Sustainable Redevelopment: The Cost-Revenue Analysis to Support the Urban Planning Decisions

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Abstract. The sustainable development of cities, by focusing on abandoned or degraded areas, represent the key driver that is able to remedy to damages that are produced by uncontrolled urban growth. The aim of the work is to highlight usefulness of the Cost-Revenue Analysis (CRA) in decision-making process concerning the enhancement of a military complex located in the city of Rome (Italy). In particular, existence of conditions that allow the Public Administration (PA) to request private entrepreneur additional operations to those established by the law is intended to examine, ensuring financial convenience of both subjects involved. The results achieved demonstrate feasibility of initiative, but also existence of wide margins for financial convenience of private entrepreneur that allow the PA to request additional financial resources or the direct realization of the initiatives to be intended to public functions. Furthermore, the influence of combination of the intended uses on urban planning loads and financial budget of the initiative is tested by analyzing the variation of share of gross floor area that can be attributed to each intended use. The adoption of the CRA can be implemented by subjects involved in the early stage of redevelopment initiatives in order to provide the size of the amount of financial resources that are necessary.

Keywords: Public-private partnership · Financial analysis · Decision support tools · Abandoned properties · Saving soil · Urban redevelopment

1 The Sustainable Urban Redevelopment as a "Zero Consumption" Soil Saving Strategy

The reduction of the land take environmental impacts through the sustainable development of the cities is currently an open topic in the worldwide research debate. An efficient and shared strategy by guaranteeing the sustainable recovery of our territories is the early step in order to achieve the European goal of "no net land take by 2050".

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In Italy, in the last 50 years the reduction of the Agricultural Used Area, equal to 6 million hectares, is pointed out by the analysis of the soil sealing, the uncontrolled urban growth and the landscape transformations dynamics [13]. The data considered, in fact, show that the spread of phenomena such as the diffusion, the dispersion and the urban decentralization have caused the loss of a large amount of the natural surfaces within the cities. Some of these phenomena can affect entire communities or individual urban districts which thus giving rise to "cities within the cities" that are configured as urban voids, also due to the particular social, economic and territorial realities [7].

The problems related to the urban voids undermine the sustainable development, discourage the investment and the economic growth, promote the deterioration of the natural and the built environment [17, 20]. Instead, the point of view that must be taken appreciate the degraded areas as a resource with a great potential, for public and private subjects, since they represent the opportunity to active regeneration interventions in order to remedy to the disfigurement that are produced over the years by the uncontrolled soil sealing processes [11, 12]. Therefore, the urban redevelopment, if it is intended as the "Planning activity, aimed at recovering a valid qualitative and functional dimension in urban and/or building structures, as a whole or in single parts, compromised by obsolescence or degradation" [1], represents an efficient and shared strategy which allows to provide a "zero consumption" saving soil solution [14].

In the current context, urban land use planning plays a crucial role in the development of support systems able to regulate the dynamics of the cities [6, 9]. If the national urban planning law (Law no.1150/1942) had the goal of regulating the urban development on a territorial scale - with the institution of the General Regulatory Plan (GRP) -, since the end of the '70s the goal of the urban planning regulation tools became the recovery and the enhancement of the degraded areas and the abandoned properties, largely.

The most critical issues of soil sealing processes regard preservation of natural resources, employment of sustainable materials for buildings construction, reclaim of contaminated or abandoned industrial areas, enhancement of properties in disuse. With the lack of a national regulatory framework, that currently has not yet been approved by the Parliament, many of the Italian regions have demonstrated an increasing attention to soil saving issue by drafting several requirements specifically dedicated to the containment of land take and highlighting the potential contribution given by renewal initiatives. Some regions, in fact, have established requirements for adoption of measures aimed at enhancing the existing abandoned heritage as the most effective solution to reduce land take [5].

The limited availability of public financial resources and the need to redevelop the city are the reasons of growing participation of private investors in urban planning initiatives of disused or degraded areas by financing the solutions capable of spreading the burdens and the risks thus giving the possibility, to the initiatives, to be carried out in compliance with the established aims [18]. Recently, the governmental institutions have focused their attention to the contribution made by the urban redevelopment operations in public-private partnership (PPP). Some experiences - such as those promoted by the European Commission in 2006, by the National Council of Conservative Landscape Architects in 2012 and by the National Urban Planning Institute in 2017 - show that success mainly depends on: robustness of public direction; adoption

of the most suitable forms of PPP for each initiative; creation of dedicated financial funds in order to avoid exacerbating the public financial resources.

Furthermore, in Italy the economic potential impact induced by a widespread urban redevelopment campaign is attested equal to 327 million euros and the amount of the concession fees collected by the Public Administration (PA) is about of 17 million euros [3]. The PA has thus an additional incentive, of a financial type, for compensating the complex management burden related to singular interests of several stakeholders involved and the great number of uncertain variables. In order to overcome such burdens the public and private subjects can recourse to the use of suitable urban planning tools in order to : *i)* provide a support for planning and managing the financial feasibility of the initiative; *ii)* take into account the needs and the requirements of the subject involved in determining the balance sheet of their conveniences; *iii)* define the goals and evaluate the effects of the project both *ex-ante* and *ex-post*; *iv)* adequately allocate the initiative's financial and failure risks among the subjects.

2 The Contribution of the Assessment Tools in the Urban Redevelopment Processes

The complexity that characterizes themes and tools used to decide, plan and implement the initiatives is one of the most common feature of the urban redevelopment projects, according to the contingent presence of public and private functions to be established, heterogeneity of subjects involved (PA, private entrepreneurs, land owners, etc.), financial resources and multiplicity of funding channels. It is clear, therefore, that each initiative requires evaluation and control of a large number of variables that, in a different way, concern the stakeholders interested and affect the feasibility of the initiative [19]. The most crucial variables may be:

- the location of areas and their accessibility, which affect the choice of the most appropriate intended use and present and future property values;
- the maintenance state of area and intended use of the site;
- the structure of property, fragmented or not, which can invalidate the feasibility of the initiative;
- the GRP requirements and constraints related to the area;
- the policies and the aims of the PA, which can influence timing and any facilitations (tax, etc.);
- the local demand of similar available areas;
- the social and economic effects produced by the intervention on the surrounding areas;
- the legal and fiscal aspects, which vary according to the subjects involved;
- the demands of production system;
- the dynamics of local real estate market.

Starting from these variables, the decision-making process must reach the balance of conveniences of subjects involved, while ensuring the feasibility of the initiative [8].

The adoption of the financial and economic evaluations allows to formulate value judgments and economic convenience ones, useful for integrating and systemizing the variables that affect the feasibility of the initiative [10, 21].

The relationships that are established among different subjects involved in the initiatives mainly depend on the structure of the properties and the onerousness of the investment [15, 16]. In particular, a negotiation relationship is established between PA and private subject as owner of the availability of the property or as a property developer [4]. The interests involved are, therefore, of two types: the first one, for private subject, expressed by maximizing the revenues deriving from the realization of buildings and minimizing incurred costs; the second one, for public subject, that deal with the economic sphere [24]. Depending on the point of view considered, different analysis can be carried out: for private investor, the Cost-Revenue Analysis (CRA) - among the several financial assessment methodologies - is a technique widely spread in the context of urban projects *ex-ante* evaluation. It is a financial analysis that does not take into account qualitative effects of the project but is aimed at assessing the ability of the project to generate revenues to a greater extent than costs necessary for its realization. The time factor, in the "instant" variant, can be excluded in order to avoid complications deriving from use of discount rate. The CRA application requires an accuracy level of the amount of financial quantities analyzed such that of a broad estimate, therefore, in line with the level of detail of initial stages of the project. Furthermore, compared to other economic and multidimensional approaches, does not require specific professional skills or knowledge of particular private software. This feature allows both technicians of the PA and real estate developer involved to obtain a summary appraisal of the cost and revenue items required by the initiative. Another reason linked to the CRA application's utility, is that it is the starting point for implementing a Cost-Benefit Analysis (CBA) of the project, thus improving the accuracy of the *ex-ante* evaluation carried out. In fact, if the point of view is that of the public subject, the adoption of the CBA widens evaluation of the project to the effects that can generates on the community as a whole, positive and negative ones, by comparing costs and economic benefits that can be monetized [22]. Both the aforementioned methodologies are useful reference for the decision-makers to order the different project solutions on the basis of the respective synthetic indicator's information - i.e. the Net Present Value (NPV), the Internal Rate of Return (IRR), the Cost-Benefit Ratio (C/B) and the Pay Back Period (PBP) - provided for each solution.

It should also be noted that in the context of the urban transformations planning, the use of the multi-criteria techniques to analyze the conflicting qualitative and quantitative decision-making problems is increasingly widespread [23]. Furthermore, the growing involvement of inhabitants in urban redevelopment projects requires adoption of techniques able to objectify as much as possible opinions collected in the community [2].

In the context of the urban renovation projects conducted in the PPP form, the assessment tools have the role to support the choices in order to be effective and efficient, i.e. that are suitable of guaranteeing the economic and the financial convenience of the subjects involved by respecting the urban and the natural environment.

3 Aim of the Work

The aim of the work is to highlight the usefulness of the assessment tools to support the decision-making process with reference to a real case study concerning the enhancement of a military abandoned complex located in a central area of the city of Rome (Italy). In particular, in order to verify the possibility for the PA to request additional operations from the private entrepreneur more than the minimum ones required by the law, the CRA is implemented, on the basis of the real physical, urban and market data and in line with the current GRP provisions.

The assessments relating to the different aspects of the initiative can lead the PA to simulate the expected financial quantities required (costs/ revenues) for the initiative, which is assumed to be realized by a generic private entrepreneur, and to evaluate its financial convenience. By this way, the public operator will be able to correctly calibrate - ensuring the financial feasibility of the initiative - the extent and the type of the requests that can be required to the private entrepreneur, in relation to the type of the initiative, its complexity and the level of demand that the redeveloped properties will have on the local real estate market.

The private entrepreneur, instead, can use the CRA to verify its own financial balance sheet, among which cost items will also include the amounts of the realization of the public buildings, including the related burdens. The adoption of the CRA allows thus the private entrepreneur to broaden the vision of the critical issues related to the initiative under analysis, highlighting the strengths and the uncertain points by recognizing the risks.

The paper is structured as follows: in the Sect. 4 the case study is described, the cost and the revenue items considered for the implementation of the CRA are presented; in Sect. 5 the conclusions and the future insights of the work are drawn.

4 Case Study

The case study is the PPP initiative for the enhancement of the *Triumphal Fortress,* that is a disused military complex composed by abandoned buildings and degraded spaces located in the North-West of the city of Rome. Following the decommissioning by the Ministry of the Defense, in the 2007 it was declared "of particularly important interest and therefore subjected to all the protection provisions contained in the current legislation" and, subsequently, it was acquired by the PA. The properties and the bordering areas are one of the six military complexes owned by the PA and which are part of the well-known "Entrenched Field" system: the 15 military fortress and the 4 artillery built between 1877 and 1891. The assets of the system are disused structures, in extreme degradation conditions, since they have not been in use for decades, whereas, by the virtue of their strategic location, they could represent an important redevelopment opportunity for the entire city. When the Triumphal Fortress was built, the countryside was the only thing that surrounded it and only after the XX century urban expansion was incorporated into the built environment. According to the current GRP's provisions, the area has now a strategic role for the public reuse focused on offering the urban-level service functions which are required by the district.

Overall, the *Entrenched Field* system represents an evident discrepancy between the cultural and the identity value that is recognized by the respective local communities and the impossibility of enjoying it. In order to pursue the enhancement of the *Entrenched Field's* properties the goals set out by the GRP's provisions foreseen are: *i)* the recovery and the redevelopment of the urban morphology's traces that are represented by the Fortresses; *ii)* the strengthening of the specific local identities of the territorial zones surrounding each buildings by including the cultural functions; *iii)* the improvement of the sustainable mobility in order to create an environmental network for each building. Among the general purposes, as regards the area of the Triumphal Fortress a public service hub is planned to be accessible both from the district in which is located and the users of the neighboring urban areas.

The buildings in the area and their original intended uses are described below and reported in the Fig. 1:

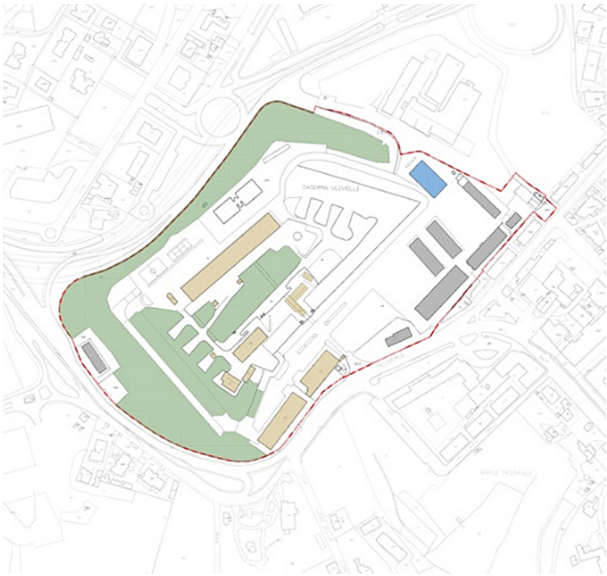

Fig. 1. The currently existing buildings in the area of the Triumphal Fortress. (Color figure online)

- the Fortress, consisting of all the buildings once used for the so-called "Ulivelli Barracks", built in 1886 and now in disuse (beige color);
- a prestigious property once destinated for the airship shelter, the so-called "Hangar of the Ulivelli Barracks", dating back to the 1930s and actually abandoned (blue color);
- other buildings of lesser architectural importance (gray color);
- an uncultivated green area (green color).

Given the purposes of the PA related to redevelopment and functional recovery of historic buildings to be used for public facilities (such as the head office of the Municipality XIV), and to the transformation of the adjacent areas for the residential and tertiary functions, the perimeter of the area which include the above described properties was defined as a "Recovery Area". Furthermore, three land sectors have been established (Fig. 2) - i.e. *Sub. 1*, *Sub. 2* and *Sub. 3* - that can be sold to the private entrepreneur in order to be redeveloped. The programmatic tools establish to build a total Gross Floor Surface (GFS) of no more than 8,200 m^2, with the following intended uses:

- Sub.1: 5,000 m^2 are the maximum GFS and residential (*res*) and tertiary (*off*) units are allowed. The intervention categories for aforementioned intended uses, established by the Art. 9 of the Technical Implementation Standards (TIS) of the city of Rome, provide demolition and reconstruction with an increase in the GFS and in the above-ground volume/new construction;
- Sub.2: 1,800 m^2 are the maximum GFS are allowed and the intended uses include residential (*res*) and tertiary (*off*) units. The intervention categories for aforementioned intended uses, governed by the Art. 9 of the TIS of Rome, provide demolition and reconstruction with an increase in the GFS and in the above-ground volume/new construction;
- Sub.3: 1,400 m^2 are the maximum GFS and the intended uses consist of residential (*res*) and tertiary (*off*) units. For the intended uses the same categories of intervention valid for Sub.1 and Sub.2 are applied, according to the TIS.

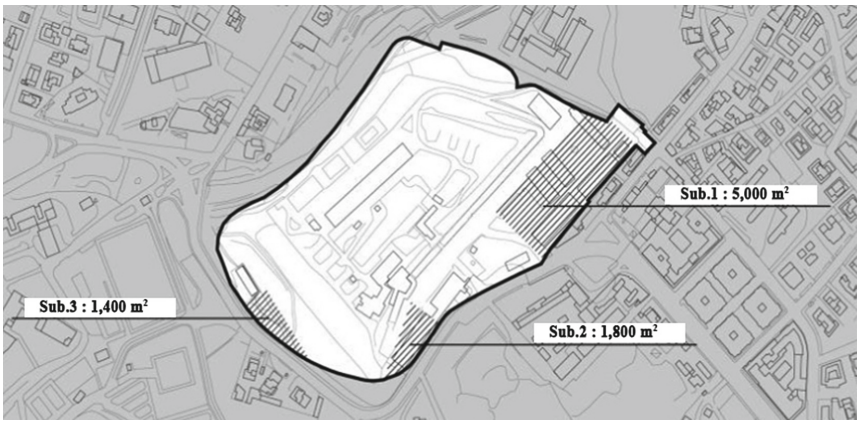

Fig. 2. - Identification of the three land sectors (Sub.1-Sub.2-Sub.3) within the area of the Triumphal Fortress.

4.1 Assumptions

The tested hypothesis is that redevelopment initiatives of the three land sectors are managed only by one general private entrepreneur. In this case, the relationship between public and private subjects can be summarized through the following exchange mechanisms:

- The PA gives building rights to private entrepreneur in order to build residential and tertiary units in the three land sectors;
- The private entrepreneur:
  - realizes the GFS quantity that is destined to the residential and tertiary units allowed by building rights and sells them on local real estate market, obtaining the monetary revenues that are produced by sales;
  - is required to pay primary, secondary and construction urbanization fees (Law no.10/1977) depending on the intended uses to be realized;
  - is obligated to reclaim areas and to transfer them to the PA freely of charge for primary and secondary urbanization operations;
  - reclaims additional areas for an amount of 4,810 m^2.

The definition of margins of agreement between subjects involved plays a decisive role since the absence of the balance of economic and financial conveniences between PA and private entrepreneur affects the feasibility of the initiative. Therefore, in order to verify the risks and the advantages of the parties involved it is necessary to adopt adequate assessment tools during this preliminary stage.

In this relationship, the real estate market has an important role linked to the absorption capacity and the phase of the local real estate market (expansion, crisis, recovery, etc.). on which the units of the building process will be sold, as established by the agreements between PA and private entrepreneur. It should be noted that in official consulted documents there are no limits on the maximum quantity of residential or tertiary units to be build. In other words, the distribution of the total GFS in shares of residential and tertiary units is defined in accordance with PA and private entrepreneur. For this reason, in the present work the hypothesis that in each of the three land sectors the 80% of the total GFS is destined to residential units and the 20% is for tertiary ones is firstly sets out. Moreover, without prejudice to legal obligations deriving from the Ministerial Decree no.1444/68, the freely transfer to the PA of additional areas destined for public neighborhood services for no less than 4,810 m^2 is envisaged, in order to satisfy provisions of urban planning standards for the area.

4.2 Cost-Revenue Analysis

In order to verify the financial feasibility of the initiative, the CRA is implemented by instantly comparing the expected financial items considered: all costs and revenues that are generated by the initiative occur at the same time, without considering the distribution that can reasonably have over time and effects - related to discount operations - that may be affect the results. This assessment methodology is well-suited with the accuracy that characterizes the preliminary phases of the initiative, for which indications required concern only the extent of amounts involved.

Specifically, the simulation of the financial balance sheet of redevelopment project managed by the generic private entrepreneur requires collection of data related to costs and selling prices to be implemented in financial balance sheets. In the present case study, these data (shown in Table 1) are identified by carrying out local real estate market analysis and by consulting construction companies operating in the area.

Table 1. Economic parameters of private investor's balance sheet.

Cost items	Unit cost/percentage incidence
Purchase of the area	200 €/m^2
Registration tax and notary fees	11%
Primary urbanization fees (res)	23.82 €/m^3
Primary urbanization fees (off)	39.31 €/m^3
Secondary urbanization fees (res)	19.82 €/m^3
Demolition of the existing volumes	35 €/m^3
Construction costs (res)	1,000 €/m^2
Construction costs (off)	850 €/m^2
Construction charges (res)	12.50%
Construction charges (off)	12.50%
Realization of the parking spaces (res)	48 €/m^2
Realization of the parking spaces (off)	48 €/m^2
Realization of the green spaces (res)	32.55 €/m^2
Realization of access roads	93 €/m^2
Private entrepreneur's normal profit	20%
Technical and general expenses	9%
Financial fees	10%
Revenue items	*Unit price*
Residential sale	3,950 €/m^2
Residential parking sale	925 €/m^2
Tertiary sale	2,925 €/m^2

By assigning the parametric amounts listed in Table 1 to the quantities foreseen by transformation hypotheses for each of the three land sector, the financial balance sheet of private entrepreneur is obtained, as described in Table 2.

The application of the CRA by instantly comparing costs and revenues assumed for the project has enabled to define the effective margins of financial convenience of private entrepreneur. The initiative is convenient on all the three land sectors. In particular, the evaluation tool adopted has allowed to determine the amount of extra-profit (see Net Values in Table 2) generated by the entire redevelopment project equal to $NV_1 + NV_2 + NV_3 = 5{,}926{,}864$ € (NV_t). This is the amount that the private entrepreneur earns from the whole initiative, in addition to normal profit included in cost items (shown in Table 3) to the extent of 20% of expected revenues.

Table 2. - The private investor's balance sheet for each land sector.

Sub.1	
Items	*Quantities*
Total land surface	13,074 m^2
Total costs	16,471,473 €
Total revenues	19,095,000 €
Net value (NV_1)	2,623,527 €
Sub.2	
Items	*Quantities*
Total land surface	2,676 m^2
Total costs	5,185,167 €
Total revenues	6,874,200 €
Net value (NV_2)	1,689,033 €
Sub.3	
Items	*Quantities*
Total land surface	939 m^2
Total costs	3,732,296 €
Total revenues	5,346,600 €
Net value (NV_3)	1,614,304 €

Table 3. - The normal profit of private investor for each land sector's interventions.

Normal profit	
Items	*Quantities*
NP_1	3,819,000 €
NP_2	1,374,840 €
NP_3	1,069,320 €
Total (NP_t)	6,263,160 €

The total normal profit (NP_t) quantity is equal to $NP_1 + NP_2 + NP_3$ = 6,263,160 € (see Normal Profit in Table 3). Definitely, by adding normal profit to extra-profit, private entrepreneur gains a total profit of $NP_t + NV_t$ = 12,190,024 €. This output proves that there are wide margins for further requests that can be elicited by the PA.

Another information that can be obtained with the CRA adoption, concerns the variation of the NV_t of the initiative linked to different combinations of shares of dwellings and tertiary units on the total extent allowed. The graph of Fig. 3 represents the relationship that occurs between the NV_t, i.e. the amount of extra-profit that belongs to private entrepreneur, and the percentage of total GFS that is differently destined to each intended use.

As can be seen from the graph, by varying the percentage incidence on the total of GFS that is intended for residential units (or symmetrically of the GFS that is intended

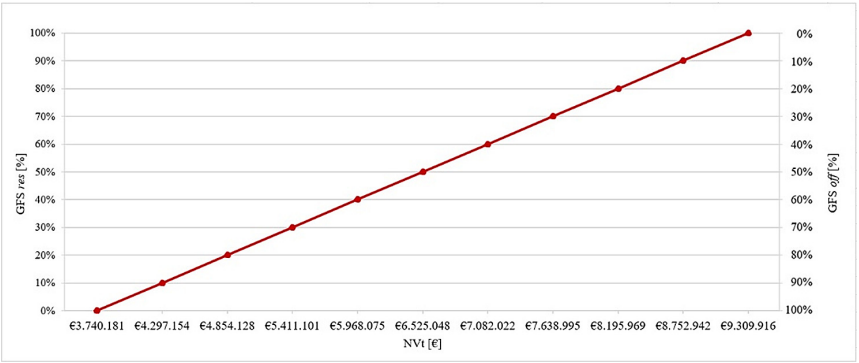

Fig. 3. NV_t of the initiative related to the percentage of the total GFS attributed to the residential or tertiary units.

for tertiary ones), different margins of convenience are obtained. By increasing residential GFS and reducing that for tertiary units, the amount of extra-profit generated is considerably higher than the one of opposite situation, i.e. when tertiary GFS increases and residential one decreases. This analysis shows up that the functional mix to be realizing is a delicate issue that the PA musts take into account, not only for urban weights that this mix determines, but also for effects it generates on financial balance sheet of initiative.

5 Conclusions

The growing establishment of the awareness to mitigate the impacts produced by soil sealing due to uncontrolled urban growth through sustainable urban redevelopment policies, is felt by all the authorities. The urban redevelopment policies, in fact, impose territorial transformation actions that allow to restore identity values to urban spaces characterized by physical and social degradation. Since the complexity is a common feature of urban renewal processes, the assessment tools are necessary to provide a useful support for making effective and efficient choices with the aim of guaranteeing economic and financial convenience for the subjects involved, by preserving natural environment.

This research is linked to issues outlined. In particular, the aim has been to highlight usefulness of the CRA assessment technique to support decision-making process of enhancement of abandoned Triumphal Fortress military complex located in a central area of the city of Rome (Italy). In particular, in order to verify possibility for PA to request additional operations to private entrepreneur more than the minimum ones required by the law, the CRA has been implemented by considering real physical, urban and market data and by applying current GRP provisions. The implementation of the CRA with instant comparison of expected financial quantities has allowed to determine balance sheets of PA and private entrepreneur and to highlight the existence of wide bargaining margins which, if not modified, leave the private developer with a

substantial profit. The achieved results enable the PA to request the private entrepreneur i) the further financial resources or ii) the direct realization of the operations that are intended to the public services. In other words, the use of the proposed assessment technique has allowed the subjects involved to quantify cost and revenue items relating to transaction so that, in compliance with constraints of financial convenience, the fair distribution of costs and advantages according to the functional mix has been guaranteed. This is an output that otherwise would not have been available.

The financial analysis conducted could represent a first step of a broader methodological approach that provides in a second phase the analysis of discounted cash flows, for a more accurate financial feasibility check, and the determination of GFS quantity which represents the break-even point of the initiative. Operating in this way, the entire financial soundness of the project to enhance the Triumphal Fortress would be probed.

Future improvements of the research may also concern the application of Operational Research algorithms for determining the specific urban parameters' quantity able to define the maximum reduction of land take impacts, by guarantying the financial interests of subjects involved.

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