



Saving soil and financial feasibility. A model to support public-private partnerships in the regeneration of abandoned areas



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ABSTRACT

The European Union aims at the zeroing of the soil consumption by 2050. Among the short-term strategies outlined by the member States of the European Commission, the highest potentialities concern the recovery of existing building assets, and in particular of abandoned areas. The regeneration of these properties, however, involves considerable costs and high risks, and therefore almost always requires the activation of a public-private partnership as well as the negotiation of the solutions to be implemented. Borrowing the theory and algorithms of operational research, the model outlined and tested in this paper aims to determine a range of combinations of urban planning parameters, to be attributed to abandoned areas, capable of reflecting the fair distribution of the burdens and financial conveniences, that constitute the basis reference for the bargaining between public and private subjects. The model is applied to a real case study, concerning the urban regeneration of an abandoned area located in a city in Southern Italy. Obtained by simulating various possible goals of the Public Administration, the outputs confirm the potentialities and flexibility of the proposed model.

1. Introduction

For several years in Europe, there has been a debate on the saving soil, i.e. the need to limit the increase in the artificial land cover mainly due to urban expansion and territorial infrastructures (Torre et al., 2017). According to the estimates of the European Commission (2011), every year in Europe an area of approximately 1000 km², equal to the area of the city of Berlin, is definitively waterproofed as a result of the construction of buildings, infrastructure and road networks. The issue is particularly important in countries characterized by high population density (e.g. the Netherlands, Belgium, Luxembourg, Italy, Germany, the United Kingdom, Denmark, Portugal, France), which show worrying growth, especially in urban peripheries, as well as coastal and central areas affected by a high housing demand (European Commission, 2012; ISPRA, 2017).

The objectives of the European Union for the member States aim at the zeroing of the soil consumption by 2050, avoiding the waterproofing of natural areas and compensating the “non-avoidable” component through the re-naturalization of areas of at least equal extension, which could produce the same eco-systemic effects that were provided by the compromised soils (European Commission, 2016).

Among the short-term strategies set out by the European Commission, the greatest potentialities concern the regeneration of

existing building assets, in particular abandoned areas. This term specifies a wide range of urban properties that includes areas, individual artifacts or entire compendiums, characterized by different dimensions, intended uses and intensity of degradation. In many cases, these are properties contaminated by their previous uses. The European Environment Agency estimates that in Europe there are 250,000 contaminated sites and three million potentially contaminated sites, for which more investigations are needed to determine whether reclamation is necessary (European Environment Agency, 2007).

In Italy, a recent and systematic survey of the abandoned areas is missing. The latest data available are provided by the National Statistical Institute in the report of the “IX General Survey of Industry and Services”, which reported that the degraded areas represent 3% of the Italian territory, with an area of approximately 9000 km², equal to the surface of the Umbria region, of which at least 30% is located in urban areas and to be reclaimed (Italian Institute of Statistics, 2012).

The regeneration of abandoned areas, however, involves considerable costs and high risks ((European Court of Auditors, Special Report No. 23/2012). In recent years, with the goal of improving the measures for urban requalification, there has been a development of several tools focused on involving the private investors through different types of partnerships (Sagalyn, 2007; Bourguignon, 2013). The public-private partnership (PPP) is a form of cooperation between public authorities

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and private operators aimed at financing, building and managing public infrastructures or providing public utilities (Ng et al., 2012). This form of cooperation allows the Public Administration to attract resources and skills that are not available within its system (Grimsey and Lewis, 2002; Bing et al., 2005; Clifton and Duffield, 2006). In these types of initiative, the public-private relationship must be based on the use of operational models that meet the requirements of flexibility, transparency and easy understanding for the parties, through which it is possible to reach mediated solutions among the interests involved, while also guaranteeing mutual financial conveniences.

In the planning of the transformation of the abandoned areas, the determination of the urban parameters of the project to be attributed to the areas (building index, intended uses, coverage ratio, incidence of roads, maximum height, green space rate, etc.) is among the main issues. The definition of these parameters depends on a number of factors that must be respected, in relation to these kinds of boundaries: i) urbanistic-design aspects, since these parameters influence the type of settlement to be implemented; ii) environmental limits, since they define the burdens connected to the users of the new functions and the soil consumption; iii) legal restrictions, since the setting of these parameters must be carried out in compliance with the current regulations; iv) financial constraints, since, if the private investor is involved in the initiative, he will decide to participate after having compared the revenues and costs.

Furthermore, in the current economic contingency, it may happen that the Public Administration, in order to lighten its balance sheets and to share the burden of the initiatives, intends to base its relationship with the private investor on the negotiation, by allowing the entrepreneur to build additional volumes, in exchange for the disposal and the reclamation of areas for public use or other kinds of public resources (Morano and Tajani, 2013). In this case, the bargaining concerns the measure of the urban planning parameters to be attributed to the area to be regenerated, capable of ensuring the distribution of the public and private conveniences.

2. Aim

With regard to the draft scenario, this research aims to develop and test a model to support Public Administration decisions in the planning of urban redevelopment initiatives, characterized by the involvement of private investors and therefore by the negotiation of the solutions to be implemented.

Through marginal-type compensatory mechanisms and taking into account the objectives pursued by the Public Administration, the model allows to determine a range of combinations of urban parameters to be assigned to the areas to be regenerated and upon which the negotiation between the parties involved should be set. These parameters, in particular, should be capable of reflecting a fair allocation of the burdens and of the financial conveniences between the public and private subjects. The aim is not only to ensure efficiency and transparency in the decision-making process, but also to encourage forms of rewarding, such as an increase in the building index, the availability of the private investor to realize substantial rates of the public spaces, especially in cases where the costs for the purchase and reclamation of the areas are particularly significant.

Public Administrations rarely have appropriate expertise to set the best intervention modality (Zhou et al., 2016). As a consequence, either the initiatives fail or the private investors' profits are so high that the PPP initiatives must be verified by a public inspection entity (e.g. the judiciary), determining the interruption of the initiatives and the resulting negative effects on the image of the current Public Administration (Gan et al., 2015; Buckley et al., 2016).

The proposed model allows to determine: the building index to be attributed to the areas to be recovered; the extension of the surface upon which the private buildings permitted by the building index will have to be concentrated; the measure of the private green spaces; the

surface of the private parking spaces; the surface for public roads; the surface of public spaces; the public area share that the private operator will have to buy, reclaim and free transfer to the Public Administration. Due to the conditions and perspectives of the local real estate market, the economic parameters and environmental objectives, the model will have to simulate the relationship between the public and private subjects, as well as determine the values of urban planning parameters that reflect the fair distribution of the burdens and the benefits of the initiative, ensuring the mutual financial conveniences.

The model can be used in the initial stages of the urban redevelopment initiatives, where there is the need to define the synthetic sizing of the investment and identify the limits of the negotiation among the parties, as well as in the verification of initiatives already approved by technical-policy decisions, that did not take into account the conditions of the property market and the redevelopment costs.

In this work, the model is defined and tested with reference to Italy, where the regeneration of abandoned areas constitutes a highly perceived issue, but the purchase of these properties is particularly expensive, since they are generally located in central areas, with consequent effects on the market values due to urban rent phenomenon.

The experimentation of the model is developed with reference to the initial stages of the investment. The lack of a detailed project, that is a circumstance that typically occurs in these phases, has led to defining a model that operates in an "automatic" way, reaching the sizing of the public spaces such as to guarantee at least the minimum share of public areas established by the national regulations (D.M. No. 1444/1968 and L. No.122/1989).

Borrowing the principles of the Operational Research, the model implements the simplex algorithm through the Linear Interactive Discrete Optimizer software (LINDO). An urban planning problem is characterized by strong analogies with the general problem of the Operational Research, since it concerns the determination of the optimal use of scarce resources that can be used in alternative modalities. In the model proposed: i) the resource available in limited quantities is represented by the area to be recovered; ii) the alternative uses are identified by the different public and private intended uses; iii) the constraints are obtained from the mathematical translation of the legal regulations, of the urban planning and environmental decisions of the Public Administration about the land use and the morphological organization of the spaces of the initiative and from the financial balance sheets of the public and private operators, through which it is possible to evaluate the mutual benefits; iv) the return function varies in relation to the goals which, in the various cases, may be pursued by the Public Administration.

The paper is structured as follows. In Section 3, the main studies in current literature in which the goal programming has been applied are recalled. In Section 4, the hypotheses of the model are introduced. In Section 5, the variables, the constraints of the model and the possible objective functions of the Public Administration are described. In Section 6, the model is implemented to a real case, concerning the urban regeneration of an area in disuse, located in the city of Salerno (Italy). In Section 7, the conclusions of the work are discussed.

3. Background

In the academic literature of the last decades, there has been a renewed attention regarding the development of models that borrow goal programming logic, as a method to solve effectively complex decision-making systems, characterized by high uncertainties related to their multiplicity of objectives, number of variables and constraints (Walker, 2001; Linares and Romero, 2002). The need to obtain valid solutions for conflicting goals – e.g. economic, environmental and social targets generated by the current economic instability and climate and welfare policies – has led to identifying goal programming as one of the most widely used multicriteria decision-making techniques (Caballero et al., 2009).

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