



Urban green spaces activities: A preparatory groundwork for a safety management system



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ABSTRACT

Introduction: Urban green spaces works and maintenance are high-risk activities and usually represent possible sources of injuries. The management issues are complex and strongly influenced by companies' policies in terms of safety management and human factor. A high number of tasks—including protecting public health and safety and safe working procedures—need to be faced by professional arborists or gardeners. **Method:** The present paper provides a preparatory groundwork for modeling and describing the real risk levels during the abovementioned activities. The methodology represents a useful tool for decision making both for group leaders and safety coordinators. This goal is reached by collecting data emerging from several workplaces located in North East Italy regarding the frequency and severity of injuries. **Results:** The preliminary results point out that the most frequent injuries in green maintenance activities are represented by cuts, contusions, and ocular lesions, but none of them have led to particularly serious consequences for the operators; indeed, the high levels of severity are related to traumas, fractures, and acute lumbar herniated discs. The riskiest activities are related to pruning, especially using mobile elevating work platforms, and grass cutting, especially when operated in escarpments and banks. Workers' behavior and companies' safety policies are key elements for a correct safety management system.

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1. Introduction

Green spaces in cities play a fundamental role for urban sustainability, especially considering that more than two thirds of Europeans live in urban contexts (Naess, 2001). On the one hand, they can contribute to improving environmental conditions through the reduction of air pollution (Nowak, Crane, & Stevens, 2006; Yang, McBride, Zhou, & Sun, 2004), regulating the micro-climates (Bernatzky, 1983; Dimoudi & Nikolopoulou, 2003), alleviating the heat island effect (Oliveira, Andrade, & Vaz, 2011; Zoulia, Santamouris, & Dimoudi, 2009), reducing the road traffic noise (Van Renterghem & Botteldooren, 2009), and preventing local floods caused by stormwater runoff from impervious surfaces (Dietz, 2007). Nevertheless, on the other hand, green spaces are high-required workforce activities (McPherson, 1992; McPherson, Simpson, Xiao, & Wu, 2011) so that a complex and professional approach is needed to protect workers and residents during all phases of these work sites (Rahardjo et al., 2009; Ricard & Bloniarz, 2006).

As it is commonly known, urban green spaces have an important role in citizens' health and well-being (Lee & Maheswaran, 2011; Nielsen & Hansen, 2007; Van Herzele & Wiedemann, 2003). As a consequence, the guidelines for planning and management are often "citizen-based" (Madureira, Andresen, & Monteiro, 2011), aimed at the creation of accessible and attractive places strictly connected with the populations' composition and their point of view (Jorgensen, Hitchmough, & Calvert, 2002; Young, 2010). However, it is important to clarify that the starting point of the present investigation is to ensure safe work places for workers; hence, the approach can be defined as "operator-oriented."

The current scientific literature about risk taking and accidents frequency among "green operators" is poor in terms of quantitative and qualitative analysis. In most of the cases, data on injuries emerge from agriculture and forestry studies (Bailer, Reed, & Stayner, 1997; Colantoni et al., 2012; Lilley, Feyer, & Kirk, 2002; Lindroos, Aspman, Lidestav, & Neely, 2008; Lindroos & Burström, 2010; Lundqvist & Gustafsson, 1992; Mann, Pouta, Gentin, & Jensen, 2010; Marucci, Pagnello, Monarca, Colantoni, & Biondi, 2012; Monarca et al., 2009; Montorselli et al., 2010; Neely & Wilhelmson, 2006; Potočnik, Pentek, & Poje, 2009; Solomon, Poole, Palmer, & Coggon, 2007; Suchomel & Belanová, 2009; Thelin, 2002). According to Solomon and his work on

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safety in agriculture in the UK (2002), the most common fatal accidents are those involving machinery, works at height, and electrocution whereas non-fatal injuries are due to manual handling. Due to the frequent use of chainsaws, human activity in green areas may be considered as most similar to forest works for which the mortality is higher than in other branches of agriculture (Tsiaras, Rottensteiner, & Stampfer, 2014).

In this scenario, the present study leads to a definition of the indicators of accident frequency and severity of injuries starting from field data in order to create a specific model for urban green area maintenance related to companies, taking into account the current policies and companies' and operators' expertise and behavior. Thus, a survey was carried out to create a preparatory groundwork to properly develop a Safety Management System (SMS). According to Fernández-Muñiz, Montes-Peón, and Vázquez-Ordás (2007), the SMS comprises a set of policies and practices aimed at positively impacting on the employees' attitudes and behaviors with regard to risk. Thus, SMSs are meant to act on processes causing risks and accidents. Moreover, an SMS provides a systematic way to identify hazards and control risks (Hale, Heming, Carthey, & Kirwan, 1998) and can be defined as a business-like approach to safety. Since it is an explicit and comprehensive process for managing safety risks (Robson et al., 2007), a safety management system is extremely important in goal setting, planning, and measuring performance and is woven into the fabric of an organization (Transport Canada, 2001).

In more detail, an effective SMS should define how the organization itself is set up to manage risk, identify workplace risks, and implement suitable controls and effective communications across all levels of the organization.

In order to properly apply SMS specifications—such as safety policy, planning, implementation and performance evaluation—two main standards are available to Italian companies: OHSAS 18001 (British Standards Institution, 1999) and ILO/OHS-MS (International Labour Organization, 2001).

2. Material and methods

2.1. Background

Broadly speaking, a method is able to provide a clear answer on how to manage a workplace for green spaces maintenance if it starts from an

efficient and effective approach. Several risk analysis models are currently available and are based on specific modeling paradigms (Beroggi & Aebe, 1996). However, the most frequently used methodologies in risk management can be summarized as (a) decision modeling (Doheny & Fraser, 1996); (b) data modeling (Crockett, Guynes, & Slinkman, 1991); and (c) dynamic modeling (Cowing, Elisabeth Pate Cornell, & Glynn, 2004).

The data/knowledge modeling was adopted in the initial phase of the study. This choice is relevant because the uncertainty inherent in risk issues can be reduced significantly by employing appropriate data and knowledge models. Data base systems can support risk management by analyzing historical data, using forecasting methods, estimating probability distributions, and analyzing causal relationships. Knowledge is represented in knowledge-based systems, which are implemented into decision support systems to help the analysis and decision making process of risk managers.

2.2. Data modeling

To perform an analysis on safety in green spaces management workplaces, a procedure was implemented to make the analysis repeatable and verifiable. A subdivision in subsequent phases was used. The procedure followed will allow us to implement a SMS model, called GreenSafety model, useful to prevent injuries in green spaces activities. The scheme of the GreenSafety process is illustrated in Fig. 1. The preparatory groundwork hereinafter described concerns the first two parts of the process: the problem structuring and the problem formalization to assign values to the indicators of the risk analysis.

2.2.1. Survey activities in green areas workplaces

First, to ensure a deeper analysis of the problem and to obtain more detailed research questions, a data collection was made to create a first database on accident frequency and severity of injuries in urban green areas maintenance. Field surveys were carried out in Veneto and Friuli-Venezia Giulia Regions (in the North-East of Italy) between May 2008 and May 2011 using a field questionnaire. Five companies operating in the Province of Padova, Vicenza, Udine, and Gorizia were involved for a total of 80 workplaces investigated. The contents of the questionnaire are presented in Table 1. The aim of the questionnaire was to assist the surveyors in monitoring and analyzing workplaces, including off- and in-site preparations: the behavior of workers (e.g. use of PPEs,

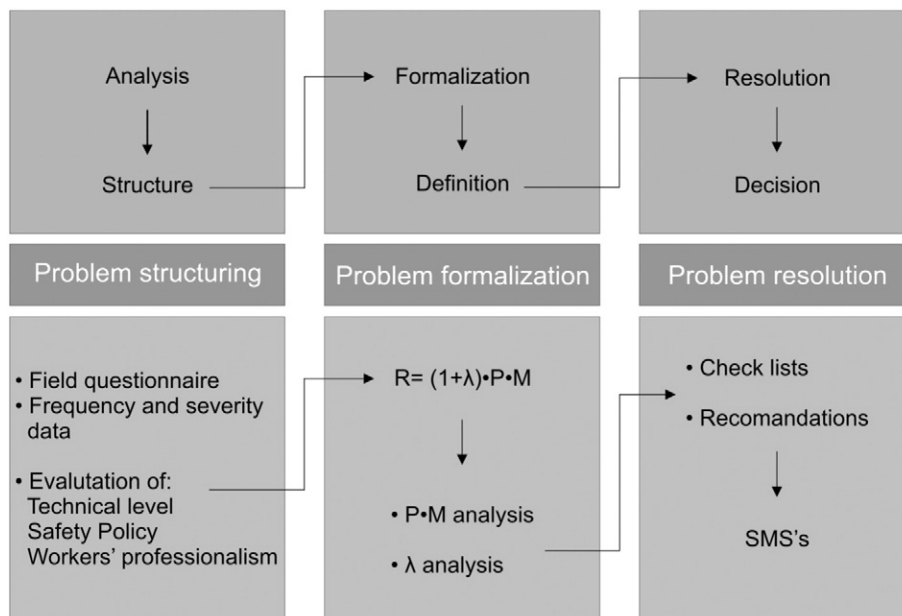


Fig. 1. GreenSafety SMS model: methodological approach (R = risk index; P = probability of accident; M = severity of accident; λ = critical index).

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