Available online at www.sciencedirect.com

ScienceDirect

Procedia Manufacturing 3 (2015) 4769 – 4775

Procedia MANUFACTURING

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

Ergonomic modernization in a selected automotive company

Aleksandra Jasiak*

Faculty of Ergonomics and Quality Engineering, Department of Management Engineering, Poznań University of Technology, Poland

Abstract

The article sets out on presenting the macroergonomic modernization of a manufacturing system employed at an automotive company specializing in repairing and refurbishing Peugeot vehicles. The paper outlines features of auto mechanics' workstations, which constitute the weakest part of the system. Based on observations, interviews with mechanics, the company's performance statistics and the activities carried out before, during and after work, the author identified common hazards encountered during the work process. The identified factors were assessed by risk evaluation methods. These were employed to estimate the probabilities of the occurrence of risk, the durations of risk exposures, as well as the nature and severity of their consequences. Based on the combined risk assessment, the article presents ways to minimize risk and precautionary measures designed to achieve a macroergonomic upgrade of auto mechanics' workstations in technical and organizational terms.

Keywords: Manufacturing system; Risk analysis methods

1. Introduction

Ergonomic modernization of auto repair shops is a crucial issue. Its significance results from the fact that, in 2013 alone, Peugeot posted the sales of 18 155 vehicles Poland-wide and 1 553 000 vehicles world-wide, all of which are going to require repairs and maintenance in repair shops.

From the macroergonomic viewpoint, modernizing a company means modifying working conditions to ensure that human resources are utilized as best as possible in terms of work effectiveness and efficiency without imposing excessive workloads on workers.

* Corresponding author. Tel.: + 48 604835961.
E-mail address: aleksandra.jasiak@put.poznan.pl

doi:10.1016/j.promfg.2015.07.578

Technology should contribute to creating a friendly working environment not only in objective terms but also in the subjective assessment of the workers. Therefore, using interdisciplinary macroergonomic knowledge, the author estimated the cost of the proposed modifications and realistically assessed the capacity to put them into practice.

As a sector, the automotive industry faces complex demands. Not only does it need to manage highly complex production systems in which the ergonomics of the workplace play a crucial role but also needs to copy with stringent quality requirements [10].

2. The manufacturing system

Analyses of manufacturing systems are among the most fundamental sources of data on the work design and corporate governance in place in corporate organizations, particularly with respect to human resources, occupational safety, work economics, industrial psychology, occupational physiology and medicine and the broad field of ergonomics.

Macroergonomic analyses of manufacturing systems are used by human labor experts specializing in technical sciences, psychology, sociology, economics, medicine, natural sciences as well as business management and marketing [5]. All of them rely on data relevant for their particular fields of specialization, which they procure by analyzing individual workstations. For that reason, each such designer needs to know the methodologies of workstation analysis, the theoretical underpinnings of such methodologies and various ways to utilize the raw data sets they obtain. The need for a macroergonomic analysis of work systems in business organizations results not only from the humanistic drive to safeguard the dignity of fellow humans employed in specific positions, ensure their psychological development at work and empower workers in their performance. The workstation analyses carried out in business organizations are also driven by social, ethical and economic considerations [6].

Macroergonomic analyses of work systems seek to acquire data on the occupational performance of workers in specific working environments employed in designated positions within the organizational structures of companies. The focus of such analyses is therefore on the operation of people in specific working environments and the tasks they have been entrusted to complete, which follow from the work design in their companies and specifically from the technologies, IT systems and organization employed in given enterprises.

The work system analyses produce empirical data derived predominantly from observations. Information for system analyses comes mainly from:

- company records the tasks and responsibilities of workers, as defined by company management for their specific positions, primary and secondary legislation as well as internal organization rules,
- monitoring the performance of persons employed in given posts (continuously and on a spot basis, with the use of cameras, through participative observation and observation focused on selected aspects of interest),
- workstation measurements (of psychological and physical capabilities of the workers, physical parameters of the working environment such as air pressure, temperature, humidity, air composition, as well as any physical, chemical and biological hazards),
- interviews with employees and their supervisors concerning tasks, working conditions and the operation of people in a given post [14].

Manufacturing system analyses rely on methods for identifying specific tasks performed at a given workstation, assessing occupational risks, recording hazards and on-the-job accidents and determining the requirements put to workers employed in the relevant posts.

One such method is laid down in the Polish risk assessment standard PN-N-18002 which corresponds to the European standard BS OHSAS 18002. The method makes use of two risk parameters: the severity of outcomes (effects) produced by the hazards occurring at the workstation and the likelihood of the occurrence of such outcomes (injuries, diseases). The severity of the outcomes and the probability of their occurrence is rated on a triple point scale describing each hazard as mild, medium and severe. Risk assessments rely on a similar scale from low to medium to high [11].

The preliminary analysis of risks occurring in manufacturing systems are carried out by the PHA method. The method allows for qualitative assessments of risks on the basis of two parameters: E – extent of damage and P – the