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A criticism of applications with multi-criteria decision analysis that are used for the site selection for the disposal of municipal solid wastes

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ABSTRACT

The main aim of this study is to criticize the process of selecting the most appropriate site for the disposal of municipal solid wastes which is one of the problematic issues of waste management operations. These kinds of problems are pathological symptoms of existing problematical human–nature relationship which is related to the syndrome called ecological crisis. In this regard, solving the site selection problem, which is just a small part of a larger entity, for the good of ecological rationality and social justice is only possible by founding a new and extensive type of human–nature relationship. In this study, as a problematic point regarding the discussions on ecological problems, the existing structure of the applications using multi-criteria decision analysis in the process of site selection with three main criteria is criticized. Based on this critique, fundamental problematic points (to which applications are insufficient to find solutions) will be defined. Later, some modifications will be suggested in order to provide solutions to these problematical points. Finally, the criticism addressed to the structure of the method with three main criteria and the feasibility of the new method with four main criteria is subjected to an evaluation process. As a result, it is emphasized that the new structure with four main criteria may be effective in solution of the fundamental problematic points.

1. Introduction

There are various approaches addressed to the source and solution of the ecological and/or environmental problems in this day and age. The abundance of these approaches stems from the diversity in social and intellectual life and differentiation in interpretation of ecological problems. Despite these differences it is possible to group ecological approaches under two categories. In the first category, the determinant factor is the "environmentalism" approach focused on scientific and technological development and takes "material production" as its primary motivation. And in the second category, ecologists who consider the society, nature and universe as a whole and adopt a viable and cyclical approach are in the forefront. The evident examples of the first group are the governments, municipalities and industrialists of the developed countries that adopt the "sustainable environment" approach and those of developing countries that adopt the "polluter pays" principle. It is possible to ensample the second group as non-governmental organizations and entrepreneurs who highlight ethical and metaphysical concerns that hosts tens of approaches from "land ethics", "animal ethics", "deep ecology" to "biocentrism" and "animal-centrism" (Under, 1999). Of course, there are various politically oriented movements standing out of these groups such as eco-socialists, greens, eco-feminists and social-ecologists. Despite its doubtfulness, it is possible to place these movements under the second category.[1]

The tension between two groups and the internal differences of each remove the possibility of forming a "general will" over the source and solution of environmental and/or ecological problems. Therefore, the first group's attempts for solution which conserve the speed of production and development (approaches of environmental management and development of environmental technologies) and the radical criticism of the second group (struggles for returning to nature and wild life) are not able to generate a social influence through the solution of environmental and/or ecological problems. In the meantime, in order to survive, humans maintain their activities in the given system, and everything which is regarded as danger or crisis or problem is continuously reproduced (Wright, 2004; Foster, 1994). In this article, there will be no specific discussion among the approaches over the source and solution of environmental/ecological problem. Rather, "a simple question" corresponding to the "real" problem will be asked and then, some practical answers will be tried to be given to this question. It is

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[1] For some studies discussing contemporary approaches on environment and ecology see: İdem (2007), Gorz (1994), Cantzen (2000), Schumacher (2011), Bookchin (1980), Myerson (2001).

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inevitable to make some conceptual discussions and technical evaluations before this analysis since there is a need for parameters and conceptual frameworks in minimum, when it comes to examining the notion of environment and ecology (and the main objective of this article). Involved in either an environmental or ecological approach, every effort regarding the environment has necessarily a social character. Thus, some concepts such as human–nature relationship, centre-periphery distinction, decentralization, security of the ecosystem and scaling problem, in other words, the concepts that have importance for the subject of this essay must be explicitly stated. Indeed, recognizing the conceptual boundaries is beneficial in giving a shape to technical discussions related to the issue.

Increasing population, enlarging in production and consumption and increase in urban pollution which often pushes the limits lead to a growing public opposition for the solution of environmental problems. In this article we perform a discussion addressed to the disposal of the municipal solid wastes, which creates public opposition especially in crowded cities. The process of disposal contains two main decision-making problems: selection of the disposal method and selection of the place in which the method is performed. Although these two problems have independent structures they affect each other to a considerable extent and they can be considered as a single structure. The main problem of this article is how to solve the problem of site selection appropriately, a part of the disposal process of municipal solid wastes, by paying regard to the social consensus.

The site selection issue is one of the problematic aspects of the disposal process of municipal solid wastes. The frequently used method for the solution of the site selection problem is using the decision making processes in which multi-criteria decision making mechanisms are integrated with the geographical information systems (GISs) (De Foe and De Gisi, 2010; Moeinaddini et al., 2010; Gorsevski et al., 2012). This mechanism has useful aspects but it is far from finding proper solutions to some serious social and environmental problems. So, it is necessary to make a structural criticism of the system, and to define a new structure for the method and question where to position this structure regarding the environmental policy as a base. This necessity will be analyzed in this article as follows: First, a conceptual framework will be formed about the main points in which existing practices remain incapable. Then the reader will be informed about the structure of existing decision making mechanisms and the weak points of the structure will be opened to the discussion. Finally, in the light of conceptual framework the new structure for the decision making mechanism will be proposed and the feasibility of this alternative will be discussed.

2. Materials and method

2.1. Conceptual discussion

Municipal solid waste management (MSWM) models used today aim at upgrading the existing methods or build accordance in these methods. The first group contains the "optimization" processes which deal with improving main operations like transportation and removal. And in the second group there are "integrated management systems" attracting attention to different phases of the waste management and interaction between these phases (Su et al., 2007). Most of the management models described under the scope of MSWM is under the second group. Optimization models generally assess alternatives by reducing the criteria to a common ground like cost. In conciliation methods, alternatives are revealed by evaluating the criteria which are weighted by considering the priorities of decision makers and stakeholders.

Most of the existing management models merely concentrate on the evaluation of common multi-criteria oriented to the problem or evaluation of the environmental impacts of the performed model. On the other hand, for a model to be sustainable as emphasized by researchers like Petts and Nilson-Djerf, examination in terms of environment, economy and society is essential and all three criteria should be met at the same time (Petts, 2000; Nilsson-Djerf, 2000). Most of the existing management models give priority to economic variables but neglect others. The factors that have been paid regard to in MSWM systems until quite recently are environmental factors such as emissions and water pollution; economic factors such as cost and benefits and technological factors such as datedness of the technology. Although they are not usually taken into consideration social variables, which are regarded as criteria by some researchers, constitute another group. These factors can be presented as social welfare (Hernandez and Martín-Cejas, 2005), public approval, social justice, political concerns (Cheng et al., 2002), cultural issues and customs and social costs (Su et al., 2007).

Public participation is an important step for the integrated solutions developed for waste management. Running of a waste management system effectively requires a strong collaboration between authorities and waste producers by means of using unpackaged products, choosing recyclable materials and separating wastes, regardless of the selected strategies. For a long term public, support public should be informed about all possible harmful outcomes and included to the processes of decision making in each step. That means, there is a necessity for an extensive education program. Raising the public awareness would trigger the attention for the strategies of waste management. After gaining concern about waste management programs of authorities, citizens start to demand active participation to the decision making process. It is easier for the people to rely on the transparency and fairness of a program when they are active; and by this way it is possible to ensure the social acceptability of the program (US EPA, 1995).

MSWM is mostly defined as the process between the emergence of the waste in the source and its final disposal. However it should also refer to an extensive and complicated process which includes the stages after the final disposal. This process does not only bear a physical aspect, but it also has economic and social dimensions. The final step of every management model is the disposal of the waste. The process of disposing municipal solid wastes has two problems that need to be encountered. These are the selection of disposal method and site selection problem. Both of them are to be evaluated in relation to each other. Moreover, the stance of the relation between them is also the matter of a great discussion. It is very difficult to claim that site selection problem – the main subject of this essay – is independent from the selection problem of disposal method. Therefore, a discussion on the site selection will naturally be related to the selection of the method. However, in the name of preserving the main structure of the essay, the problem of the selection of disposal method is excluded.

Main problems occurring in the process of site selection for the disposal of municipal wastes can be analyzed under two groups. First of these is the ecological destruction emerging during the usage of technology used for disposal. The case of destruction reveals that existing structure should be modified paying regard to ecological rationality. The second one refers to various social problems such as disamenity of the people living in the areas close to the disposal sites.[2] From this aspect, new studies concerning the disposal of municipal solid wastes must include solution suggestions for these two problems together.

There are lots of application models which concern waste management in general terms and specifically, solution for the disposal

[2] For a research about social costs caused by disposal facilities see: Sasao (2004), Guikema (2005).