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Development of a software package for ergonomic assessment of manufacturing industry[☆]

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Abstract

A computer software package has been developed to be used as a self-assessment tool to evaluate ergonomic improvement potential of production systems by engineers, managers and safety professionals. Production managers of manufacturing industries with no prior knowledge of ergonomics were able to identify ergonomic deficiencies successfully (81%) in the shop floors as a result of the application of the ergonomic assessment tool. This enabled them to formulate intervention strategies to improve ergonomic conditions in their industries. The software package is user friendly, self-explanatory and provides relevant information, data and guidelines. It is unique, as the users will have access to necessary ergonomics information, which is often lacking in the manufacturing industries, especially in developing countries. © 2002 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Ergonomics/Human Factors Engineering deals with the application of information about human behavior, capabilities and limitations to the design of systems, machines, tools, tasks/jobs, environments, etc. for productive, safe and effective human use (Chapanis, 1985). A manufacturing industry is a complex human–machine–environment–organization system. For productive and effective functioning of this system management should ensure optimum functioning of the system components. The philosophy should be *to fit the task to the human and not the human to the task* (Grandjean, 1982).

There is a growing concern to improve productivity, safety, and quality in manufacturing industries.

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Some of the common features of these industries are improper workplace design, ill-structured jobs, mismatch between workers abilities and job demands, adverse environment, poor human–machine system design and inappropriate management programs. They lead to workplace hazards, poor workers' health, mechanical equipment injuries, disabilities, and in turn reduce worker productivity and product/work quality and increase cost. It would, therefore, be extremely difficult to attain the objectives of the manufacturing industries without giving proper consideration to ergonomics.

Effective application of ergonomics in work system design can achieve a balance between worker characteristics and task demands. This can enhance worker productivity; provide worker safety, physical and mental well-being and job satisfaction. Many research studies have shown positive effects of applying ergonomics principles in workplaces, occupational health and safety, machine design, job design, environment and facilities design (Das & Sengupta, 1996; Das & Shikdar, 1999; Grandjean, 1982; Konz, 1983; Sanders & McCormick, 1992; Shikdar & Das, 1995).

Studies in ergonomics have also produced data and guidelines for industrial applications. The features of ergonomic designs of machines, workstations, facilities are well known (Grandjean, 1982; Konz, 1990; Sanders & McCormick, 1992). However, there is still a low level of acceptance and limited application in the manufacturing industries. The main concern of work system design is usually the improvement of machines and tools alone. Inadequate or no consideration is given to the work system as a whole. Therefore, poorly designed work systems are commonplace in manufacturing industries (Das, 1987; Konz, 1983). Neglect of ergonomic principles brings inefficiency and pain to the workforce. An ergonomically deficient workplace can cause physical and emotional stress, low productivity and poor quality of work (Ayoub, 1990).

Ergonomics has been used to reduce occupational injuries. Current thrust is to reduce musculoskeletal disorders, but ergonomics has long been used to increase efficiency and productivity. The underlying principles of ergonomics can be used to improve occupational health and safety as well as productivity. Workstations can be designed to maximize performance and reduce costs by considering both ergonomics and productivity together (Resnick & Zanotti, 1997). Productivity was found to improve significantly when ergonomics was applied in the work design in industries (Burri & Helander, 1991; Das & Shikdar, 1999; Ryan, 1989; Schnauber, 1986; Shikdar & Das, 1995).

It is believed that ergonomic deficiencies in manufacturing industries are the root causes of workplace health hazards, low level of safety and reduced worker productivity and quality. The poor acceptance and application of ergonomics is probably due to lack of ergonomics knowledge, training in ergonomics and resources.

The main objective of this research was to design an Ergonomics Assessment Procedure for manufacturing industries that would identify ergonomic deficiencies, assess, and provide solutions to the problems. This paper reports the development of the software package and its applicability in manufacturing industries.

2. Methodology

The methodology to develop the Ergonomics Assessment Procedure for manufacturing industries involved: (1) development of a measuring instrument of ergonomic deficiencies/problems, (2) create a database of relevant ergonomics information, and (3) evaluate and assess the instrument for application in the industry.

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