects of the inner organizational context and are viewed in terms of (1) "objective" conditions and relationships regarding variation, complexity, autonomy in work, supply of training, etc. These factors themselves constitute important preconditions for learning and learning activities. To be able to benefit from learning activities however, the individuals and the team need to (2) subjectively understand and evaluate these conditions as important and (3) be able to utilize the potential of the (objective) learning conditions (Ellström & Kock, 1999).

Furthermore, a distinction can be made between two different levels (or forms) of learning and learning conditions; adaptive learning and developmental learning (Ellström 2002). Viewed as a learning condition, adaptive learning represents a less favourable condition, while developmental learning represents a more favourable condition (cf. restrictive and expansive learning, Fuller & Unwin, 2004). Traditionally, research on learning in industrial contexts has often viewed learning as an adaptive process (Ellström, 2002). This view is characterized by an individual who is supposed to learn something on the basis of given (or taken for granted) objectives, assignments and methods, without extensively questioning or having the opportunity of affecting the learning conditions. It is a learning process that promotes what can be described as a competence for adaptation, i.e. the capacity to perform without questioning the goals and underlying principles of the work. This adaptive view of learning is in contrast to a more developmental view of learning. In developmental learning there is a focus on exploring and questioning, solving problems and creating new solutions. A work situation that supports developmental learning and competence development is characterized by a higher degree of freedom to plan the work tasks, choose methods and evaluate the results. These two levels of learning should not be seen as mutually exclusive, and both forms are required. The lower level of learning (adaptive) corresponds to tasks and methods which are performed on a routine basis and is sufficient for handling routine problems that occur frequently. The higher form of learning (developmental) becomes necessary in novel situations and when previous experiences are inadequate and there is a need to consider new alternatives and critically analyze established definitions of problems, routines and practices (Ellström, 2002).

Methodology – Case Studies

The results are based on three longitudinal case studies of manufacturing companies. In line with Yin (1994), case studies are here considered as a research strategy, rather than as a method for data collection. Appropriate use of case studies can contribute to an increased understanding and to development of theory. This is important as critics of case studies often focus on conclusions drawn from seemingly narrow empirical bases. The construction of a case study should be evaluated according to its aims, research questions, access to the field, resources, etc. The position in this paper is that the use of case studies can support theoretical and analytical generalization, rather than empirical conclusions (Yin, 1994).

The case selection was based on the following criteria:

  the companies had recently implemented teams and team-based production;

  the selected companies differed regarding type of production.

The selected companies and teams had a certain variation regarding work tasks, size and composition of teams, etc (see table I below). Within each company two teams/groups were studied intensively while two other teams were studied less extensively (questionnaire alone). The results presented are based foremost on interviews with operators in the six teams studied intensively; first-line managers, production management and union representatives. The companies were studied over a period of approximately two years, during which time there were two "waves" of data collection, with a 1.5-2 year interval (1998-2000). A total of 146 interviews were carried out. The interviews were conducted on-site, on a confidential basis. Tapes and transcripts were at all times under the control of the researcher.

An Emerging Learning Strategy

In the following section a selection of results from the three case studies are presented. In the first section the motives and implementation are described, followed by a description of work tasks, working conditions and competence demands. In the third

section the leadership and the organizational climate is portrayed and in the final section the focus is on learning conditions and learning activities.

Team Characteristics, Motives and Implementation

The design of the team-based organization in the three companies differs in several respects (table I, below). Based on the degree of integration between working duties and functions in production (Schumann et al., 1995), it was found that the Mechanical Company had a higher degree of integration, primarily because the introduction of several rotating "responsibility roles" in the team. A responsibility role denotes a specified responsibility for a certain area, such as continuous improvement, where the operator is given adequate training for the role and works for 6-12 months as an "improvement leader" before rotating to another responsibility role. The other two companies, the Engineering Company and the Telecommunications Company, had a lower degree of integration. The Engineering Company did not apply responsibility roles and in the Telecommunications Company responsibility roles were fewer and less developed.

The introduction and the design of the team-based organization in the three companies differed in several respects, including the pace of change, the size of teams, composition of teams, the training of operators, etc.(see table I below).

Table I. . The Three Studied Companies – An Overview

	The Telecommunications Company	The Engineering Company	The Mechanical Company
Products	Cell phones	Equipment for power generation	Equipment for automation
Total number of employees	1,620	2,050	560
Type of production	Volume production of printed-circuit cards	One-piece production of technical equipment	Volume production of mechanical components
Year of implementation of team-based production	1996	1995	1994
Pace of change	Very rapid	Moderate	Rapid
Main work tasks in the Production	Surveillance and control	Manufacturing	Mounting
Complexity of work tasks[1]	Low	High	Low
Size of the studied teams	6-9	11-18	16-17
Composition of the studied teams with respect to:			
- *age*	28	32	36
- *gender*	11 men, 2 women	11 men, 1 woman	14 men
- *formal education[2]*	19% / 29%	78% / 2%	29% / 3%
- *period of service*	3 yrs	16 yrs	8 yrs
Opportunities for operators to choose a team	Restricted	Few restrictions	Restricted
Training to support and develop work in teams	No	No	Yes

It seems apparent that the size and composition of teams are important factors for the progress of the team-based work. Research on team organization describes how larger teams can experience difficulties in their efforts to develop co-operation, mutual norms and unity (Yeatts & Hyten, 1998), a difficulty that was also experienced among the larger teams in The Engineering Company. A certain degree of diversity (e.g. gender, age, ethnicity) in a team can be regarded as a more supportive condition to learning and to the development of the team (Moore, 1999), while homogeneity is less favourable in this respect, and also point towards an increased risk of "groupthink" (Janis, 1972). The more homogeneous teams (regarding age and work experience) in The Engineering

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[1] Based on the degree of integration between work tasks and functions in production (Schumann, Baethge-Kinsky et al., 1995

[2] Vocational education / upper secondary school

Company consider these similarities as beneficial to teamwork, while the heterogeneous teams in The Telecommunications Company view their dissimilarities in this respect as supportive to teamwork. When it comes to the size and composition of a team it seems important to find a "trade off" between teams that are small enough/homogeneous to be able to co-operate in a more developed way, but still large enough/heterogeneous so that a higher number of dissimilar members can make contributions to the teamwork. The results from the case studies indicate that the team in The Telecommunication Company was of adequate size and had a balanced composition concerning homo/heterogeneity, but was hampered by an overall staffing shortage and reduction of lead times. The operators in the Mechanical Company experienced similar problems, as the company was increasingly focused on the reduction of stocks, batches, lead times and staffing:

> Today we´re always short of people. Several things can disturb: people can be on sick leave, on training, etc. so we have to get operators from other teams to fix our daily production figures; and that's no easy thing. They often have similar problems (operator, Mechanical Company).

In the Engineering Company (and the Mechanical Company) several teams had difficulties in exploiting vital advantages of teamwork (e.g. increased co-operation) due to the large size of the teams.

Another interesting difference between the companies concerns the change process. In the Telecommunications Company the team organization was introduced with a high tempo, leaving little space for participation by the operators. As the management of the company experienced a strong pressure from the external context (markets, competitors, and rapid technological change) it was considered necessary to reform the work organization at a very high tempo. As a consequence, the operators' experiences from the introduction process were predominantly negative. The implementation process within the other two companies was accomplished with a higher degree of participation; resulting in more predominantly positive views of the team-based production. The higher degree of the operators' participation in the introduction process seems also to have been important for the continued development of the team organization.

Work Tasks, Competence Demands and Working Conditions

There were significant differences between the three companies in the characteristics of work tasks, competence demands and working conditions (see table II below). The Engineering Company diverged in several respects from the other companies. The operators' work duties can be characterized by a higher degree of autonomy, variation and complexity; qualities that were prevalent prior to the introduction of team-based production. Development of the operators' work tasks led to increased demands on technical/work-oriented competence while other forms of competence were considered less important. In the Telecommunications Company, the operators had limited autonomy, variation and complexity in their work tasks. They were also affected negatively as the rotating responsibility roles were phased out during 1998, without being replaced with any corresponding positions. This change was considered necessary because it was difficult to maintain competence among those operators who had responsibility roles. The operators' subjective evaluation of the working conditions in team-based production showed that they had deteriorated during the period under study. This is commented on by a union representative in the Telecommunications Company:

> The upper management denotes this change (the introduction of a team-based production) as a learning organization. It´s okay for me... but today rarely anyone experiences themselves as committed to the concept as it has developed. The single operator no longer has any personal responsibilities, can no longer say; this is *my* role in the team, *my* contribution to the teamwork.

In the Mechanical Company, the system with responsibility roles constituted an important factor for creating variation and increased complexity in work tasks. The operators' experience of work in teams actualized the need for increased competence; in particular the need for a co-operative competence. The responsibility roles which were introduced were, however, phased out during 1998, since the management could not agree on the principles for setting wage levels for operators in responsibility roles. Another important change was the introduction of a highly standardized work layout, which was an element in the company's interest in lean production. In the first phase the management unified the technical equipment in the different work stations. In a second phase, efforts were made to get the work done in the "best way"; the methods

for mounting parts were specified and standardized. The standardization of the work tasks were criticized by some operators, while others saw possible benefits:

> Disadvantages? If you ask me it's all about that everyone can't catch up with the higher tempo. Less people, higher tempo, more conflicts within the team... We're not very good at solving conflicts (operator, Mechanical Company).

> I think this will increase the teamwork in our team. Everyone should do the job in similar ways; all the lines. Maybe one or two of the older operators in my team dislike it, but in the long run it will be beneficial for the team (operator Mechanical Company).

The working conditions could be described as learning supportive during the period when the company had a rotation of assemblers in responsibility roles and more developed work in the groups, but less supportive after the responsibility roles were phased out.

Table II. Work Tasks, Competence Demands and the Operators' Experiences of Teamwork.

	The Telecommunications Company		The Engineering Company		The Mechanical Company	
Work tasks:						
• autonomy	Low		Restricted/High		Restricted	
• variation	Restricted		High		Restricted	
• complexity	Restricted		High		Restricted	
Competence demand [3]	*Operators*	*Supervisors*	*Operators*	*Supervisors*	*Operators*	*Supervisors*
• technical	Unchanged	Higher	Higher	Higher	Restricted	Restricted
• co-operative	Unchanged	Higher	Unchanged	Unchanged	Higher	Higher
• developmental-competence	Unchanged	Higher	Restricted	Restricted	Higher	Higher

The work tasks, competence demands and working conditions were more supportive for developmental learning in the Engineering Company and less supportive in the Telecommunications Company. With regard to the Mechanical Company, the rotating responsibility roles led to increased opportunities for learning and competence

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[3] Operators' judgement of the competence needed in a team-based production as compared to the former work organization.

development, but with the dropping of these roles, the work tasks consisted mainly of assembly. The main reason for this decline can be understood by considering the divergent views which the management and the Metal Workers Union had concerning the question of compensation in the team-based production. The management regarded the introduction of responsibility roles as a way to enrich the production work, with no need to modify the compensation system. The union's interpretation on the other hand, focused on new work tasks, which pointed toward negotiation of new standards for compensation. The two parties were unable to reach an agreement, and, as a consequence, a majority of the operators did not carry out work in responsibility roles.

Organizational Climate and Leadership

Regarding the organizational climate in the three companies, the Engineering Company was successful in maintaining a more positive climate among both operators and supervisors. This seems logical since the operators had more opportunities to participate in the introduction of team-based production. In the Telecommunications Company and the Mechanical Company, however, a considerable corrosion of the organizational climate took place during the period under study. This was largely due to an increase in demands for flexibility, efficiency and shorter lead times experienced by both the operators and supervisors. Due to a considerable expansion by the Telecommunications Company during the period under study, the operators experienced a lack of stability and predictability in their work situation. In the Mechanical Company, the organizational climate was negatively affected by the conflict concerning compensation for working in responsibility roles.

The literature on teamwork describes the importance of a leadership that supports and promotes development of the operators and groups. The leadership that gradually emerged in the three companies was more of a traditional (functional) leadership based on a leader's technical competence, rather than team leadership based on co-operation and development-oriented competence among leaders and operators.

Table III.. The Normative Model of Team Leadership vs. Leadership in Use.

The Normative Model of Team Leadership [4]	Team Leadership in the Three Companies
Team leaders are recruited, trained, motivated and supported by a positive organizational climate.	Team leaders became leaders by coincidence, with insufficient training and a de-motivating work situation.
Leadership is distributed to the members of the team.	The leadership is partly (and with great difficulty) assigned to the team.
The team leader develops, supervises and supports the team members.	The team leader "fixes" technical problems and is occupied by administrative tasks.
The development of leadership is guided by visions and distinct objectives.	The leader is situated at the intersection of incompatible demands, unclear objectives and operators' demands for accessibility.
The team has competence to handle work tasks, co-operation difficulties and conflict resolution.	The leader solves problems of co-operation and serves as the team's "counsellor."

The overall picture of the leadership in the three companies studied reveals several difficulties in developing a team-based leadership and there is a substantial gap between the normative leadership model and the "actual leadership" in the three companies (see table III, above). One apparent difficulty experienced by several first-line managers in all three companies, was the increasing "span of control"[5] as the team-based organization was introduced:

> In the work as a first-line manager my ambition is to coach the operators. Being out in the shop, talking to people, being of assistance. This could be done some years ago when I was supervising 30 operators. Today they are almost 60! (First-line manager, Telecommunications Company).

In all three cases studied, the span of control was widened as a result of the introduction of the team-based organization and each first-line manager consequently had a larger number of operators to lead. This finding underlines at least two necessary conditions concerning leadership and employee relationships in a team-based organization: the

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[4] Cf. Mohrman, Cohen and Mohrman, 1995; Manz and Sims, 1995.
[5] Mintzberg (1983): How many subordinates that "report" to each supervisor.

employees should be able to lead themselves and the first-line manager should be able to delegate certain work tasks to employees (Manz & Sims, 1995).

Learning Conditions and Learning Activities

The introduction of team-based production affected both work tasks and competence demands in the three companies. In the Engineering Company, the learning conditions were based on variation, complexity and autonomy in the work, and the operators' highly complex work tasks were extended even further. The learning conditions in the Mechanical Company and the Telecommunications Company were, to a high degree, based on the introduction of a team organization which included the development of responsibility roles. A plausible interpretation of this finding is that the introduction of team-based production founded on horizontal work rotation and responsibility roles, and with unchanged and low complexity in the operators' other work tasks, is a change which is insufficient to support an increase in developmental learning (Davidson & Svedin, 1999). In order to provide long-lasting support for learning, the tasks on which the operators spend most time, i.e. operating the machines and assembling components, should also have increased variation, complexity and autonomy.

The supervisors describe a leadership style that can be denoted as "coaching," i.e. they strive to create good relations within the teams, represent these externally towards other production areas and the company, and create motivation by supporting the teams. The duty that in the literature is the main focus in team-based operation – leading those who lead themselves (Mohrman et al., 1995) – can be traced in all three companies, and is expressed in the form of demands on, and expectations for, a changed leadership from the production management. In this matter however, the leaders experienced a conflict between team demands and expectations that leaders should assist the groups on the basis of technical-oriented competence, compared with the management's expectations that the leaders should develop teams capable of leading themselves. The production manager in the Mechanical Company is aware of the problem:

> If you take it to the limit you might say that there's no need for managers on this level. If the
> teams are self governing, the first-line manager should be more supportive and focused on what

can be done better: but at the same time, some of the operators expect from their manager that he should be more operational, while the upper management tells him to step back. This is tricky ... it cannot be done until the teams are more accustomed to teamwork.

The way in which the personnel training is related to the new work organization in the three companies, shows considerable similarities. All three companies placed an emphasis on competence development and training and there was a wide range of training options for the operators. During the study, all of the operators took part in formal training activities, the majority of which were production-oriented. The learning activities in the three companies can be characterized as:

an emphasis was placed on formal learning activities;

training needs were identified on the basis of individual and (less often) on team training needs;

competence needs in team-based production were equated with a high degree of technical competence relative to the needs to develop co-operative competence in teams;

the opportunities for learning in work were supported only to a limited extent (e.g. support in handling production problems and opportunities to participate in continuous improvement).

Furthermore, when formal learning activities were used to increase the operators' competence, training was, for example, not used to increase the operators' ability to perform work with continuous improvements. This is one of several examples showing how the companies found it difficult to develop and use more integrated learning activities, i.e. learning activities where there is a bridge between formal learning and support for its application in the work; for example in the form of guidance, accompanied instruction, follow-up seminars, etc (cf. Antonacopoulou, 1999).

Learning Challenges and Dilemmas

Turning to the findings from the case studies, how are we then to evaluate the three examples of a team-based production and what possible conclusion can be drawn? In the first place, it seems obvious that none of the companies are fully developed

examples of what was previously denoted as the learning strategy, and that the introduction of a team-based production implies certain challenges and dilemmas that have to be resolved. Secondly, it also seems unwarranted to conclude that any of the three companies are examples of a control strategy. The case studies show *de facto* changes as the work organization changed from functional groups to teams with a collective responsibility for the work in teams, and a number of operators experienced increased opportunities to learn in/from the work in teams. Third, it also seems difficult to view the cases as failures in strategy implementation. The introduction of team-based production can hardly be interpreted as (using Mintzbergs term) an unrealized learning strategy, but rather as a planned strategy, partly realized, adjusted and reinterpreted as the outer and inner organizational contextual conditions changed over time.

Based on the findings presented in this paper, it seems reasonable to presume that a work organization based on teams, under certain conditions, can be considered to be supportive to learning; at least on the level of adaptive learning. The introduction of a team-based production however, both as a normative model and as a phenomenon based on empirical research, demonstrates important limitations in relation to the support for developmental learning. The presentation of the results from the case studies has also highlighted several groups of conditions that can be viewed as necessary to support developmental learning in a team-based production.

Challenging Work Tasks. An introduction of team-based production founded on horizontal work rotation and responsibility roles, and with unchanged and low complexity in the operators' other work tasks, provides a certain support for adaptive learning (cf. the Mechanical Company). In order to provide support for developmental learning however, the tasks on which the operators spend the most time, i.e. operating the machines and assembling components, should also have increased variation, complexity and autonomy. All three companies have made efforts to establish work on continuous improvement and problem solving as "ordinary" work tasks within the team-based production. This is definitely an interesting way to introduce more challenging work tasks. The results also underline however, the importance of institutionalizing these changes. The work on continuous improvement and problem solving ought to be

supported and "defended" in order to sustain a balance between demands for efficiency and demands for learning.

Development of a Team Leadership. The exploitation of favourable learning conditions seems, to a high degree, to be dependent on a supportive team leadership that encourages improvement, use of alternative methods and the development of new methods/processes. The relatively slow development of the teams with regard to work on continuous improvement and active problem solving is at least partly related to the underdeveloped team leadership. The results presented also call for a need for a competence shift; from a focus on the leader's technical and adaptive competence, towards the expansion of a developmental and innovative competence (cf. Ellström & Kock 2004).

Organizational Climate. The exploitation of favourable learning conditions seems, to a high degree, to be dependent on a supportive organizational climate that encourages improvements, use of alternative methods and the development of new methods/processes. In order to develop a supportive organizational climate, the team-based production should be introduced and implemented as a structure where teams have more authority over important aspects of teamwork; composition of teams, division of work tasks, development of responsibility roles, etc. Another issue, important for the development of the organizational climate, illustrated foremost by the Telecommunications Company, concerns time as an important resource. As many companies experience increasing demands on efficiency and strive to reduce batches, support staffing, lead times, etc., a supportive climate can counterbalance the operators' recognition of less stability and predictability in a work context that can be defined as "lean".

Design and Composition of Teams. The progress of team-based work seems to a certain extent to be contingent with how the teams are designed and composed. Research in this area underline the importance of forming an adequate variation concerning skills, background and demography (age, gender, tenure in the organization) to secure the presence of different backgrounds and experiences within the team (West et al., 2004).

Several of the teams studied had, due to their large number of members, difficulties in exploiting advantages of team work and the important issue, to find a "trade off" between the size of team and the degree of homogeneity/heterogeneity, were not considered in an observant way. Competence within this field was most likely to be found within the HR departments of the companies, however, there was no co-operation between the respective HR department and production in these matters.

Competence Development and Learning Support. The three companies have comprehensive resources for carrying out competence development. In doing this however, they relied heavily on formal competence development activities, i.e. formal courses targeted to the individuals' ability to perform the daily job on a regular basis, rather than to needs related to the team. The content of courses was directed towards increased technical competence, rather than co-operative and developmental competence. Production management, first-line managers and operators all had in common the interpretation of competence needs in the team-based production as technology-oriented, rather than directed towards an increased competence to work in teams. It seems obvious that the companies were unaware (or reluctant) of the need to "bridge" the frequently occurring gap between formal learning and the work situation. Consequently, the use of integrated competence strategies (i.e. formal competence development activities more closely connected to the team-based organization) was not used by the companies. Finally, the lack of learning support (opportunities for feedback and reflection, discussions, meetings, seminars, etc.) appears to have hampered the development of work on continuous improvement and the handling of problems and disturbances in the daily production.

Concluding Remarks

As an overall evaluation of the three team organizations studied, the companies can be described as emerging team organizations, where the development intermittently as slowed down, moved forwards, or even gone in the opposite direction (e.g. in the Mechanical Company). These findings indicate that there are no straightforward or linear relations between the introduction of team-based production and the expansion of learning opportunities among employees. It also seems apparent that an introduction of

an alternative work organization does not automatically change the workers attitudes towards self-realization, participation and increased responsibilities (Hackman, 2002; Minssen, 2005).

The findings from these three case studies underline the significance of creating favourable learning conditions in a team-based work organization, based on what was previously described as favourable objective and subjective learning conditions and the actor's ability to utilize these conditions. From the three case studies it is apparent that the realization of a team organization in the sense of a learning organization depends on several important conditions; access to adequate challenging works tasks, team leadership, a supportive climate, an adequate team design and access to learning support.

Team-based production has been seen as way to reconcile learning at work with increasing demands on efficient production (Ashkenas et al., 1995; Womack, 1990). This issue seems to be highly relevant today as many modern work organizations (including team-based organizations) are claimed to consume, rather than regenerate, their human resources (Docherty et al., 2002). What are then the possible contributions from the three case studies concerning this issue? In two of the companies (the Mechanical and the Telecommunications Company) there were, during the studied period, increasing pressures to reduce lead times, batches, staffing and support. The management experienced increasing pressure from the outer context in terms of sharper competition, rapid technical development and increasing customer demands, and these changes were "translated" into a more intensive work organization. Several operators and first-line managers were critical of this development and anticipated a contradiction between the team-based work and the efforts to intensify the production system.

From these experiences it seems apparent that the conditions for learning in a team-based organization can be seriously eroded in intensive production settings. There is an obvious risk also that the time for learning and partaking of experiences is given shorter lead times. The challenge, in order to create favourable conditions for learning in intensive production systems, can, from this perspective, be seen as; to set aside certain

indispensable resources for learning (including time and learning support) and to argue that the gains from the economization of the production should be reinvested in forms supportive of learning and competence development (cf. Ellström, 2002).

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