

## Chapter 33

# Applying Metaheuristics to Minimize Work–Related Musculoskeletal Disorders

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### **ABSTRACT**

*This article covers the topic of planning and organization of work, which is one of the biggest problems is to establish the most appropriate allocations between human and technical resources, according to the characteristics that define and characterize each individual. These adjustments to decision-making regarding the characteristics of a new larger workforce is a challenge for human resource managers and researchers working to provide well-being and quality of life improvements for employees. The problem of work-related musculoskeletal disorders, coupled with the aging of the active population, may increase the number of citizens with permanent disabilities. Given the complexity and uniqueness of the problems, a decision support system that uses some metaheuristic approaches is presented. The result is a hybrid approach that gives the best solution according to several parameters defined by the decision-maker. Computational results of real problem instances are presented, proving that in most cases, the optimal solution is achieved.*

### **INTRODUCTION**

The planning and work organization of human resources is a dynamic process. The working capacity of a human resource is a reflection of the balance between: the job (e.g. work performed); their individual resources (e.g. strengths and weaknesses); and motivation (e.g. job satisfaction). When these three aspects are reconciled, the work capacity of a human resource is increased, their quality of life is improved and consequently their productivity as well. In work planning and scheduling, the priority is always

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given to the capacity and efficiency of equipment and workstations, yet never to human resources. This could lead to some adverse effects on their health. However, some initiatives have been implemented by organizations in order to preserve the health and safety of workers, such as: breaks, gymnastics, health monitoring (e.g. medicine at work), among others. But, work-related musculoskeletal disorders (WMSDs) continue to affect active citizens all over the world (Occhipinti & Colombini, 2016). It is common for companies to sometimes neglect the individual characteristics of their human resources (e.g. limitations, capacities, health condition and capabilities), due to work organization, in order to fulfil their objectives. Moreover, with the average life expectancy increasing and the birth rates decreasing, the labor force will grow older in the coming decades. Thus, the biggest problem nowadays should be allocating the best person to the most adequate workstation, ensuring that WMSDs are minimized. For this type of decision, one must consider the characteristics of the workstation and the capabilities and health condition of the human resource, while ensuring stable productivity. Each person has strengths and weaknesses, regardless of age, which must be leveraged and also taken into consideration in order to ensure the health, safety and quality of life of human resources. In an attempt to provide an active ageing, the main objective of this work is to present a metaheuristic approach, to solve the Work-Schedules Programming and Organizational Resources Integrated Problem (WPORIP) that will establish the most appropriate allocations between human and technical resources, according to the characteristics that define and characterize each individual.

One of the most common and expensive problems of occupational health in the European Union, focuses on WMSDs (OCDE, 2010; Takala, 2007). About 40 million people are affected by these injuries, which are responsible for 50% of occupational absenteeism (with at least three days breaks) and the other 50% of permanent disabilities (Bevan, 2013). Demographic changes, in recent years, points toward a likelihood that in the next decades older workers will become the larger portion of the workforce (Ilmarinen, 2012). There are several works that discuss the inability of companies to adapt to such changes in society (Cappelli & Novelli, 2010). The “Healthy Workplaces for All Ages Campaign 2016-2017” is designed to increase the public’s awareness to the importance of good health and safety management at work, throughout an active life and to the importance of adapting the work to the human resource during all his professional career (AESST, 2016). In order to adapt to this new reality, managers will need to not only identify, specify and focus their efforts on changes that characterize the larger workforce, but also to follow this tendency and adjust their actions (Voelpel & Streb, 2010). Scientific researches and developments of new methodologies should be necessary in order to organize the work according to each person’s capabilities and characteristics (Castillo & Collins, 2013). The workforce is generally made up of a group of individuals with different characteristics (e.g. lifestyle, skills, training, capabilities and limitations). The lifestyle and adaptability of people at work are some examples of factors that have been ignored over several years by scientific research (Othman, Bhuiyan, & Gouw, 2012). Thus, making quick decisions in line with the individual characterization of organizational resources (human and technics), as well as according to the restrictions and pre-defined objectives by the employers, are some of the essential ingredients to provide workplace safe and healthy and productive workers. Nowadays the development in storage capacity and the increase of computers’ processing speeds, can help to automatize the process of making this kind of decisions and improve the solutions (Sheridan, 2014). Organizations and the government should actively promote the values of a focused culture on health and safety, and finally, researchers have the mission to create new flexible working models, which commit to planning and organizing work, according to the individual features of the existing resources. In an increasingly long professional, social and personal life, lifestyle, adaptability to work and the health of

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