



# Multi-criteria evaluation in strategic environmental assessment for waste management plan, a case study: The city of Belgrade



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## ABSTRACT

Strategic Environmental Assessment (SEA) is one of the key instruments for implementing sustainable development strategies in planning in general; in addition to being used in sectoral planning, it can also be used in other areas such as waste management planning. SEA in waste management planning has become a tool for considering the benefits and consequences of the proposed changes in space, also taking into account the capacity of space to sustain the implementation of the planned activities. In order to envisage both the positive and negative implications of a waste management plan for the elements of sustainable development, an adequate methodological approach to evaluating the potential impacts must be adopted and the evaluation results presented in a simple and clear way, so as to allow planners to make relevant decisions as a precondition for the sustainability of the activities planned in the waste management sector. This paper examines the multi-criteria evaluation method for carrying out an SEA for the Waste Management Plan for the city of Belgrade (BWMP). The method was applied to the evaluation of the impacts of the activities planned in the waste management sector on the basis of the environmental and socioeconomic indicators of sustainability, taking into consideration the intensity, spatial extent, probability and frequency of impact, by means of a specific planning approach and simple and clear presentation of the obtained results.

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## 1. Introduction

The definition of Strategic Environmental Assessment (SEA) that describes it as a systematic process of evaluating the environmental consequences of the proposed policy, plan or program initiatives in order to ensure that they are fully included and appropriately addressed at the earliest appropriate stage of the decision-making process on a par with the economic and social considerations (Sadler and Verheem, 1996) can be considered the most general and the most comprehensive one. Since the 1990s, many authors (Maričić and Josimović, 2005; Nilsson et al., 2005; Nilsson and Dalkmann, 2001; Therivel and Partidario, 1996; Therivel, 1992; White and Noble, 2013 among others) have written about the role and importance of the SEA in creating policies in different spheres of social activities, as well as about its role in decision-making. The issue is therefore quite interesting, from both scientific and professional aspects, and is of great importance in creating any environmental policy. This is also supported by the fact that an increasing number of international financial institutions, such as the European Commission, World Bank, UNDP, UNEP

and USAID, have developed instruments and imposed requirements for the implementation of the SEA for the purpose of checking and increasing the number of development initiatives in tune with the principles of sustainable development (Chaker et al., 2006; Dalal-Clayton and Sadler, 2005).

Strategic Environmental Assessment Directive 2001/42/EC prescribes the obligation to undertake SEA for plans, programs and framework documents<sup>1</sup> in different fields, thus also in the field of waste management. By carrying out an SEA in waste management planning, it is possible to consider the consequences of the proposed planning solutions and changes in space, while at the same time taking into account the needs of the users of the space and appreciating the subject environment. On the basis of this, adequate measures can be defined for the protection and monitoring of the potentially threatened elements of the environment, in addition to having public participation in all stages of the SEA process. In this context, SEA obviously contributes to the decision-making process for the waste

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<sup>1</sup> A framework document is a generic term for all kinds of documents and studies in the energy sector and in the fields of forestry, water management, waste management, agriculture, nature preservation, etc., representing a framework for future development projects.

management planning (Arbter, 2005; Desmond, 2009; Josimović and Marić, 2012; Salhofer et al., 2007).

Compared to other methods which contribute to decision-making, such as the traditional “life cycle assessment” (Bjorklund and Finnveden, 2007; Bond et al., 2001; Laurent et al., 2013; Tukker, 2000), the SEA contributes to integrating the impacts at the strategic level of waste management (national, regional and, if necessary, international level). For the purpose of making good decisions regarding the sustainability of the solutions defined in the waste management plans, it is necessary to consider different aspects of the potential impacts. Multi-criteria analysis has been strongly advised by various authors with expertise in the energy sector (Finnveden et al., 2003), water management sector (Garfi et al., 2010) and in the SEA for waste management plans (Finnveden et al., 2003; Fischer, 2003; Jay, 2010; Salhofer et al., 2007; Wilson et al., 2004).

The subject of this paper is the application of the Multi-criteria Evaluation (MCE) method in carrying out the SEA. The MCE method developed in the early 1970s is now considered a well-developed scientific field, supported by abundant references (Ananda and Heralth, 2009; Figueira et al., 2005; Kangas and Kangas, 2005). When first developed, MCE was characterised by the methodological principle of multi-criteria decision-making (MCDM) with little or no participatory mechanisms included (Zionts, 1979; Zionts and Wallenius, 1976). The primary objective was to elicit clear preferences from a decision maker and then solve a well-structured problem by means of mathematical algorithms (e.g., to design an engine by taking into account its power, weight, and efficiency). Progressively, the ideas of procedural rationality (Simon, 1976) and the constructive or creative approach (Roy, 1985) led to the development of the multi-criteria decision aid (MCDA), in which the quality of the decision-making process became central. Research started to point out the need to include public participation in MCE (Banville et al., 1998; De Marchi et al., 2000; Proctor, 2004), thus fostering the emergence of participatory multi-criteria evaluation (PMCE) (Banville et al., 1998; Proctor and Drechsler, 2006) and social multi-criteria evaluation (SMCE) (Munda, 2005, 2008). In such a context, appropriate deliberation is a prerequisite to ensuring a quality outcome. Nowadays, the MCE method is often recommended as a convenient support in the decision-making process because of its capacity to point out in many ways multiple alternatives of development on the basis of assessing criteria related to the environment and socioeconomic aspects of sustainable development. (CL:AIRE, 2011; Linkov et al., 2006; Rosén et al., 2009, 2013; Sparrevik et al., 2011).

The MCE method was originally defined in a scientific research project themed “Method for Strategic Environmental Assessment in Planning” (2005–2007), and later developed through several still ongoing scientific research projects, all of which have been funded by the Ministry of Education and Science of the Republic of Serbia. The results obtained have been used in carrying out several strategic environmental assessments for strategically significant planning documents. This paper examines the possibility of using the said method in the SEA process for the Belgrade Waste Management Plan 2011–2020 (BWMP), by which a completely new, contemporary waste management system is being established in terms of both its functionality and its spatiality.

## 2. Initial position

An SEA was carried out for the purpose of the BWMP for the city of Belgrade, which comprises 14 municipalities. The city of Belgrade is a metropolitan area unique in Europe by its geographical and strategic position. It is geographically positioned at the contact point between two different geographical areas (the low

Pannonian Basin to the north and the mountainous and hilly region to the south). Two large European rivers, both international waterways – the Sava and the Danube, run through the two said areas.

According to the Statistical Office of the Republic of Serbia for 2012, the population of the city of Belgrade is 1,621,396 and the estimated generation of solid waste in households approximately 1,801 tons per day. In the course of revising the waste management system before the implementation of the BWMP, several major waste management points and issues were raised (BWMP):

- out of 14 municipalities included in the BWMP, 11 municipalities dispose of their waste at the city's central landfill, while the remaining three have local landfills at their disposal;
- the city's central landfill does not fully comply with the Landfill Directive 1999/31/EC, while the municipal tips do not meet even minimum sanitary conditions for waste disposal, thus raising major ecological and social problems;
- there is no centrally organised recycling system, and so the recycling depends on individual initiatives;
- the waste is collected from around 80% of the territory and 90% of population;
- the institutional, organisational and financial aspects of the waste management in their present state cannot meet the requirements of an effective modern waste management system;
- the level of education for the public in the field of waste management is unsatisfactory.

The objective of the BWMP is to establish a completely new, sustainable and integrated waste management system to replace the old one, which is unsustainable, uneconomic, dysfunctional and inconsistent with the principles of environmental protection. This objective is to be achieved through the following eleven general priorities:

1. to widen and strengthen the administrative capacities of the city in the area of waste management;
2. to widen the territory from which the waste is collected to 100% before 2019;
3. to establish an efficient system of waste separation, its reuse and recycling;
4. to build a waste management centre and close and remediate the existing municipal landfills;
5. to build communal waste treatment facilities in Belgrade;
6. to build a green waste composting facility;
7. to build a facility for recycling waste from construction sites;
8. to build an animal waste treatment facility;
9. to build a biogas production facility;
10. to develop a system for financing waste management at the local level;
11. to raise public awareness of the importance of waste management.

The aim of carrying out the SEA for the BWMP was to direct the planning process towards the goals of sustainable development, i.e. towards achieving the objectives set in the SEA related to environmental protection and socioeconomic aspects of development. The results obtained served as a basis for decision-making on the sustainability of the BWMP and its adoption.

## 3. Methodological framework

An increasing number of theoretical studies in the field of environmental and waste management planning (Calvo et al., 2005; Christensen et al., 1999; Tchobanoglous and Kreith, 2002;

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