

# Managing ergonomics in the development of rotation between workstations in the automotive industry. A balance between health and traceability of tasks

Filus, Dr.. Rodrigo<sup>a,\*</sup> and Partel, Luciana<sup>b,\*\*</sup>

<sup>a</sup>*Corporate Ergonomic Sector Volkswagen do Brasil. Corporate Responsible Production Unit Taubaté – HR Unit Manager.*

<sup>b</sup>*Human Resources Production Unit Curitiba – Volkswagen do Brasil. HR Manager.*

**Abstract** When the subject rotation between workstations (job rotation) is inside the organizations it's seemed that technically there are lots of restrictions to the development of an adequate system of rotation. We went from the need for an advanced ergonomic study and even possible restrictions of versatility and training of employees. The implementation of the ideal system of rotation passes through stages of development and research ergonomic study of the level of employee versatility, awareness and discussion with employees, implementation of the proposed system, feedback and audits for maintenance of the ideal sequence and time of rotation. For the success of the project there is a need for multidisciplinary involvement in the areas of manufacturing engineering, industrial engineering, human resources, medical services and manufacturing. Rotation between the tasks may mean that a worker should conduct two or more different activities in different parts of the day (ie. change between activity A and activity B "between 1 hours and 2 hours interval). An important consideration is to ensure that different activities do not present the same ergonomic risk for the same body part. The tracing of the execution of the activity is an important factor for production processes. Thus it is possible to conduct appropriate levels of training for employees and ensure safe and sustainable processes in terms of workers' health, productivity and quality.

Keywords: Process, Rotation, Training.

## 1. Introduction

According to Dan Kennedy and Eric MacLeod [3] there are many reasons to implement the system of rotation between workstations in the workplace, they are included among the potential to increase product quality, employee satisfaction and reduce musculoskeletal complaints. This work aims to establish a new system of rotation between the jobs taking into account the biomechanical situation of the types of activities performed level of knowledge of workers, sectors aligned with management training and leadership need for traceability product. Establish a system of rotation that properly determines the fre-

quency and number of workstations and monitors their safe use is not a simple activity.

Firstly made up to overcome issues concerning to absenteeism [2] and productivity decrease [3], job rotation has become a comprehensive tool for companies to maximize their work process by reducing the risks connected to them.

Slack, et al. [4] observed that when an eventual increase in work tasks was limited by the technological level of work process, taking turns (i.e. periodically move individuals among different groups of tasks to provide some variation in their activities) turned to be a possible alternative to be taken into account. Several studies have already reported posi-

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\* : [rodrigo.filus@volkswagen.com.br](mailto:rodrigo.filus@volkswagen.com.br).

\*\* [luciana.partel@volkswagen.com.br](mailto:luciana.partel@volkswagen.com.br).

tive results related to those variations and pauses during work, however, only a few have included job rotation at all.

Henderson, [5], Canadian Center for Occupational Health and Safety, [6]; and Kuiser, et al, [7] affirm that the use of those taking turns or swapping schemes based on simple post position change are to be considered job rotation hence supposed to guarantee ergonomic risk decrease.

Kuiser, et al, [7] analyzed both advantages and disadvantages of job rotation regarding to manual load rising. They concluded that the appropriate outline of a job rotation scheme, taking into account ergonomic aspects, would improve tasks performance. Anne Gerling, et al, [8] noticed that the required content necessary to outline a job rotation scheme might naturally be taken from analysis of previous evaluations, and also that the focus, during this process, have to be seriously placed upon the reduction of the biomechanical demand of work.

Ellis, [9] and Mac Leod and Kennedy,[3] concluded that either the shift increase or taking turns monotonous or repetitive work might indeed decrease boredom up to a certain level. But differently from what is expected the adaptation capacity of workers to difficult work situation is hardly reached.

## 2. Complexity of workstation rotation

### 2.1. Versatility

To Couto [10] the purpose of the workstation rotation is to transform and train workers in versatile individuals. According to the author, although this measure does not present the complete solution to the problem of quality of life at work, the worker feels much better, after the initial resistance, he realizes how learned and still realize an increase in their alternative practitioners.

It is usual in many companies that the rotation in the workplace are made randomly without adequate standardization, where workers change jobs according to other workers, often not following ergonomic appropriate recommendations, such as the alternation of the members used for a sequence of rotation. This is due primarily to lack of data available in the various literatures dealing with ergonomics [11].

### 2.2. Life quality in work

One of the contributions to the achievement of rotations in the workplace, in the social aspect, is search quality of work life. According to Barbosa [12] "In an era when organizations are willing to adopt the flag of quality life, encouraging people to develop other interests, to maintain a balance between work and family life, between physical activity and inactivity of offices, leisure and work, they never invested in both mechanisms that retain individuals within it, preventing them, metaphorically, to practice quality of life."

When it comes to research methods in ergonomics, Braviano [13] gave the following opinion: "research in ergonomics is characterized by a holistic approach to complex systems, usually irreducible. The problems often involving subjective concepts such as quality of life, motivation, and others, suggest a heuristic method in which, through a deepening gradual and systematic, clearing up the matter and never exhaust it".

### 2.3. Ergonomic methodology

Over the past fifteen years the methodology originated in the analysis of ergonomic work is diversified and solidified with a considerable body of research and studies.

Wisner [14] cites in particular the following points:

- a) Extension of the analysis of the environment, adding the demographic aspects, biological and anthropological;
- b) Methodology of the analysis of work activities; Methodology of preparation of solutions, most of the recommendations;
- c) Extension and deepening of the criteria for successful intervention.

These propositions formed a new field of ergonomics, even broader, because until then it turned to the analysis of the specific job and the recommendations and suggestions for improvements, used by professionals, and which had its focus of attention on individual workstations and micro-ergonomics aspects of the systems work, they found a strong deterrent in the broader understanding of the role of the worker within the organizations, leading to a difficulty to incorporate ergonomics into the organizational objectives were sufficient grounds to bring up a third generation of ergonomics, since the first two generations only sought examine and propose improvements as mentioned in this paragraph[14].

The scope of issues to consider when it comes to adapt technology is such that the population study of

the environment in which to concern technical, economic, social, demographic and anthropological, not represent more than merely a prerequisite but an ergonomic study part of the whole [14].

#### 2.4. *Work organization*

The systems analysis is the concern about the overall functioning of a team work using one or more machines [15]. The analysis of the positions ergonomic approach to work is the level of the workplace, prioritizing analysis of the task and activity, with the postures and movements performed as also physical and psychological demands of the worker [15].

Once the analysis Ergonomic work is studied in detail all the important work-related, from the physical, environmental and organizational work as components in the development of its activity. [11].

Knowing specifically the data cited, the idea of applying the workstation rotation becomes more clear, since in practice there are several business occurrences that may affect the achievement of rotation. Having the questionnaire research in order to clarify the methodology is used to achieve the rotation in the various companies there is the most common means for achieving the same, and thus define the best way to start the Project Research topics dealing with rotation and muscle fatigue [11].

#### 2.5. *Participatory management*

Although some articles on the rotation in the workplaces are available for research, notes that there is still a great lack of data available in various literatures dealing with ergonomics. For rotations in the topic posts work is presented in a richer way we should, however, add issues that directly affect the jobs, they are: the Organization Labour Productivity, Participatory Management, Quality of life in Work and working conditions [11].

#### 2.6. *Human Resources and productivity*

The rotation of tasks started due to demand resource management generation of humans due to absenteeism [17] and reduced productivity [3]. As much as the wheels of the jobs have a condition favorable and ergonomic risk reduction [6] and [7], one can see that currently the lack of scientific studies.

#### 2.7. *Ergonomic benefits*

Joint studies, are the advantages of rotation of tasks [17],[6] and [7]. The authors claim that the use of these systems of exchange or rotation of workstations based on a proposal whereby a mere change of job is now considered a rotation and thus claim to ensure the reduction of ergonomic risks.

#### 2.8. *Systematization*

MacLeod and Kennedy [3] say that to promote the benefits of performing rotation in the workplace is necessary to establish definitive rules that allow for consistency of application and at the same time allow employees restricted in positions in which they do not show good performance.

To ensure that all casters in the workplace are requirements basic ergonomics a consistent and systematic approach to the workers is required.

Anne Gerling, Agnès Aublet-Cuvelier, Michel Aptel [8] provides a comparison methods among some wheels made.

Studies such as [7] to envisage rotation in the workplace without, however they have an appropriate methodology.

#### 2.9. *Enrichment work*

Unfortunately it is not possible with current knowledge to determine which limit security. For this reason it is critical to select rotation in tasks that reduce levels of exposure. [3] and [9]. The authors state that task switching or extension of work in which may occur an exchange between a monotonous and repetitive work may decrease, to a certain degree, the risk of monotony, but rather the desired capabilities of the adaptation of the difficulties of working unlikely to be achieved. The simple sum of monotonous and repetitive work still does not lead to job enrichment.

#### 2.10. *Product quality*

Maramatsu et al.[18] used questionnaires to 4,500 Japanese workers. Through its work the workers got special breaks and a number defined group of employers for work. Some results were improved productivity and product quality.

Calabrese et al. [19] concluded that the rotation in the workplace is a means to improve the conditions of the manufacturing process. Concluded that the rotation is an argument of the adaptability of workers facing a new situation work.

Being an important tool of ergonomics, it is expected that with a rotation standard in the workplace the

division of labor will be increased in quality, productivity and health. The standardization of rotation is a very important contribution, since the ergonomic definitions concerning the adaptation of work to man, focusing on the dynamics of human activity at work

### 3. Methodology and Results

According to the references mentioned, establish a plan of workstation rotation is not an easy task, primarily because the establishment of an adequate level of ergonomics, productivity and quality does not always make this mission easier and second why there is the necessity to plan an effective training of employees targeted for the areas of human resources, health and production.

Within the focus and criteria of the Contemporary Ergonomics, Alan Wisner [14] pointed out and cited by Mario Vidal [20], as was predicted in 1967 is now widely observed in the new industrializing processes (Figure1). The factors resulting from work direct consequences on health, productivity and quality of the process.

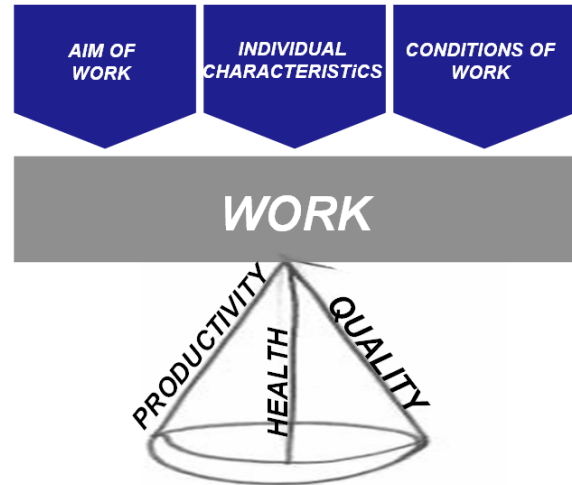


Figure 1 –Focus and Criteria of Contemporary Ergonomics

Aiming the harmonization of these items, the working method to the start of workstation rotation was divided into twelve (12) stages. (Figure 2).

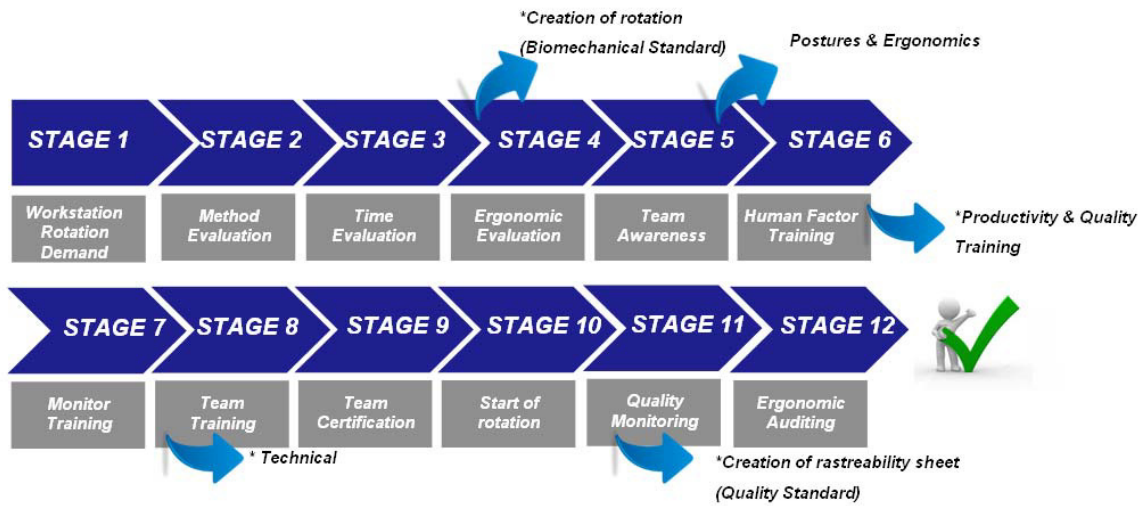


Figure 2 – Stages to the workstation rotation creation

The stages pre defined are described below:

Stage 1 – The necessity to create or review the workstation rotation can be send by demand of the quality, industrial engineering,, process engineering and, human resources ergonomics areas.

This stage starts a cyclic flow and the demand can come from the health complains, new production process or quality necessities. This demand is always directed to the ergonomist responsible for the area.

Stage 2 – After receive the necessity of changes in the workstation rotation, some tracks are directed to the responsible areas. In the stage 2 the actions are directed to the process engineering to review the methods to the group team, first to check if what is really planned is being executed by the workers and second to align with workers and group leaders if there are some necessities of changes in the method or sequences of activities.

Stage 3 – Times evaluation directed to industrial engineering. In this stage the times of tasks are reviewed following the factory plan and the occupation of workstation. It's the first important step that helps the ergonomists in the creation of the adequate rotation.

Stage 4 – The ergonomic evaluation is concluded by the specialists on ergonomics from human resources. The method of evaluation is a Konzern Standard from the company and called EAWS (European Assembly Work Sheet). In this stage the ergonomist has the responsibility to look for biomechanical and physiological demands and create the best structure for the appropriate rotation considering 3 important items: Strength, Inadequate postures and muscle overloads.

Another important point is the appropriate time between the workstation rotation (according to the bibliography between 1 and 2 hours to cyclic workstation, depending on the body demand) and the appropriate number of workstations.

As experienced in the literature and internal practices the ideal number of workstations, to generate some appropriate level of quality and concentration of work, is four (4) workstations, but there are some exceptions.

Stage 5- The team awareness is the most important stage of the project. In this time the ergonomist has the responsible to do the first speech to the workers showing the real necessity of group rotation (time

and number of workstations) according to the biomechanical concepts and the sharing of quality responsibility.

Stage 6- The Human Factor training is a concept applied by a partnership between human resources and manufacturing. The instructors of these training are specialist in some activities and their responsibility is finding the skills of workers and choose the more capable worker to the workstation. This worker called (human factor) will be the responsible for the workstation because he has the best skills to the activities and theoretically know more about the activities of the specific workstation than the others.

The instructors have these skills training directed to all the areas and with this ensure that activity will be done in the standard way.

Stage 7- The monitor, responsible for the group, although has the knowledge of all the activities will be again recycled by the “human factor” employee.

Stage 8- After the first stages the group of workers needs to be trained again with the presence of team leaders, ergonomists and engineering's to show again the responsibilities of each one and the Traceability sheet created by the team leader.

The traceability is the most important point for the quality following.

With this tool the monitor and team leader can follow the possible inadequate assembled parts in the workstation and know who needs more training (if it is the case) with the instructors of human resources and manufacturing partnership.

Stage 9- This stage is the certification of the the group of workers made by the ergonomist and instructors of partnership. This means that the workstation rotation can now start.

Stage 10- The workers now start the rotation.

Stage 11- The responsible for this stage is the team leader and the managers of the area. The quality monitoring is realized and the possible action plan can be directed for some new training too.

Stage 12- Ergonomic auditing made by the ergonomists to ensure that the time and sequences of workstation rotation are being realized as planned.

In the method if there are some necessities of the restart of flow it can be generate for all the areas involved, including the workers.

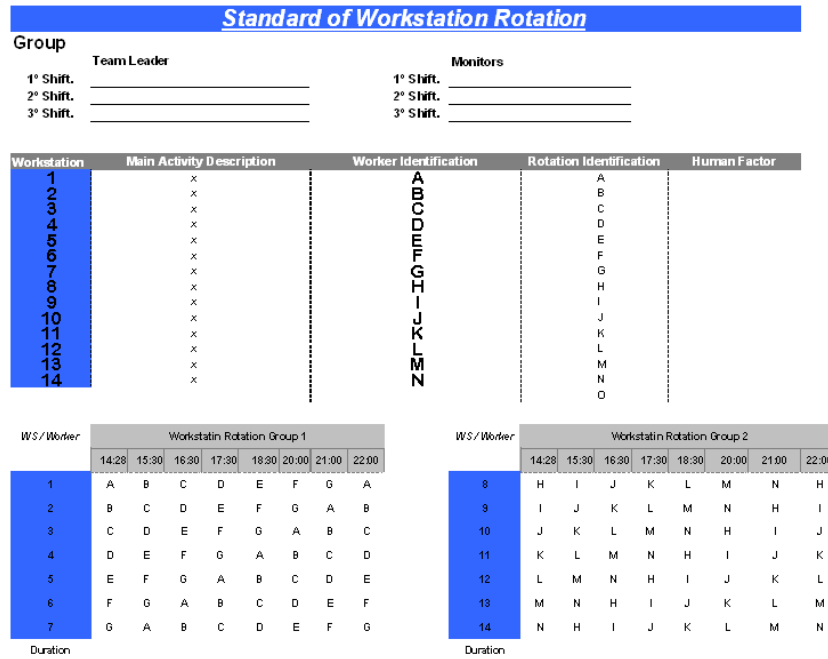


Figure 3 – Workstation rotation sheet.

The Figure 3 is the final result of the Stage 11, developed by team leaders and validated by the multidisciplinary work.

The Figure 4 shows the lay out of the Workstation Rotation map for visual acceptance and training. This information in created in the Stage 4.

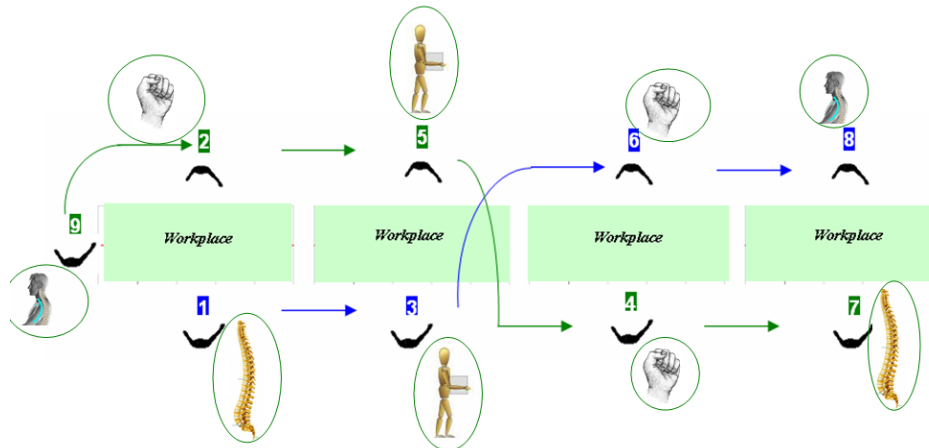


Figure 4 – Example of Lay Out with Workstation Rotation

#### 4. Conclusion

This method was created as a corporate solution to get the responsibility of the multidisciplinary group involved in the theme.

The pilot was introduced in the unit of the company in Curitiba and now is a cyclic procedure coordinated by the Human Resources sector of the company.

Some good results of traceability was pointed by the areas, and, in the ergonomic auditing the main conclusion is that the responsible for the project (human resources ergonomist), in the schedule of evaluation needs to create always an specific action plan to keep the system going fine.

As a corporate procedure it can be applied in all the kind of activities equalizing the three important items in the process – Ergonomics, Quality and Productivity.

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