



## A holistic approach on workplace risk assessment through methodological consideration of human characteristics

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### Abstract

Workplace risk assessment is a valuable tool to identify hazards, reduce risk and improve working conditions. During the last few years, scientific research has identified the so-called emerging risks that include issues like psychosocial risks, gender, ageing etc. However, previous studies have identified that risk assessment, when conducted, rarely takes into consideration those emerging risks, even though they can significantly affect occupational safety and health. The purpose of this paper is to highlight the importance of including all those factors in the actual workplace risk assessment that is conducted and reviewed by enterprises of any size. The need of including “human characteristics” when conducting a risk assessment is highlighted. Workers’ participation and job crafting could adjust physical, psychological and cognitive requirements to perform the job duties, as well as boundaries. Physical differences (as body build, gender, health, capability) as well as mental differences (attitude, motivation, perception) will need to be considered carefully when establishing controls for work activities. Moreover, age, organizational factors and culture can strongly influence human behavior. The need for a dynamic risk assessment, continually improved while considering human characteristics is highlighted. Finally, a framework for conducting a holistic Risk Assessment is proposed identifying key issues that should be considered.

## 1. INTRODUCTION

Workplace risk assessment (RA) is considered to be a requirement for every enterprise in order to establish an effective Health Safety Management System, either mandatory or voluntary. In the European Union (EU), the Framework Directive 89/391/EEC at 1989 established a common framework for enterprises to conduct a risk assessment, that effectively transposed into National Legislation for each one of the Member States ([COUNCIL DIRECTIVE of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work \(89/391/EEC\), 1989](#)). The process of conducting the workplace RA, includes the assessment of the risks in which workers are exposed to at work, which can be either a quantitative or a qualitative estimate and the appropriate occupational health and safety measures that are taken or should be taken in order to reduce those risks.

In that sense, workplace RA is considered a valuable tool that provides the opportunity to identify hazards, focus on measures to reduce associated risks and improve working conditions. All sources of risks including psychosocial factors should be considered, while the measures taken should be reviewed for their effectiveness. The outcome should be a dynamic document which will be improved and updated by the employer at a regular basis and/or when needed. There are several well established methods to conduct a RA, as well as ISO standards (e.g. ISO 31000) that describe the procedure in detail ([“ISO 31000:2018 Risk management Guidelines”, 2018](#)). However, in practice, a workplace RA mostly considers workplace characteristics and little attention is given on human characteristics ([Stubbs, 2000](#)). Specific

human characteristics like body size, gender, age etc. are often neglected and RAs are conducted having in mind the average human (Karwowski, 2012; van Duijne et al., 2008). The purpose of this paper is to highlight the importance of including all those risks in the actual workplace risk assessment that is conducted and reviewed by enterprises of any size.

## 2. BACKGROUND

There are several and diverse scientific fields that deal with differences in human characteristics like gender, body size gender etc. Each human is unique either in terms of biology or psychology. However, for categorization purposes, science usually forms rough categories in order to study specific properties or phenomena (Zeng et al., 2017).

The concept of gender equality is a relatively new phenomenon. Until the end of the nineteenth century, women were treated as the inferior sex. In that sense, they were excluded from taking part in public life, politics, education and certain professions. However after the Second World War and especially at the late 1980's, when the campaign for gender equality entered the "third wave" many have changed regarding gender equality (Ross, 2018; U.S. Equal Employment Opportunity Commission, 1980). Feminism and the corresponding school of thought attempted to polish inequalities between genders and many times took the issue to the edges, ignoring differences at the biological level. However, it is well understood that there is a number of differences between the bodies of women and men that could pose different threats to each one of them. For example, body strength, prevalence of heart related diseases or the secretion of different hormones, are topics extensively studied and documented (CDC, NCHS, 2015; Jayakumar, 2012).

Additionally, workplace consequences of both descriptive (designating what women and men are like) and prescriptive gender stereotypes (designating what women and men should be like), have been extensively investigated by a number of authors (Abele, 2003; Heilman, 2012).

Workplace violence typically encompasses attacks or attempted attacks (Hoyle et al., 2018; Neuman & Baron, 1998; Vossekuij et al., 2015) at the workplace. However, in addition to that traditional risk factor, sexual harassment was defined in 1980 by the U.S. Equal Employment Opportunity Commission (EEOC) as either *quid pro quo* harassment (eliciting sexual cooperation using threats of job consequences) or as a hostile environment (sexually related physical or verbal actions that are offensive and unsolicited), and it is typically conceptualized as a type of sexual violence that consists of unwanted sexualized actions of employees toward their peers or subordinates (Sexual Harassment, n.d.).

Differences in body size and the adaption of work to a specific human body are mainly studied by Ergonomics. Ergonomics is the practice of designing products, systems, or processes to take proper account of the interaction between them and the people who use them. The term ergonomics derives from the Greek "ἔργον", meaning 'work', and "νόμος", meaning 'natural law'.

One of the main problems that arise due to the non-application of ergonomics is musculoskeletal disorders (MSDs). Musculoskeletal disorders are defined by the World Health Organizations as health problems of the locomotor apparatus, that is, of muscles, tendons, skeleton, cartilage, ligaments, and nerves (Luttmann et al., 2003). Traditionally MSDs were associated with the physical requirements of work performance, often referred as manual handling, however today, there is enough evidence to support that MSD risk is also influenced by a diverse range of non-physical hazards like repetition, awkward positions and psychosocial factors (Bernard, 1997; Eatough et al., 2012; Gallagher & Heberger, 2013). In any case, MSDs are considered today as a major cause of suffering and disability of working-age adults (Anyfantis & Biska, 2017).

Ageing of the workforce is another aspect that is often not given the appropriate importance, even though it has been identified many decades ago by Medvin (1957). During the last fifty years, special provisions have been made for the protections of older workers however most of them were focused to prevent discrimination than to effectively exploit their abilities. For example, in the U.S., the federal Age Discrimination in Employment Act (ADEA) was established back at 1967, that prohibits age-based discrimination against older workers through hiring, firing, layoffs, compensation and other conditions of employment (Lahey, 2010). Recent studies have brought in the foreground the topic of the aged working force,

challenges and ways to exploit new opportunities (Falk, 2014; Varianou-Mikellidou et al., 2019). The issue was also of particular interest to the EU, since this was the topic of a recent EU-OSHA campaign (EU-OSHA, 2017).

### **2.1. Conducting a risk assessment – the traditional approach**

Risk assessment (RA) is about identifying hazards and thinking of what might cause harm to people while decide on taking reasonable steps to reduce the involved risk. Currently, most risk assessments are based on workplace, work characteristics and work factors. The most usual methodology used in order to conduct a RA is by following a five-step process (ILO, 2014): a) Identify the hazards, b) Identify who might be harmed and how, c) Evaluate the risks – Identify and decide on the Safety and Health risk control measures, d) Record who is responsible for implementing which control measure, and the timeframe, e) Record the findings, monitor and review the risk assessment and review when necessary.

In recent years, several risk assessment tools have been developed and offered to employers for implementation: standard two-dimensional matrices (Harms-Ringdahl, 2001; Rouhiainen & Gunnerhed, 2002), bow-tie models (Ale et al., 2006) , and risk graphs (Brandsæter, 2002; Kościelny et al., 2017) are used. However, even those do not take into account special characteristics of the workers, and still have in mind the average human.

### **2.2. A holistic approach - taking into account human characteristics**

A more holistic approach should take into consideration more factors while it should be developed in line with policy, corporate values and corporate safety culture. RA is a core element of the concept of health and safety management system that has proved to be an effective way to rise the standard of human protection against the physical harm as well as heading the well-being in a physiological and psychological sense.

However, this is a multidimensional goal to achieve and well defined procedures or standards have to be followed. In that sense, the starting point should be policy. Based on specific provisions some of which are also defined by national legislation or European Directives and Standards (for the case of the EU), a company develops the risk assessment, taking in mind work and workplace characteristics. The development and compliment of risk assessment, requires commitment from the employer, a well-defined occupational safety and health (OSH) management system and a respective safety culture.

The Framework Directive 89/391/EEC has been successfully transposed into national legislation, forming a basic mandatory Safety Management System to be applied for every single firm operating within the EU. Larger or high-risk enterprises may also use a voluntary Safety Management System however this will be on top of the Framework Directive. Risk assessment is considered a core component and general directions are given on that at the Framework Directive. Almost 30 years have passed since then and probably it's about time to have a more detailed approach on that in order to tackle with new emerging risks that have been aroused during the last few years, taking into consideration the knowledge provided by recent research and studies.

Tackling with the new emerging risks and by taking them into consideration, risk assessment is lifted at a higher-level verifying processes of OSH management and culture. According to the traditional approach, risk assessment is conducted having in mind the average human. Thus, at a second thought, someone should ask himself if all the processes, tasks and measures mentioned in the RA can be performed by everyone. In that sense it would be easier and more obvious to identify limitations posed by specific human characteristics, such as age, gender, language, etc. Worker participation could be really important at this stage in which special attention is given to human characteristics.

Considering the "human characteristics" in risk assessment all the three dimensions of matching job to the person should be considered, which are the job, individual factors and the organization (Andrew & Sofian, 2012; Kumarasamy et al., 2015; Martin & Schinke, 1998).

### *The job*

This is the traditional dimension that is mainly considered when conducting a RA. Includes issues such as the nature of the task, workload, the working environment, the design of displays and controls, as well as the role of procedures. Every task has to be designed having in mind the concept of adapting the job to humans and not humans to the job, both physically and mentally. Ergonomic principles should apply, to take account of both human limitations and strengths. Apart from the physical, this also includes matching the job to the mental strengths and limitations of people, such as perceptual, attentional and decision-making requirements. Previous research has identified the need for critical evaluation of the efforts that have been employed so far to European level in order to address such mismatches, that could allow flexibility as well as benchmarking capabilities across EU members states (Iavicoli et al., 2014).

### *Individual factors – individual difference*

Physical differences (as body build, gender, health, capability) as well as mental differences (attitude, motivation, perception) will need to be considered carefully when establishing controls for work activities – some differences may limit or prohibit individuals from certain tasks.

### *Physical differences*

This point includes the application of Ergonomic principles for the adaptation of work to humans with physical differences. Every task should be designed in accordance with ergonomic principles to consider limitation in human performance and physical ability (Alexander & Rabourn, 2001). In that sense, interventions at the workplace should be performed, either by the purchase of new equipment or the adoption of new organizational methods. Such interventions should furthermore cover: critical task analysis, design of person-machine interfaces (displays, control devices), environment, shift organization and workload, emergency procedures, efficient communication.

### *Gender*

Male and female have biological, psychological, and environmental vulnerability differences and thus, their bodies and minds respond differently to diverse conditions. Physical differences are mainly covered by ergonomics.

However, the types of exposures facing female and male also differ. For example, women's average body frame and size are generally smaller than men's. As a result, women especially in the past were neglected by many ergonomic solutions and the size of personal protective equipment (PPE) and tools.

Furthermore, men and women face different types of psychological stresses. Women are subjected to more incidents of harassment and discrimination, especially in nontraditional occupations (Burgess & Borgida, 1999). New concerns, such as harassment and discrimination, may become key concerns, and there could be a shift from traditional physical safety and health issues to psychological stress and gender specific productivity and job satisfaction related safety and health issues. Work related distractions and self-imposed injuries, and workplace violence (e.g. verbal threats, rapes, or physical assaults) could become more acute.

From a different perspective, men are more exposed to stress, and the mechanism of cortisol and adrenaline secretion make them more prone to cardiovascular diseases, since they also lack the secretion of oxytocin that takes place in the body of a woman and provide a protective mechanism (Heinrichs et al., 2003).

Men and women are also vulnerable to different types of toxins, men on toxins that affect sperm quality, while women those affecting pregnancy or breastfeeding. Finally, several not so straightforward health issues may arise. For example, women who have work on construction sites with inappropriate bathroom facilities, may avoid using bathroom by not drinking water, which can cause bladder and kidney infections.

Despite such differences, it could be argued that gender alone does not determine safety and

health hazards and this is further formed by the gender interaction with social, biological, and environmental factors.

#### *Mental differences*

Each working position should refer to a minimum standard of mental state, especially critical task or tasks that include increased risk. Furthermore the language barrier should be taken into consideration. Training material and instructions should be given in a clear form and easy to understand form by every employee. According to the latest Programme for the International Assessment of Adult Competencies (PIAAC) study, on average one in five adults in Europe have literacy difficulties. A similar study performed in the UK revealed that there are about 12 million people in employment with literacy skills and 16 million with numeracy skills at level 1 or below - equivalent to the levels of 11-year olds and younger (Smithers, 2006).

#### *Age*

During the last decades we have witnessed an increasing demographic change. There is a remarkable gain of about 30 years in life expectancy especially in western Europe, the USA, Canada, Australia, New Zealand and Japan (Christensen et al., 2009). Since people are to work for a longer period of time, they will need to be in good physical and mental health, with access to more flexible working arrangements, healthy workplaces, lifelong learning and retirement schemes (Christensen et al., 2009; Taylor & Walker, 1994; Varianou-Mikellidou et al., 2019). These issues should also be included in the risk assessment in order to perform the appropriate interventions. The effectiveness of potential interventions on older workers should be checked regularly and revised, since early intervention is the key for a healthy and safe workplace.

#### *Organisational factors – the culture*

The culture that should promote staff commitment to health and safety and emphasizes that deviation from health and safety goals at whatever level is not acceptable. Organizational culture strongly influence human behavior and can be critical in front of the well-being at work of sensitive groups of workers that are exposed to specific risks (Mokarami et al., 2019; Park & Evans, 2016). Such risks can include psycho-social risks, like bullying, harassment, etc.

### **3. DISCUSSION**

The result should be an improved RA which will take into account the new parameters. This approach could also allow for effective job crafting either driven by the employer or by the employees themselves.

The whole process should be often repeated and evaluated, coping with managerial issues and organizational limitations, motivated by the firm's safety culture and targeting at the improvement of OSH management and OSH in general. In that sense the PDCA (Plan-Do-Check-Act) cycle should be followed to ensure continual improvement.

The employees should be seen as a diverse team, consisting of people with different characteristics, which contribute to the same scope, who could perform more than the sum of each individual performance when working effectively. Human factor should not be seen as a threat, but instead as an opportunity, which should be given special attention. For instance, older employees hold the key to safety culture, business continuity and internal processes which are done by heart and in many cases are not appropriately documented and described.

The development of a dynamic risk assessment that would be continually improved while considering human factor, should propose specific solutions and improvements.

Workers' participation is also considered very important, since an experienced worker is the one who knows the work, himself and possible limitations best. Workers' participation could be significantly assisted by applying the concept of job crafting.

By definition, job crafting is how an employee reframes his/her work, physically, socially and cognitively. It is "...what employees do to redesign their own jobs in ways that foster engagement at work, job satisfaction, resilience, and thriving" (Wrzesniewski et al., 2013).

The employee could determine the physical, psychological and cognitive requirements required to perform the job as well as those boundaries. In order to cope with emerging risks, some of these elements of the job should be altered by the employee. This process is to be 'job crafting' (Wrzesniewski & Dutton, 2001)

The whole concept can be summarized in Figure 1.

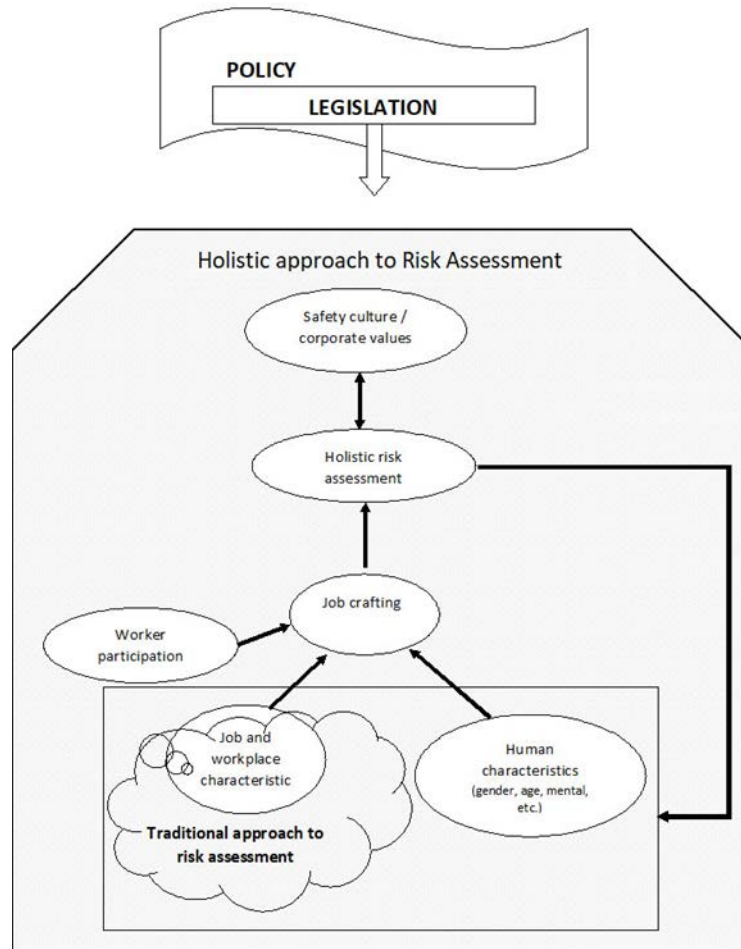


Figure 1. A framework for conducting a holistic Risk Assessment.

Enterprises usually learn after an incident. However, they should also take into consideration that there are a number of good practices, look at what works and develop their corporate culture in risk management according to the Safety II approach (Hollnagel, 2018).

#### 4. CONCLUSIONS

Workplace risk assessment has to break traditional boundaries since it is a valuable source of information, for any firm. Its importance has been broadly recognized even by organizations developing management systems, since today most management systems have been shifted towards a "Risk based concept". Despite the fact that a holistic approach of RA that will take into consideration every special human characteristic for every single working position is a complicated task, such an approach can become a major step forward for the promotion of occupational safety and health in every working environment.

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