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International Journal of Industrial Ergonomics 31 (2003) 33–40

International Journal of

**Industrial
Ergonomics**

www.elsevier.com/locate/ergon

Ergonomic performance and quality relationship: an empirical evidence case

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Received 3 December 2001; received in revised form 13 February 2002; accepted 8 April 2002

Abstract

Empirical verification of the existence of a positive relationship between the ergonomic design of workplaces and achieved product quality levels is not easily established due to the difficulty involved in changing production procedures in a real workshop exclusively for research reasons. In this paper, a metalworking firm with ISO-9002 certification was selected, and its quality results were analyzed with respect to reprocessed and rejected parts after varying the initial work method on the basis of the results of and ergonomic evaluation by means of RULA. Statistical evidence of improvement in relation to reprocessed parts was confirmed, although not in relation to rejected parts.

Relevance to industry

Ergonomics and quality are both important aspects of management. Here we establish the positive relation between both: a reduction in ergonomic problems implies better quality records. To invest in ergonomics is worthy. © 2003 Elsevier Science B.V. All rights reserved.

Keywords: Quality management; Ergonomics; Process design

1. Introduction

Among the numerous applications of ergonomics in industry that have proliferated in recent years, several studies highlight the contribution of the ergonomic design of workplaces to an increase in quality (Helander and Burri, 1994; Schwind, 1996). Karapetrovic (1999) even establishes a relationship between ergonomics and quality assurance systems, postulating that compliance with the ISO-9000 norms contributes to fomenting the interaction between the worker and their work

environment. In general, all the studies related to the implantation of quality systems consider the individual to be a fundamental element for success (González Torre et al., 2001). Thus, the participation of the worker in the development and improvement of their workplace is strongly related to the quality of the results obtained (Eklund, 2000). On the other hand, the firm's management also has to act along these lines, facilitating the reduction of accidents at work, improving productivity and enhancing the life quality of its employees (Fernández, 1995).

However, the difficulty of being able to experiment in real workshops, of varying work procedures and observing the results (both from the

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viewpoint of ergonomics as well as from that of the quality attained) means that studies that verify these relationships are not so numerous (Eklund, 1995).

Eklund (1995) evaluated relationships between different ergonomic conditions and product qualities in eight mini-lines of a Swedish car assembly plant. After identifying some tasks with ergonomic problems, the results showed that the quality deficiencies were more common for them than for the rest of the tasks. However, it can be argued that it is difficult to compare different tasks due to the different characteristics of each one. For that reason, our proposal is to check the relationship by analyzing only one task under different ergonomic conditions.

The aim of this study is to empirically demonstrate the existence of a positive relationship between a *reduction* in ergonomic problems and the product quality attained. To do so, a firm belonging to the metalworking sector was selected in which an initial ergonomic analysis was carried out employing the RULA method, while at the same time checking the results of quality inspections. Having identified the ergonomic problems, a series of improvements were then implemented, analyzing whether significant alterations in quality levels took place in parallel as a result of these ergonomic improvements.

Three phases in the methodology to be applied may therefore be identified (Fig. 1): the first includes the selection of the profile of the firm to study (which has to be carefully chosen so that the sought-after relationship is more easily identified), while the second and the third will, respectively, consist in the choice of the workplace and the gathering and treatment of the representative data of the levels of ergonomics and quality.

As mentioned above, the RULA method—*Rapid Upper Limb Assessment* (McAtamney and Corlett, 1993)—was employed to evaluate the ergonomic situation. This method breaks down the activity carried out in the workplace into tasks. The movements of each task are scored, taking into account the section and part of the body involved, according to certain criteria, and once all the individual movements have been evaluated, the

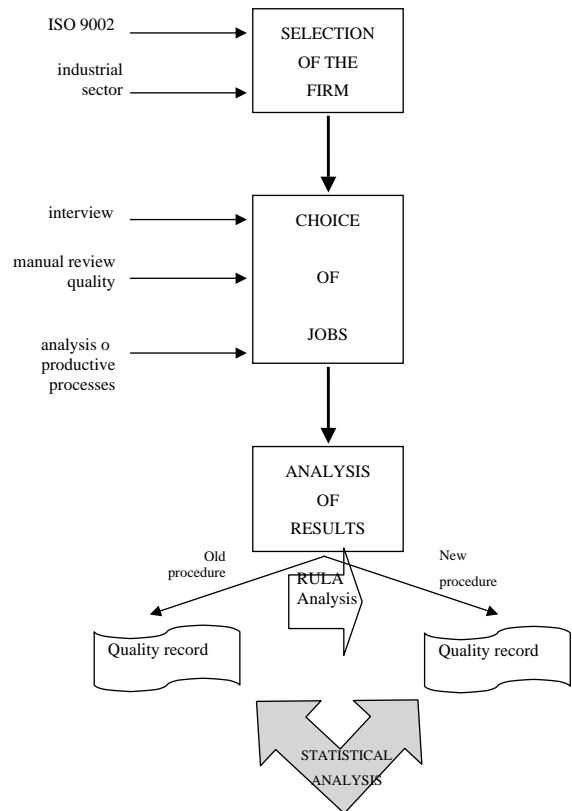


Fig. 1. Schematic representation of the methodology employed.

results are integrated so as to obtain the evaluation of the task.

In this way, definitive scores are obtained for each part of the body, which in turn give rise to an overall ergonomic score or evaluation of the task carried out, ranging from the value 1 (acceptable movement) to 7 (changes urgently required). By conducting this process for each task, the movements in most urgent need of action are detected and an order of priority may be introduced in the application of improvements.

The structure of the rest of this article is the following: the next section describes the empirical study carried out, starting with the selection of the firm and the identification of the workplaces. The research results are subsequently analyzed and discussed, and finally the main conclusions reached are presented.

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