



Worker evaluation of a macroergonomic intervention in a Brazilian footwear company



L.B. de M. Guimarães^{a,*}, J.L.D. Ribeiro^{a,1}, J.S. Renner^{b,2}, P.A.B. de Oliveira^{c,3}

^a Graduate Program in Industrial Engineering, Federal University of Rio Grande do Sul, Av. Osvaldo Aranha 99 5° andar, Porto Alegre, RS, Brazil

^b Health Sciences Institute, Feevale University Center, RS 239, 2755 Vila Nova, Novo Hamburgo, RS 93352-000, Brazil

^c Department of Health, Federal University of Rio Grande do Sul, Rua Ramiro Barcelos, 2600 sala 413 – CEDOP Santana, Porto Alegre, RS 90035-003, Brazil

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ABSTRACT

This article presents a macroergonomic intervention in a Brazilian footwear company and its evaluation by the workers. Using participatory ergonomics, the traditional Taylor/Ford production system was transformed into a socio-technical one and tested by 100 volunteers working during 3.5 years in a pilot production line. Multiskilling and teamwork were the major changes promoted to enlarge and enrich work and make it more flexible. The workers' evaluation pre- and post-intervention showed an increase in overall satisfaction with the work and more commitment to the results and company targets.

Statement of relevance: This study showed that problems and solutions can be identified through participatory ergonomics, that it is easier to involve workers than the managerial staff, and that a macroergonomic intervention, mainly focusing on work organization, led to positive personnel, health and production outcomes, despite management's resistance to changes.

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1. Introduction

Footwear manufacturing is an important sector in the Brazilian economy. Brazil is the third largest shoe manufacturer in the world (after China and India) producing 893,900 pairs of shoes per year (mainly for the North American market) in 8200 companies by 348,700 people (Abicalçados, 2011a), representing 4.4% of the 7,885,702 employees in the industrial sector in 2010 (Brasil, 2011). The state of Rio Grande Sul, considered the most important footwear cluster in the world (Abicalçados, 2011b), is responsible for 37% of employment (in 3400 companies) of the Brazilian shoe manufacturing industry (Abicalçados, 2011a).

Despite its importance, the Brazilian footwear manufacturing system is not as modern as it should be: productivity is low (Piccinini, 1990; Ruas, 1992), production is highly dependent on manual work done by minimally skilled (or unskilled) labor (Piccinini, 1990; Prochnick, 1992; Gorini and Siqueira, 1999), as is to be expected from the Taylor/Ford production system (Friedman, 1967; Dejours, 1980; Braverman, 1998) adopted in most shoe

manufacturing companies. Environmental conditions are often dangerous (due to the high risk of chemicals used like glue and solvents) and workstations are risky (due to unsafe conditions of the low technology machines and equipment). Work organization where workers work on repetitive, monotonous and fragmented tasks leads to high risk of work-related musculoskeletal disorders (WMSD) (Renner, 2002, 2007), high rate of accidents (Renner, 2007; Renner et al., 2008; Guimarães et al., 2012), as well as high rate of turnover and absenteeism (Piccinini, 1992; Ruas, 1992; Renner, 2007; Guimarães et al., 2012b).

Ergonomic studies focusing on WMSD risk in shoe manufacturing have been conducted in Japan (Amano et al., 1988); Mexico (Serratos-Perez and Mendiola-Anda, 1993); Italy (Agnesi et al., 1993; Del Bianco et al., 1993); USA (Drury and Wick, 1984; Wick, 1991; Center for Workplace Health Information, 1995; Burton et al., 1996); France (Roquelaure et al., 2002); Brazil (Renner, 2002); Romania (Croitoru et al., 2007); and Cuba (Herrera and Huatuco, 2011). Ahasan et al. (2002) evaluated the satisfaction with shiftwork and work in a shoe components manufacturer in Bangladesh. Few studies focused on noise (Herbert and Miles, 1991) and on the exposure to chemicals (Decoufflé and Walrath, 1983; Garabrant and Wegman, 1984; Pippard and Acheson, 1985; Walker et al., 1993; Roquelaure et al., 1994; Fuh et al., 1996; Mayan et al., 1999; Jockel et al., 2000; Davila et al., 2005; Croitoru et al., 2007).

Most studies concentrate on the evaluation of environmental, tools and workstation conditions (i.e. microergonomics). The

* Corresponding author. Tel.: +55 51 33083948; fax: +55 51 33084007.

E-mail addresses: liabmg@gmail.com.br, lia@producao.ufrgs.br (L.B. M. Guimarães), ribeiro@ufrgs.br (J.L.D. Ribeiro), jacinta@feevale.br (J.S. Renner), pbarros@ufrgs.br (P.A.B. de Oliveira).

¹ Tel.: +55 51 33084005; fax: +55 51 33084007.

² Tel.: +55 51 35868800.

³ Tel.: +55 51 33165291; fax: +55 51 33165291.

studies at the Red Wing Shoes (Center for Workplace Health Information, 1995) at the Hanover Shoe Company (Burton et al., 1996) and in a Cuban shoe manufacturer (Herrera and Huatuco, 2011) were the only studies reporting an ergonomic intervention and evaluation of the work organization (i.e. macroergonomics), which included workstation redesign, job rotation and teamwork, exercise and conditioning program, and special training on ergonomics. However, they did not propose a complete modification of the work conditions, did not detail the intervention and did not report the level of worker participation.

This article presents a participatory, macroergonomic intervention in a Brazilian shoe manufacturing company that aimed to enhance the social, technical, and work design sub-systems of the company's socio-technical system and improve workers' quality of life, as well as productivity and product quality. The study can be considered a special case in the Brazilian shoe-manufacturing sector, which is very traditional and often resistant to change. Actually, promoting changes by ergonomic interventions is not easy (Vink et al., 2008); but in developing countries where most footwear companies are located, it might be even more difficult. Most factories are in developing countries because shoe manufacturing is labor intensive, competition is frequently based on price and the low wages paid in these countries are one of the ways to reduce production costs (ABDI, 2008).

Ahasan et al. (2001) stressed the differences between ergonomic interventions in developing and developed countries such as the conditions of health, safety, and wellbeing of industrial workers, climate, work culture and organizational structure. While many businesses in developing countries wish to make a quick return on their investment, capital and machinery (sometimes leading to excessive working hours to increase production under unhealthy and unsafe conditions), union leaders may want to pursue the goals of the labor union organization rather than reducing the difficulties of work (Ahasan et al., 2001). Brazil is not an exception in this scenario. One of the characteristics of Brazilian trade unions is to fight for (small) increases to wages and to pay less attention to labor conditions. The country has a specific regulation on Ergonomics, named NR17 (Brasil, 1978a); the inspection of the quality of working conditions is under responsibility of the Ministry of Labor through their regional branches but there is not enough trained staff to audit all companies.

Participatory ergonomics was used in the study considering that participation by both workers and managers in identifying and implementing change (e.g., Vink et al., 2008) is an essential component of a macroergonomic intervention. Macroergonomic interventions are complex and have multiple components (Neumann et al., 2010), but the participatory approach has the ability to address both physical and organizational aspects of the work system design (Brown, 1990, 1993; Nagamachi, 1995; Lanoie and Tavenas, 1996; Wilson and Haines, 1997; St-Vincent et al., 1998; Wilson, 1995; Imada, 2000; Haines et al., 2002) leading to increased levels of job communication and improved work content, which has been associated with reduced pain (Rivilis et al., 2006) as well as increase in productivity (Vink et al., 2008).

Although top and middle management are usually involved in participatory interventions in developed countries (Vink et al., 2008), they are often a stumbling block in interventions in developing countries (Scott, 2009): in general they are not interested in changing established operational routines to adjust to worker needs, desires and wants. In Brazil, the participatory approach is not well accepted by some who understand that the change might actually be imposed on workers (Dwyer, 2000), which jeopardizes the democratic value of the intervention. There are questions about whether participatory management in Brazilian enterprises is a tool for worker participation or worker domination, or in more

direct terms, whether it is a managerial strategy for worker manipulation (Martins, 2000), whether the workers are satisfied with participatory management, and whether they want a different approach (Fensterseifer, 1995).

The study presented in this paper was possible due to its three-party character: besides the University, there was a governmental grant and participation of the Ministry of Labor, and the company's industrial director who supported the research despite resistance by other directors, top and middle management as well as union officials. Since 1994, the Brazilian shoe-manufacturing sector has been experiencing a crisis due to the opening of the commercial trade and the valorization of the Brazilian Real currency in relation to the American Dollar: this made it more difficult for the Brazilian industry to compete with low-priced Chinese shoes (ABDI, 2008). Therefore, the company's industrial director understood that the traditional production system was precarious and that the labor force was not sufficiently skilled to compete at a world level. He foresaw that improving the socio-technical system could make a difference to increase the company's competitiveness in the world market, and also that the company could become a model for the Brazilian footwear manufacturing sector.

The following sections describe the participatory research method, the macroergonomic intervention and its evaluation by 100 workers of the study pilot production line and their managerial staff. The validation based on social/health/safety and production results have been already reported (Guimarães et al., 2012b).

2. Method

The study is a longitudinal, multifactor intervention in a single shoe factory. It was conducted from May 2002 to August 2005 in one of the eight plants of the sixth largest footwear factory in Brazil, located in the Paranhana Valley, state of Rio Grande do Sul. It had 1800 employees on average during the study period and manufactured about 22,000 pairs of shoes per month, under a Taylor/Ford production model.

The study has an action-research character based on the participatory, socio-technical approach of the Macroergonomic Work Analysis (MA) (Guimarães, 1999). MA encompasses the steps of a participatory ergonomics process (Vink et al., 2008): introduction (stage 0) named launching in MA, analysis (encompassing stage 1) appraisal and (2) diagnosis in MA, idea generation, selection, prototyping, testing and adjustments (all in stage 3) proposal of solutions in MA, implementation, and evaluation (stage 4) validation in MA, with feedback loops provided by discussion forums in between stages.

The forums are a means of keeping the participants engaged and aware of the intervention process. During the 3.5 years of the intervention there were (a) four meetings of 1-h duration with the 100 workers of the pilot production line, the company's Ergonomics Committee (COERGO), the managerial staff and the ergonomics team; and (b) thirty 30-min meetings with the COERGO.

MA stages are detailed below. Stages 0, 1, 3 and 4 involve workers, management, HRD, Safety and Health Department (SHD) and union representatives in addition to the ergonomists. Stage 2 is mainly developed by the ergonomists.

2.1. Stage 0: launching

The objectives of stage 0 (launching) are to (1) introduce the ergonomics team; (2) discuss the objectives and intervention method with the managerial and non-managerial staff; and (3) engage workers in the study.

The ergonomics team was composed of three ergonomists from the University, one of them being also an employee of the Ministry

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