Abstract. This paper presents the model “Work Situation Operative Model” - MOST (after its Spanish acronym). It offers a comprehensive, systemic approach to analysing work stations and/or work processes, serving also as a framework for pursuing various ergonomic and occupational health and safety goals. Originally produced for a food sector company, the model has been extended and successfully applied in several industries in Colombia and Ecuador, including cement, oil, and paper industries. Based on a systemic understanding of work systems and tasks, the model not only allows different, commonly-used methods and tools for evaluating or assessing the risk of muscular-skeletal disorders to be included, but also supports occupational risk management strategies. Hence, one of its more important contributions relies on providing meaningful information that is useful for improving the work station and/or work process through design and re-design, by focusing on the interactions between all system elements.

Keywords: ergonomic system, ergonomic method, comprehensive model, workplace design, work station design

1. Introduction

Work station and work process analysis and intervention are core ergonomics practices in the occupational health arena. Many methods and tools have been developed and are currently used. Some of them have been proposed for special working scenarios, while others emphasise their analysis of specific dimensions and variables. However, even if useful for identifying risk factors and allocating body/muscle strain and fatigue, these approaches do not necessarily provide useful information for resolving the situation - i.e. developing design proposals aimed at overcoming the analysed problems. In other words, knowing “what is happening” does not necessarily contribute to knowing “what to do”.

MOST was developed by Ergofactos Ltd. to meet the demand of a Colombian food sector company, and set out to go beyond the diagnosis and prioritisation of problems. The goal was to link diagnosis with control phases, supporting the whole optimisation process.

It provides a kind of map that allows occupational health practitioners and related stakeholders to have a detailed understanding of the characteristics, limits and interactions of all elements in a work system. This is especially important when improvements are being implemented, because designers need to establish clear requirements. Therefore, it is important not
only to investigate and take into account human fac-
tors, but also to consider other aspects, such as indus-
trial and environmental matters. This justifies the
creation of models that allow system requirements to
be established from a comprehensive viewpoint,
looking at tasks and their components, immersed in
an environment.

2. Development of the model

2.1. Some theoretical elements

Two theoretical and practical ergonomic streams
underlie this model. One the one hand, the ergonomic
system proposed by García-Acosta [1] was taken as
the core concept for achieving a systemic understand-
ing of the work station and work process; on the
other hand, concepts related to Activity Theory, such
as formal task, redefined task and updated task [2],
were used for analysing and understanding the differ-
ences frequently found between what a worker is
expected to do (formalisation of a task), and the real
performance of it by the worker. Hence, two com-
plementary approaches are combined. Firstly, the
systemic approach allows part and the whole of a
work system to be visualised, thereby boosting the
understanding of interactions between the multiple
elements that make up the system. Secondly, the Ac-
tivity Theory approach recognises that humans are
more than just another element in the system, ena-
bling differences between what is institutionally and
organisationally pretended, and the way workers act
and solve concrete work situations, to be understood.

It is important to mention that this model is ori-
eted toward industrial design, and conceived as a
creative activity with the goal of establishing multi-
faceted qualities of objects, processes, services, and
systems throughout their whole product life cycles
[3].

2.2. Description of the model

The basic principles of the model are the follow-
ing:
– Systemic understanding of the work station and
work process through an analysis of the ergo-
nomic system - i.e. human being, object-
machines, physical space, and resulting interac-
tions, considering relationships with the work
organisation and/or technological variables [4];
– Sensitivity to identifying the differences be-
tween the formal task and the real task per-
formed by the worker;
– Flexibility, for incorporating specific tools ac-
cording to the requirements and needs of the
particular company; and
– Capacity to detect technological state and pro-
spective technological changes.

2.3. Specific instruments

The model includes specific instruments for cap-
turing data relating to all ergonomic system elements,
and instruments for deducing interactions between
elements. The instruments are organised in two
groups. The first group records the task, as a system
and as an action, including a characterisation of the
interacting elements, and its application is obligatory.
The second group concentrates on interactions be-
tween the different elements. The first set of instru-
ments must be applied, while some of the specific
tools in the second group may vary, depending on the
specific interest of the company and the type of work
being observed. Most of the instruments in this group
are validated and well-known tools that are already
incorporated into many occupational health risk
management systems.

The first group of instruments includes the follow-
ing items:
– Description of the task as a system: it allows the
task to be located as the result of the interactions
in the system. Hence, the formal task is regis-
tered (what the worker has to do, according to
the supervisor or written procedures), along with
the re-defined task (what the worker interprets,
the activity itself, how he/she performs the task)
and the up-dated task (changes or adjustments
made by the worker, depending on unexpected
situations, in order to make it possible to con-
tinue performing the task). Here is also regis-
tered data regarding work organisation (shifts,
pauses, shift rotation, and dependency relation-
ships)
– Data regarding human beings: this instrument
captures anthropometric data, important findings
relating to the medical history, education and
qualification of workers holding this post, working
rules (simultaneous, parallel, successive), and data regarding type of contract, seniority)
– Data about physical space: includes workstation
layout, interferences between workstations, per-
forming areas. Functional relationships with
other workstations or work processes are registered, including communication channels. Safety issues (emergency exits, demarcation of areas, signs, location of emergency equipment) and environmental aspects like thermal, sound, lighting, biological air quality, and vibration conditions are taken into account.

Object / machine data: With this tool, all objects that play a role during the work process are classified, including endowment equipment and personal protection devices. The instrument allows not only technological level and technological state to be recorded, but also potential interaction modes (maintenance, supervision, regulation, operation, cleaning). A general characterisation of elements is also done, considering dimensions, apparent problems, and intervention possibilities.

The second group of instruments is headed by a format where action principles involved in the different interactions are registered, taking into account postures, segment positions, comfort angles, work cycles, strength requirements and movements requirements. In other words, this tool deals with biomechanical aspects resulting from the interaction between human being and the objects involved when the activity is being performed. In addition to this tool, at least two established methods for assessing physical load are performed, such as Sue Rodgers method [5], Corporal Mapping [6], OWAS [7], and Job Strain Index [8].

Complementary to the previous instruments, videos are sometimes captured in order to enhance information that is available during the analysis and design process.

2.4 Application of model

The model’s main purpose, parallel to establishing a diagnosis, is to build a basis for further workstation optimisation of health and productivity conditions, so that requirements for the design or re-design of technologies, techniques and forms of organisation can be driven. MOST has been applied to:

- performing a comprehensive analysis of work station and work process conditions;
- establishing design requirements, and testing and evaluation criteria for measuring intervention effectiveness;
- supporting occupational health and safety management, in order to identify irregularities and areas where there is room for improvement; and
- as a guide for experts’ intervention as part of participative occupational health and safety strategies like SOBANE [9].

This model highlights the importance of a comprehensive view, emphasising the context and the organisational particularities of the company, in line with situated ergonomics.

3. Discussion and future work

Based on the experience of applying MOST in different scenarios, the following advantages can be outlined:

- the possibility of including methods for different purposes, according to companies’ requirements;
- it makes the establishment of design requirements and intervention strategies easy, including evaluating criteria;
- it can be integrated with ongoing health and safety management systems; it is compatible with participatory processes;
- the model is easily understood by health and safety, production, and management stakeholders inside the companies;
- and finally, thanks to its systemic approach, MOST makes it possible to include connections between different work stations or work processes, thereby enhancing the possibilities of detecting related problems.

Application in the Colombian industrial and production context, in contrast to the Ecuadorian context, has resulted in it being appreciated that the model has a basic structure that can be replicated, yet is flexible at the same time, thereby allowing expert ergonomists to navigate without necessarily having to adhere strictly to a package of unalterable formats. Quite the contrary, for when the applications were being applied both in Colombia and in Ecuador, it was found that flexibility is not a synonym for lack of control or strictness, and we therefore insist that the model is more like a navigational chart showing "labour routes" (processes and their work conditions) than a “straitjacket”

According to the SOBANE strategy, MOST belongs to the general prevention strategy from the second level - in other words, "subsequent intervention factors, where aspects of the problem will be studied in depth with a view to [...] finding the most effective solutions" [9].
References