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# CO-OPERATIVE FOR OPTIMIZATION OF INDUSTRIAL PRODUCTION SYSTEMS REGARDING PRODUCTIVITY AND ERGONOMICS (COPE).

A Swedish industrial research program.

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**Background.** For several decades, extensive efforts have been put into ergonomic research in Sweden. In spite of this, musculoskeletal disorders still seem to be one of the most prominent health issues in working life. One possible explanation may be that ergonomic research has focused upon isolated questions without sufficient consideration to the context in which the musculoskeletal disorders appear, i.e. the production system (Ellegård et al. 1992; Winkel and Westgaard 1996). This notion forms the background for the initiation of a research program denoted "Co-operative for Optimization of industrial production systems regarding Productivity and Ergonomics" (COPE). The COPE program acknowledges the production system as the prime determinant of ergonomic outcomes in working life. This paper presents the main scope and principal ideas of COPE.

**Musculoskeletal research and production system design.** The outcome of a production system in terms of mechanical and psychosocial loads (i.e. exposures) in shop floor work basically depends on the product manufactured and factors in the production system, e.g. division of labour, work station design, tools and work method.

Delimited technical issues in the production system, such as design criteria for tools and furniture, have gained most attention in earlier ergonomic research. Measures have primarily been discussed in terms of their influence on the exposure *level* of the operator, while restricted research data exist regarding the significance of *frequency* and *duration* of use. However, frequency and duration are crucial dimensions of exposure (Winkel and Mathiassen 1994), and they are principally determined by the production model (Winkel and Westgaard 1996). Knowledge of the ergonomic consequences of different production system designs, or in a more general sense different rationalization strategies, is thus a crucial prerequisite for effective ergonomic interventions in working life.

COPE considers these views by emphasizing research which addresses the optimization of production models with respect to both ergonomics and total productivity. As suggested by the authors' affiliations, COPE is organized as a network between researchers with experience of applied technical issues and researchers within ergonomics. The research is planned to be organized around case studies in the Swedish manufacturing industry. In the first phase, activities will concentrate on developing general concepts and terminology, as well as on formulating and realizing focused joint-venture pilot research projects. Later, shop-floor studies and interventions in full-scale production systems will be carried out, as well as simulations and experiments in the laboratory.

**Rationalization with ergonomic potentials.** Today, an increasing number of industries replace Tayloristic production models advocating delimited and strictly controlled work by "post-taylorism" emphasizing team work, responsibility and multiple skills. As in any rationalization, the goal is to improve productivity, quality and efficiency, but "modern" strategies recognise that the well-being of the employees is one means of obtaining the goal (figure 1). Thus, "modern" rationalization seems to offer the employees varying and autonomous jobs, and may comprise previously unrecognised potentials for combining efficient flexible manufacturing with good ergonomics (e.g. Kadefors et al. 1996). However, other elements in "modern" rationalization may lead to unfavourable ergonomic conditions, e.g. the endeavour to maximize effective work time by minimizing the "porosity" of the work. This may reduce the opportunities for the worker to recover from mechanical or psychosocial exposure through "micro-pauses" (Björkman 1996).

COPE will investigate the ergonomic potentials of "modern" rationalization. Studies will be conducted in industries which deliberately include ergonomic aspects in their rationalization efforts, e.g. by inviting researchers to participate actively in the design of production systems.

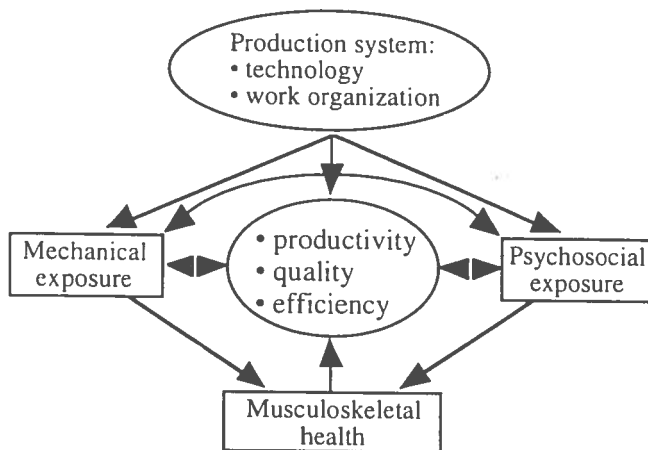


Figure 1. An illustration of important interactions between the production system and ergonomic issues. "Modern" rationalization acknowledges proper mechanical and psychosocial exposures and a low risk for musculoskeletal disorders as prerequisites for a competitive production, i.e. a high productivity, product quality and efficiency (from Winkel and Westgaard 1996).

**Social contexts determining production models.** The choice of production model, and consequently the design of production systems, is influenced by a number of factors in the company above the shop floor level (figure 2). The decisions made by industries are, in turn, influenced by e.g. market forces, community culture and regulations. A thorough understanding of a production system and thereby implicitly also musculoskeletal health, requires insight into the research areas dealing with the social contexts of the system. The COPE program intends to include some of these issues at a later phase.

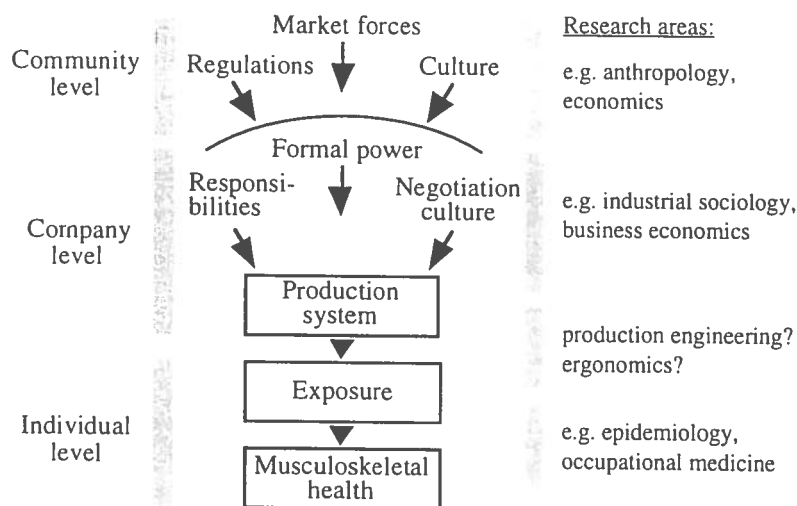


Figure 2. Model illustrating a chain of significant factors determining occupational musculoskeletal health. According to this, successful ergonomic intervention research should include areas and initiatives not usually considered. Further details in the text.

**Major activities in the COPE program.** The program initially comprises three main areas of research and development:

- **Methods**; i.e. development of methods to describe, quantify and evaluate suitable entities of production systems in terms of (1) productivity, quality and efficiency, and (2) ergonomics.
- **Relationships**; i.e. studies revealing relationships between (1) and (2), using the methods developed.
- **Interventions**, i.e. integration of knowledge concerning methods and relationships in production systems during rationalization, with the aim of optimizing between (1) and (2).

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