

Abstract Number 0027

Ergonomics aspects and productivity in a Production line: a case study

Rosangela Vanalle¹, João Camarotto², Roberto Torres¹

¹University Nove de Julho. Masters Degree in Production Engineering. Avenida Francisco Matarazzo 612, São Paulo, Brazil, rvanalle@uninove.br. rodrigues@metrosp.com.br

²University Federal de São Carlos. São Carlos. São Paulo. Brasil.. camarotto@dep.ufscar.br

POMS 23rd Annual Conference

Chicago, Illinois, U.S.A.

April 20 to April 23, 2011

Abstract. This paper presents a case study of an ergonomic intervention in a business sector of the house goods. It discusses the strategies adopted by operators in an assembly line to perform the tasks in a flexible work environment, with variable demand. Aiming to meet the production operators adopt individual forms of work organization to reduce the workload in work situations with novice operators, and changes in product mix of the line

Keywords: ergonomics, line production, productivity, absenteeism.

1 Introduction

The operation of a company depends on a set of logics mediated by distinct targets, sometimes conflicting. Among these logics, the productivity of production factors and the health at work are considered two sources of conflicts. The flexibility and the production speed to meet demand variations together with the need for the operational costs reduction for the maintenance of competitiveness generally bump into actions for accident prevention at work. However, the accidents at work which result in workers' withdrawal generate operational costs, reducing the quality and performance of the company.

The different logics, necessary for the economic effectiveness of the company, are, however, partially contradictory with each other and need a daily management of commitments in production work situations. The production operators and supervisors are going to interact with these different logics. These commitments can be explicit like the adoptions of overwork to meet customer requests, or implicit like the increase in the work pacing in situations of demand acceleration, resulting in direct negotiations among several actors.

The realities which make up the work are considered separately in the company's practices, as well as in the ones of scientific subjects which historically composed in this field; this way the company work is object of differentiated approaches.

The role of the ergonomist is, then, to make such logics explicit from the activity analysis to afterwards take them to be discussed in the process of possible organizational solutions

definition [1].

The analysis of the operator activity will make clear the cases in which he finds difficulties to accomplish the targets set by the company, and will let to identify the determinants of these activities that connect with the resources supplied (tools, technical devices, work organization, education and training). The work analysis allows to identify the competences driven by the operators the same way..

1.1 Objective

This study is result of an ergonomic intervention in a Brazilian company in the household appliances sector. The problem faced by the company is connected to the scenery of low productivity associated with workers' absenteeism in a seasonal and of increasing demand atmosphere.

The object of study was the final assembly line of the main product component which, besides being the production bottleneck, presented higher rates of withdrawals and health complaints in the company.

In this work we discuss strategies adopted by the operators to perform production tasks in a flexible work environment with variable demand. At the end we discuss the relationships in the organization which enable minimizing the absenteeism and increasing the assembly productivity.

1.2 Methods and techniques

The process of investigation was based in the principles of action research [2] with the participation of production technicians, assembly operators and the occupational health service of the company in the team composing for the research development. For the confrontation of rationalities about the work process, principles of focused ergonomics [3] with the method of work ergonomic analysis (WEA) and the case study as a practical way of exploring the problem[4].

The action research in organizations have been used in cognitive structures for the resolution of organizational problems by the development of routines of self-monitoring and self-reflexion, the intervention that allows and motivates the integration of several social agents' points of view engaged in the question being studied in interventions which allow people to learn through the problem variables to find new configurations and challenges that emerge from several interpretations during the questions exploration. It is an appreciative investigation to trigger positive talk and changes, destroying the existing patterns of the speech, making room for new voices and discoveries and expanding conversation circles to provide an innovating action [2].

Work Ergonomic Analysis – WEA is an approach method of the work situation that focuses operators' representations about their activities in which, from the instrumental point of view, two main techniques are used. One aimed to establish the differences between the assigned work and the real one, and the other to deepen the analyses from the physiological and biomechanical point of view. The factors that explain the differences between the assigned work and the real one are in the distinction between the task and activity and in the concept of variability. The results of these factors are expressed in the workload (physical and mental), understood by the repercussions about the worker's health and operating ways adopted at work which determine the regulation process [5].

The case study is a study of empiric nature that investigates a certain phenomenon, generally contemporary, in real context of life, when the borders between the phenomenon and the context in which it inserts are clearly defined [6]. It is an investigation process appropriate for the study of problems of operations management, particularly in the development of new production approaches to deal with the increasing frequency and magnitude of changes in technology and managerial methods. A case study requires qualified interviewers; care is needed in the preparation of generalizable conclusions from a limited set of cases and to

ensure a strict investigation. [4].

2 Case Study

The start of every ergonomic intervention is the study object delimitation, defined at the demand formulation. The demand, in ergonomics, is a social demand expressed in an institutional chart by one or more social actors involved in the work situation whose points of view are not necessarily coherent.

The seasonal production always implies meaningful changes in the work structure in the shop floor, by the immediate supervision's worry in ensuring the quality of products in situations of variability increase where there is rhythm acceleration and rotation of product patterns in the line.

The assembly line analyzed provides one of the main product components for the main assembly line, separated by a buffer. In the line any of the patterns may be assembled at any time, without change time, being responsible for the quality of what is supplied. The work cycle time in each workstation varies between 13 and 20 seconds. The line is composed by 10 workstations, 9 operators in the assembly sequence and one material supply operator for the workstations. The line is coordinated by a supervisor, generally the most experienced of the group, responsible for the general organization of the area, the temporary replacement of the operator, the production, and the reprocessing (disassembly and routing) of the reworked products. The line supervisor remains in the position for about 6 months and is replaced afterwards.

The operators make shift among the workstations every half hour. This shift is difficult due to the fact that women do not work in all line workstations, remaining only the ones judged "less heavy" by the company.

Besides the variation of workstations, there is a variation of quantity of tasks for each workstation when the product changes or when there are not enough operators in the plant.

The line work may be interrupted by the operators for several reasons. Any operator may stop the line by a start button which is placed in the intermediary session of the line. When one of the operators has a problem, he asks the operator closer to the button for him to start it. Another reason for the line stop is the lack of components, either caused by the supplier or not internal or external supply of it. In this case they adopt the pattern change in the line.

Problems of equipment reliability were identified mainly of the first and the last workstation. The first workstation is separated from the conveyor belt by a buffer of about 10 pieces due to this lack of reliability. The last workstation, responsible for the product test, may stop the line as when it cannot process the products. In this case the line pause happens by a sensor which detects that the line is full.

There is occurrence of wrong assemblies mainly because of the incorporation of changed components according to the fast change of product pattern in the line.

It was checked, however, that in full capacity production, by the seasonality, there is an increase of the line productivity, explained in ergonomics by the regulation and self-acceleration, as specific ways of operators to ensure the production demanded at the moment.

The seasonal production always involves significant changes in the structure of the work on the factory floor, the immediate concern of managers about the quality of the products in situations where there is increased variability increased pace and switching of product models in the line.

There is, however, that in the peak of production, seasonality, there is an increase in productivity in line. This fact is explained in the ergonomics regulation and self-acceleration, as specific forms of the operators to ensure production required at the time.

The regulation is how each employee is organized to do the job imposed on it by generating specific operational methods and self-acceleration is an answer, usually unconscious, the official organization of the pressures on their conduct, quantity and quality of their work. This

self-acceleration occurs in situations where the employee has no clarity of what is required, when it does not have the same experience and skill of the other companions that perform the same or similar tasks in situations of loss of production when there is need to address some absence, for example.

There is a correlation between the demand for production and type of complaint. During the full production appear some problems related with efforts and repeatability and, in low production periods, the predominant complaints of psycho-physiological problems.

An important element identified during the ergonomic intervention on the assembly line was the establishment of actions by operators featuring the collective work. This first analysis contradicts the Taylorist-Fordist's work organization. Some observed facts point towards the group compared to the results of work even though formally the operators are liable individually.

Another aspect observed was the redistribution of tasks among the operators themselves, from one side to ensure the achievement of goals and another one's job performance while speeding up the treadmill. When the rhythm is accelerated or have an inexperienced operators on the line, the provider or the next workstation operator make others operation to provide the line performance at the pace determined by the treadmill.

The change on the product models results on the incorporation of more operators on the line, called operators flywheels. Such situation creates additional work and cause assembly errors by the similarity of items and disorder of the storage in the line. These changes increase the quantity of work by the need of replacement parts and disassembly rework.

3 Conclusions

The demand, in ergonomics, is a social demand, expressed in an institutional board by one or more social actors involved in the work situation whose points of view are not necessarily coherent.

The work effectiveness depends on the operator's creative action, the task accomplishment. More recently, new perspectives added to this classic view. The objectives of effectiveness, quality, etc also depend on the contribution of the operators themselves (or the operators collectively): these ones spontaneously build new instruments or knowledge which contribute for the production system change (Falzon, op cit).

An important element identified during the ergonomic intervention in the line was the establishment of actions by the operators, characterizing the collective work. This, at first sight, contradicts the Taylorist/Fordist way of work organization.

Some facts observed pointed to the group's responsibility regarding the work results despite the fact that operators are formally charged individually.

Behaviour observed concerns the product quality, knowing that the formal inspections established by the work assigned organization cannot be completely accomplished in the workstation; the operators of the other workstations informally make inspections of the previous operations. The inspections are visual. The main aspects observed are the right assembly of components and likely appearance imperfections of the product, chiefly regarding the risks. This check occurs even if this task is not assigned for the individual. This is expressed in the following statement:

“in the workstation where we attach component A, we can have a look. When you are going to put component B ... it is almost in front, you have a little look to see if it is not inverted. There you have something complex, if you look at the other's, you let yours go wrong. You cannot look a lot, you have to look, but you cannot get involved a lot either, otherwise you have complications”.

This behaviour exemplifies that cooperation at work is what makes many mistakes be corrected and their consequences may be controlled. When the rhythm is accelerated or there are inexperienced operators in the line, the supplier or the operator of the next workstation

helps to ensure that the operation be accomplished in the pacing determined by the conveyor belt.

The supervisor's job as operators' assistant in break moments was already previewed by Lean Production theory as a way of reduction in the stops and for the satisfaction of workers' physiological needs [7]. The cooperation among operators is established from their trust which, according to [8], must also be condition for the coordination.

The recognition of these elements by the company is important as it can enlarge the operator's regulation spaces, ensuring that the task be accomplished without posing risks to health and productivity. For this to be possible there must be a change in the company's organizational structure to open a space for discussion among the agents.

We have seen in this work that from the distance between the task and the activity as reference for analysis, we have found in the collective work the distance between the work assigned organization and the real work organization.

The work activity is the central element which organizes and structures the components of the work situation and in this sense. The integration of the different dimensions must be considered when speaking about performance in the organization.

References

1. Carballeda, G., Garrigou, A. Comprendre la demande : la première étape de l'intervention. Santé et travail. no56. Mutualité française, Paris. (2006).
2. Reason, P.; Bradbury, H. Action research: Participative Inquiry and Practice. Sage Publications (2008).
3. Falzon, P. (editor). Ergonomie. Presses Universitaires de France. (2004).
4. Yin, R. K. Case Study Research: Design and Methods. 4th ed. Applied Social Research Methods Volume 5, Sage Publications (2008).

5. Guérin, F.; Lavile, A., Daniellou, F., Duraffourg, J., Kerguelen, A. Comprendre le Travail pour le Transformer - La Pratique de L'Ergonomie, Éditions de l'ANACT. (1997).
6. Miguel, P.A.C. Business excellence through a world-class organizational structure: experience from the Baldrige National Quality Program. International Journal of Business Excellence, Vol. 1, Number 1-2. (2008).
7. Ohno, T. Workplace Management. Productive Press, Cambridge, MA. Trad. Andrew P. Dyllon. (1988).
8. Dejours, C.. Le facteur humain. 4e Édition. Presses Universitaires de France. (2005)