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CORPORATE ERGONOMICS PROJECT: PROPOSAL OF ANALYSIS CATEGORIES

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ABSTRACT

The corporate ergonomics project discussed in the present paper was carried out in thermal power plants. This project aimed to improve performance and working conditions, beyond to expanding worker's perception about the contributions of participatory ergonomics. The sample consists of 25 ergonomics analysis reports, carried out in 5 thermoelectric plants. It was carried out a content analysis of 100 project reports, proposing a structure of categories for the following dimensions: identified problems, diagnosed causes and planned actions. This categorization showed, as a result of the project, the scope expansion of ergonomics interventions in these thermoelectric plants. Evidences of importance of the adopted integrative and participatory methodology was observed. Opportunities for improving the corporate ergonomics program were also identified. These were mainly related to the performance of the ergonomics committees and the integration of participatory ergonomics into other programs for continuous improvement of occupational health and safety, quality and productivity.

KEYWORDS: macroergonomics; ergonomics analysis; corporate ergonomics projects; participatory ergonomics.

1. INTRODUCTION

The energy company discussed in this text has had a corporate ergonomics program for over 10 years, including training actions, establishment of local ergonomics committees in Operational Units (UO), establishment of indicators, procedures, development of software to support ergonomics action management, among other initiatives. However, the implementation stage is heterogeneous in different business areas and in different UOs, being more recent in the Thermal Power Plants (UTE).

Ergonomics actions at the company's Thermal Park until 2013 were mostly carried out independently by the operational units (UOs), mainly focusing on assessments of administrative workstations and some control rooms. The Safety, Environment, Energy Efficiency, and Health Management (SMES), responsible for UTEs at the time, noted that workers predominantly viewed ergonomics as mainly dealing with postural analysis, Work-Related Musculoskeletal Disorders (WRMSDs), and primarily acting on furniture changes in administrative activities.

This limited view of ergonomics is not unique to the Brazilian thermal park. Despite the definition of Ergonomics provided by the International Ergonomics Association (IEA) and the publication of various studies (HAINES et al., 2002; HENDRICK, 2008; MONROE et al., 2012, TOMPA et al., 2013) reinforcing the potential contribution of participatory ergonomics to system performance and worker health and safety, this is not the predominant perception among most workers, including organizational leaders, even in other countries. Dul and Neumann (2009) identified that managers generally do not associate ergonomics with business performance. In many cases, ergonomics programs are not even integrated into an occupational health and safety management system (YAZDANI et al., 2015). In the case studied here, this disintegration was evidenced in some statements, such as one manager who, during the demands assessment phase, said: "But this is a risk of accident, it's a safety issue, it has nothing to do with ergonomics".

In this context, the company decided to review the actions of the corporate ergonomics program in the thermal park. Among the actions taken, the corporate project, the subject of this text, stands out, which has been developed in partnership with the Production Engineering Department of a Brazilian federal university since 2013. The focus of the project is on the industrial area, aiming to promote performance improvement and health and safety conditions. The project also aimed to promote training and change the workforce's perception of the potential contribution of ergonomics. This corporate project includes the conduct of 80 Ergonomic Work Analyses (EWA), carried out in 16 different Thermal Power Plants (UTE).

This article aimed to propose a method for consolidating and analyzing information from

a subset of 25 EWA experiences, conducted in 5 UTEs. Through content analysis of 100 project reports, a structure of categories was developed to consolidate and analyze the EWAs in the following dimensions: identified problems, diagnosed causes, and planned actions.

2. ERGONOMIC INTERVENTION

The methodology of Ergonomic Work Analysis (EWA) sheds light on the fundamental participation of workers in the analysis of work activities and in the design of improvements to working conditions (GUERIN et al., 2001; DANIELLOU and BÉGUIN, 2007). Taking the Participatory Ergonomics Framework – PEF (HAINES, 2002) as a guidance base for planning and describing this participatory ergonomics project, various dimensions of the project were defined, such as: phases, participants, role of ergonomics specialists, duration, scope, focus of analyses, among others.

2.1 Ergonomic Intervention Methodology

The object of this corporate ergonomics project is to carry out Ergonomic Work Analysis (EWA) services, in accordance with the requirements established by Brazilian Regulatory Standard No. 17 (BRASIL, 2007) and with the methodology recommended in the Application Manual of Brazilian Regulatory Standard No. 17 (BRASIL, 2002), which was structured into the following four main phases: Phase 1 – Identification, prioritization, and selection of demands; Phase 2 - Development of EWA until validation of preliminary recommendations; Phase 3 – Development and validation of improvement recommendations; and Phase 4 – Planning and monitoring of the implementation of prioritized actions.

The overall coordination and supervision of the project are carried out by the corporate management of SMES, which has an ergonomics specialist. In each UTE, the project is locally monitored by a company specialist in occupational health and safety, responsible for facilitating interaction between the university's team of experts and the workforce of the UTE.

The university's technical team, allocated to conduct 5 EWAs in each UTE, consists of the following professionals: one technical coordinator (operating in all 4 phases), two ergonomics specialists (operating in phase 2), and one ergonomics specialist (operating in phase 3), the latter necessarily having experience in conceptual ergonomics. The technical coordination of the project is carried out by a faculty member from the production engineering department with knowledge and experience in ergonomics. Given their education and professional background, in line with recommendations from authors such as Hendrick (2008) and Dul and Neumann (2009), the technical coordination of the project is familiar with the strategic "language" of various stakeholders (e.g., Total Quality Management-TQM, Lean Production, Business Process Management-BPM, etc.).

Leaders and other workers from the UTE participate in all phases of the project. Participating teams are constituted and reorganized on demand and voluntarily, considering the nature of the activity, the stage of the EWA (identification of problems, risk assessments, solution design, feasibility evaluation, etc.), as well as the interests and potential contributions of different knowledge holders among workers from operations, maintenance, laboratory, supplies, warehouse, management, engineering, health and safety, environment, etc.

Phase 1 – Identification and prioritization of demands (duration: 15 days) – This phase begins with a study conducted by the technical coordinator, which includes a global analysis of the company, business unit, technical processes, workforce, organizational structure, production, health and safety results, among others. Subsequently, during a two-day technical visit to the UTE, the unit management and the technical coordinator seek to involve as many workers as possible, who are encouraged to identify difficulties they face in their work activities (accident risks, situations causing pain or discomfort, generating rework or loss of time, etc.). Through field interaction, approximately 30 demands (problems) are identified in each UTE. Considering criteria such as centrality to the business, severity, frequency, seriousness of the problem, as well as ease and estimated investment for the solution, the problems to be analyzed during the 5 EWAs to be conducted in the unit are chosen in a meeting with the multifunctional and multihierarchical group. An additional guidance in this selection process was to seek a set of EWAs involving different teams of workers.

Phase 2 - Development of EWA until validation of preliminary recommendations (duration: 75 days) - The intermediate objective of this phase is to diagnose the causes of the problems identified and prioritized in the first phase. Two ergonomists from the technical team, under the guidance of the coordinator, go through the stages of the EWA, promoting the participation of workers and managers from the UTE. Various methods (IIDA, 2005; SALVENDY, 2006; STANTON et al., 2005) are used in each case and stage for identification, recording, and analysis of problems and causes. This phase culminates in the construction and validation of a set of preliminary ergonomic recommendations, validated in a meeting, for solving the problems selected in phase 1.

Phase 3 – Development and validation of improvement recommendations (duration: 30 days) - In the third phase, the university's technical team, consisting of the coordinator and a design ergonomist, builds upon the preliminary recommendations validated in phase 2 to develop, refine, and create a set of detailed recommendations or conceptual designs. These are presented, discussed, and validated in a face-to-face meeting at the UTE, with participation from the leadership and representatives of other workers who participated in the 5 EWAs.

Phase 4 - Planning and monitoring the implementation of prioritized actions: During the planning stage, the technical coordinator (university), contract oversight (corporate), managers, and workers (UTE) interacted remotely (via email, telephone, and video conference) to develop the plan for implementing the project's components. During the monitoring stage, the technical coordinator remains available for one year to guide the UO in case of doubts regarding the implementation of actions or the need for adjustments to recommendations. Additionally, they conduct a visit to the unit to verify and document the progress of the planned actions, the results achieved, and any possible need for replanning. The UO's ergonomics committee is responsible for continuing to monitor the implementation of planned actions after the contract with the university ends.

3. RESULTS AND DISCUSSIONS

The partial results presented in this article focus on 5 UTEs, where 25 Ergonomic Work Analyses (AET) were completed, related to activities performed by various teams: Operation (12 AET), Laboratory (7 AET), Maintenance (4 AET), Warehouse (1 AET), and Engineering (1 AET). During the 25 AETs, 67 problems were analyzed, for which 117 causes were identified, and 140 improvement actions were planned.

In this research, a content analysis of the 100 reports, referring to the 4 phases of the 25 conducted AETs, was performed. As a result, a structure of categories was developed to characterize the set of AETs in the following three dimensions: Identified Problems, Diagnosed Causes, and Planned Actions. Various categories were defined for each dimension, with the most frequent ones presented in the following figures.

In phase 1, about 30 problems were identified in each UTE. The problems were prioritized, and, through participatory methods, the problems to be analyzed in each unit were chosen, totaling 67 across the 5 UTEs. Figure 1 presents the classification of the 67 analyzed problems into the proposed categories, highlighting physical discomfort (27%) and risk of accidents (24%) as the most frequent categories.

In the thermoelectric park, the perception of ergonomics was mainly related to postural issues in the analysis of administrative workstations. The fact that the risk of accidents was the second most frequent problem category (Figure 1) shows progress in the integration between the ergonomics program and SMS management. The distribution of the set of problems across various categories (Figure 1) led to the involvement of diverse work teams and evidenced that this project broadened the scope of ergonomics, including issues related to safety, productivity, among others.

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Figure 1 - Relative frequency of analyzed problem categories

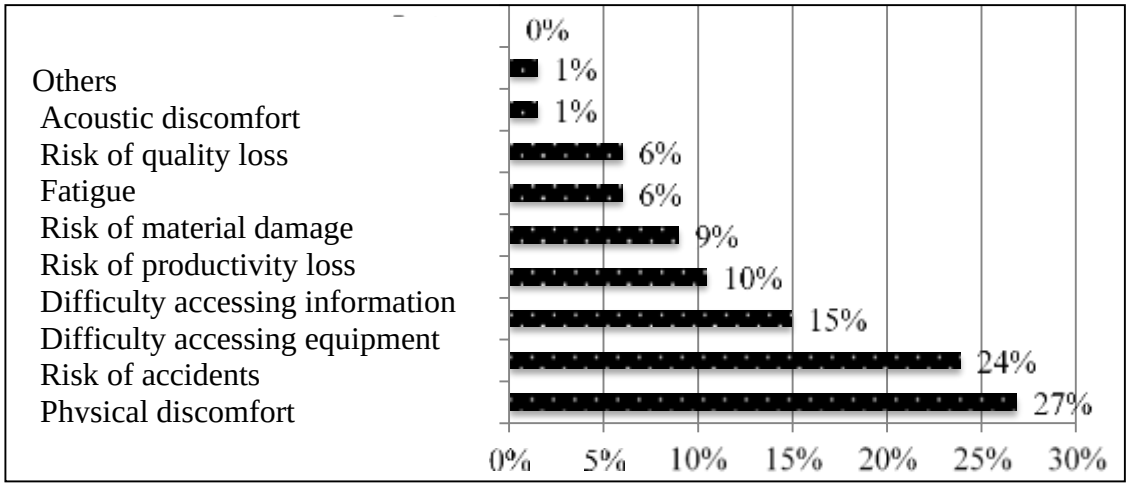
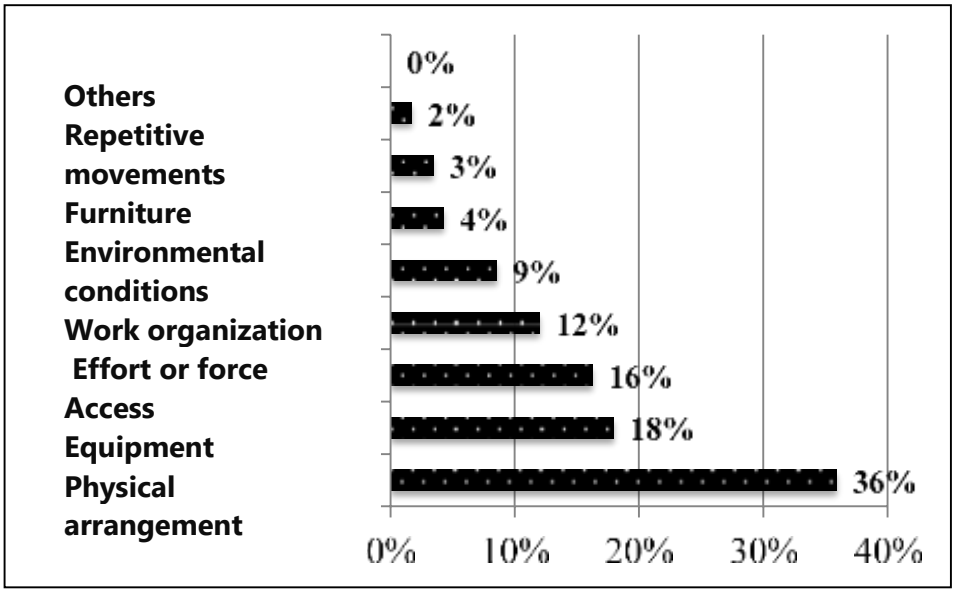


Figure 2 presents the distribution of the 117 identified causes for the 67 problems analyzed in the proposed categories.

Figure 2 - Relative frequency of diagnosed causes categories

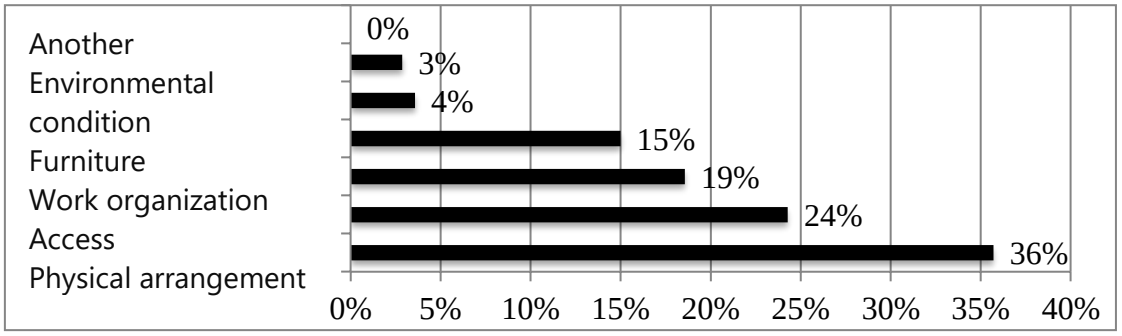


In phase 2, teams were instructed to adopt different methods to diagnose root causes, which reside in the working conditions, explaining the adopted operating modes and resulting in identified problems. As a result, for example, the classic "adoption of unfavorable postures" does not appear in Figure 2, as it was considered in these analyses as an intermediate cause. Those involved in the AET were encouraged to seek answers to what working conditions lead workers to adopt such postures. Is it the difficulty of access? The pace of work? The equipment activation system?

In Figure 2, causes related to physical arrangement (36%) and equipment (18%) stand out, which most of the time are conditions defined even in the design phase of the Power Plant and often difficult to change.

Phase 3 of the project conducted in the 5 Power Plants resulted in a set of 140 planned actions. Figure 3 synthesizes the results of phase 3 of the project, presenting the distribution of planned actions among the categories.

Figure 3 - Relative Frequency of Planned Action Categories



As expected, the categories of actions align coherently with the causes of the problems. The inversion between the two predominant categories can be explained in the continuous process industry by the difficulty of altering the physical arrangement in industrial areas. Most of the actions regarding physical arrangement were carried out in control rooms and laboratories. In some cases, in the industrial area, it was possible to adopt equipment and procedures (work organization) that allowed remote operation, at a safe distance from the risk situation, without the need to change the physical arrangement. The category of actions on equipment (e.g., use of pumps, mixers, forklifts) also addressed problems such as physical discomfort or risk of accidents associated with causes like repetitive movements, excessive effort, or difficulty of access. The higher percentage of actions in work organization, relative to the percentage of causes associated with this category, occurs because some changes planned in other categories, such as equipment, require changes in work organization because they alter requirements related, for example, to procedures, personnel, and task duration.

At the end of phase 4, during technical visits conducted at the 5 units, progress was recorded in the completion of planned actions. However, part of the actions had been planned for 2019 because the restrictions imposed by the crisis had even suspended investments and temporarily halted the project at the units. The actions still planned should be monitored by the local ergonomics committees.

4. CONCLUSION

To verify the scope of ergonomics' role in the corporate project in question, a proposal for categorization structure was developed in this research to consolidate and analyze the results of the Ergonomic Analysis of Work (EAW) in terms of addressed problems, identified causes, and planned actions. The analysis allowed to highlight the expansion of ergonomics' focus of action in the company's Thermal Power Plant Park. It was observed that the analyzed problems and planned actions had a broader scope than what prevailed in the ergonomic actions that used to be conducted in the Thermal Power Plants before the project.

The results also show that the contributions of this corporate ergonomics project are related to the integrative and participatory nature of the ergonomic intervention carried out. As predicted in the EAW methodology, the project promoted the integration of objectives (performance, health, and safety), solutions (in technical and organizational domains), and for this, required the integration of knowledge, logics, interests, and priorities of the intervention actors.

The advancement in integration between the ergonomics program and the Health, Safety, and Environment (HSE) management was exemplified by the fact that the risk of accidents was among the categories of problems most frequently selected for analysis in the EAWs. To further integrate ergonomics and safety, it is suggested to experiment with merging ergonomics committees, which have not been permanent in the Thermal Power Plants, and the Internal Commission for Accident Prevention (CIPA), which has its formation, training, and regulated actions.

The organizational restructuring that occurred during the project, including staff reductions and replacement of managers, contributed to some projects being temporarily discontinued, requiring the new manager to learn about the ergonomics project. This points to the importance of change management systems being applied to organizational changes as well.

The lack of integration between the computerized systems for controlling planned actions in the ergonomics project and in the other ongoing improvement programs in the company became challenges perceived by the actors and indicate system integration as an improvement opportunity.

The indication of progress in integrating ergonomics with other existing management and continuous improvement programs within the company was also noted in Monroe's (2012)

research, which highlights that this integration leverages limited resources and makes the best use of workers' and managers' time. Dul and Newmann (2009) indicate that, in order to capture all the benefits of ergonomics, it should be integrated into the organization's strategies and planning and control cycles. As an example corroborating this indication, in the analyzed project, some budgetary difficulties were overcome for actions that had their contribution to performance (productivity, loss reduction, etc.) recognized and could be framed within budgets and improvement programs outside the scope of HSE.

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