

Public and Private Interests in Urban Regeneration Programs: The Case Study of Trieste Historic Centre

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Abstract. This paper focuses on the evaluation of the economic aspects related to urban transformations, with particular attention to the relationships among the different interests involved. Starting from the application of the Discounted Cash-Flow Analysis, the study investigates public and private perspectives in the development of the regeneration of the historic center of the city of Trieste (Italy). Different scenarios are considered and evaluated from the point of view of the public and private convenience considering the Internal Rate of Return and the Net Present Value indicators. The final results are also verified by means of specific sensitivity analyses that allow the validity of the proposed model to be tested.

Keywords: Discounted Cash-Flow analysis · Internal rate of return · Feasibility analysis · Sensitivity analysis · Urban economics

1 Introduction and Overview

This paper focuses on the economic evaluation of urban regeneration processes [1] concerning historic centres. Despite these long-term view evaluations are quite consolidated [2, 3] and have been used for assessing several urban development operations (e.g. Hamburg [4], Barcelona, Malmö, Berlin, Amsterdam [5]), limited studies investigate their application related to the regeneration of historic centres [6], which are characterized by high complexity of values and needs.

This paper is part of a wider research work¹ which aims at examining the case study of Trieste historic centre by suggesting a sustainable planning approach (i.e. an integrated Multicriteria Analysis framework) that considers the broad spectrum of problems, aspects and Stakeholders involved within the decision process. For the present article, in particular, the sensitive economic point of view has been screened and further developed, examining - in order to promote awareness and to aid the framing of possible solutions - an innovative Public fund proposal for its contribution to boosting

¹ Master thesis [8] developed by Mauro Crescenzo and Sara De Matteis with the supervision of professors Marta Bottero, Mauro Berta and Valentina Ferretti at Politecnico di Torino.

the overall process [7]. Economic purposes, among others, are related to great urban development projects operations [9] (e.g. Bilbao and Copenhagen, in addition to others already mentioned) as they offer opportunities for investors for which economic aspects are crucial [5]. From Private investors' perspective, profits on investments usually ensure the success the operation [10]; however, common benefits can also be obtained [11]. Cities (i.e. urban communities) are in fact lived and shared by many - either Private or Public - individuals: the increase of value (i.e. indirect economic and social benefits) resulting from the operation can be thus shared - maximizing the benefits [10] - with the whole community. The proposal investigated in this paper is thus framed considering both individual (i.e. Private) and community (i.e. Public) economic aspects of the intervention, thanks to the development of various Discounted Cash-Flow Analyses, in a shared economy perspective where both actors involve resources for achieving common goals and benefits. Public effort is in fact usually considered the starting driver of successful urban renewal experiences [10].

After the introduction and the presentation of the case study, the paper is organized as follows: Sect. 2 presents the Discounted Cash-Flow analysis methodological background; Sect. 3 illustrates the application to the historic centre of Trieste, clarifying the subsequent steps of the evaluation model; Sect. 4 illustrates the results and discusses the main findings of the research, Sect. 5 summarizes the main conclusions that can be drawn from the work and contribute to future perspectives and the study of economic aspect and the urban regeneration of historic centres.

1.1 The Historic Centre of Trieste

Trieste is an ancient city with Roman origins located in Northern Italy. The city experienced a very complex development process during the years that deeply marked its urban environment and particularly its historic centre, which is named *Cittavecchia*. A large depopulation in late 1700 and the following repopulation with the poorest classes of the society [12] led to widespread sanitary problems [13], collapses and a significant abandonment that caused in 1900 the partial completion of several demolition plans and the walling-up of the area that lasted until the early '90. In 1986, the increasing awareness on the problem and the first recovery plans led to the opportunity to start an extensive renovation of *Cittavecchia* with Communitarian fund obtained for the Urban II Programme in 1998. Moreover, various buildings and archeological areas were recovered and discovered [14] during the intervention, which successfully accomplished various objectives but left incomplete other portions of the area. After several years, this situation increased the fragmentation of the urban fabric and the identity issues that can be perceived today. Archeological areas and public spaces clearly symbolize this condition: despite their great potential they do not properly connect the various interventions and the city itself to the historic centre.

For the evaluation of a proper regeneration proposal it is important to consider the impact on the citizens of the complex development that Trieste faced during the years. The deep scars on the urban tissue due to the extensive abandonment, the poor sanitary conditions and the historic centre confinement for many years, contributed to the existing issues as *Cittavecchia* were excluded from the city and citizens were deprived of

these spaces. Also today it can be in fact perceived a certain type of confinement as Private investors are not motivated to recover their abandoned buildings despite the great potential of the area [15]. Therefore, in order to envisage a successful regeneration for the historic centre it is increasingly required to consider the importance of commitment and the feeling of trust between citizens and local Institutions. In fact it has been noted that trust facilitates the relation between actors, reducing negative outcomes and risks of the operation [16]. Investments can be encouraged and economic development reached if citizens and Stakeholders are motivated to comprehend the potential of the area - sharing then resources [17], goals and aspirations - thanks to long-term solution proposals and inclusive decision-making processes. In this sense, the present paper aims at investigating a particular Public-Private Partnership (PPP) proposal that recalls the Allen and Meyer definition of Organizational Commitment [18]: a psychological state that binds the individual to the organization. If citizens in fact take part to the development acting loyally and responsibly towards the Institutions, as it happens in the relation between the individuals and the organization in which they are employed, a better successful regeneration process can be achieved. The economic literature on PPP also emphasizes the effect on incentives and risk transfer of bundling building and operation into a single contract, with different assumptions on the contractual framework and the quality of the information held by the government [19].

2 Methodological Background

The feasibility analysis applied in the research work and further developed for this paper aims at answering the question “will it work?” for a specific project proposal. The method identifies in fact the full range of costs and incomes of a project, allowing investor to understand if minimum objectives of the intervention will be achievable. According to the scientific literature [20, 21] feasibility analysis is iterative and continuous and it involves the following eight steps: (1) assessing the physical and legal aspects of the site; (2) estimating demand for the space; (3) analyzing competitive space; (4) estimating costs of acquisition, construction or rehabilitation; (5) estimating the cost and availability of borrowed funds; (6) estimating absorption rates; (7) developing cash flow schedules; (8) evaluating the estimated cash flow in terms of acceptability of the expected outcome. A very important part of the overall feasibility study is related to the financial analysis which normally can be addressed through the Discounted Cash-Flow Analysis (DCFA). Particularly, this technique is used to derive economic and financial performance criteria for investment projects [22] in the form of synthetic and easy to interpret indicators that allows the Decision Maker to understand if the project should be accepted or rejected. Net Present Value (NPV) and Internal Rate of Return (IRR) are thus the most used project performance criteria.

Let X be a project with real benefits B_{Xt} and real costs C_{Xt} , in $t = 0, 1, \dots, T$ years from now and r the discount rate. NPV of the project is defined as in Eq. (1):

$$NPV = \sum_{t=0}^T \frac{B_t - C_t}{(1+r)^t} \quad (1)$$

It has been noticed that: (i) If $NPV = 0$ the discounted benefits are equal to the discounted costs and then we should be indifferent in the decision whether to accept or reject the project; (ii) If $NPV > 0$ the discounted benefits are larger than the discounted costs and then we should accept the project; (iii) If $NPV < 0$ the discounted benefits are smaller than the discounted costs and then we should reject the project.

With reference to the Internal Rate of Return (IRR) of the investment, the value can be derived finding the rate of return so that the project breaks even, in order to find the IRR which makes the present value zero as represented in the Eq. (2):

$$\sum_{t=0}^T \frac{B_t - C_t}{(1+r)^t} = 0 \Rightarrow r = IRR \quad (2)$$

It is then possible to affirm that a project is admissible if $IRR > r$ (i.e. rate of return exceeds opportunity cost).

3 Application

3.1 The Urban Regeneration Scenarios

The urban regeneration envisaged for Trieste aims, as defined by Roberts [23], at solving the existing problems and achieving lasting improvements on economic, physical, social and environmental conditions with an integrated vision. In particular, three scenarios - that are analyzed from the economic point of view in the present application - have been proposed in the main research work with different functional mixes (Table 1) and design solutions (Fig. 1) for public, private, unused and underused spaces, considering reusing and preservation principles in order to obtain a solution more economic and respectful of the existing heritage.

3.2 Public and Private Perspectives of the Operation

Public sector is increasingly supporting economic regeneration processes with integrated approaches and partnerships in order to ensure a better value to the invested capital [23]. Recent urban development initiatives propose various solutions for Public and Private funding and their relationship - e.g. PPPs (London), Public-owned companies (Hamburg, Barcelona and Copenhagen), mixed approaches (Berlin), more traditional Public-Private cooperation (Amsterdam and Malmö) [5] and private-led operations (Brussels) [9]; however, new coalitions can be forged for the redevelopment of historic centres [11] where large part of the buildings already exists.

In this paper, an innovative approach has been thus proposed and investigated, in relation to a Public contribution that is useful to increase the desirability of the Private investors, to encourage the beginning of the operation and to involve the existing owners within the process. The Discounted Cash-Flow Analysis described in the previous paragraph has been thus applied to identify the convenience of both Private and Public investors. In particular, in this study an innovative public incentive, which

Table 1. Envisaged scenarios for the regeneration of Trieste historic centre

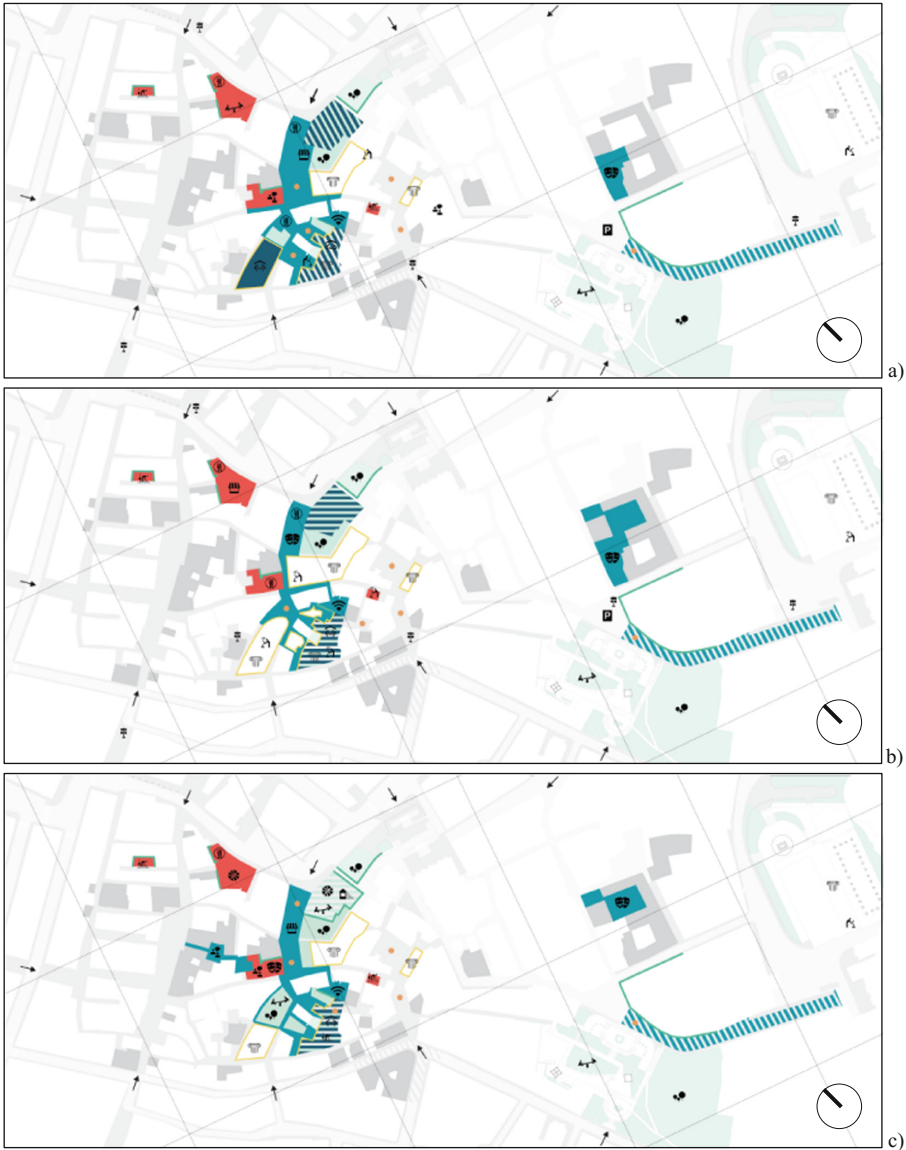
Scenario	Description
Working setting	The proximity to the Institutional buildings and the presence of various existing work realities in the area suggest the solutions proposed in this scenario: large part of the buildings and public spaces are designed to host a large Neighborhood Market, traditional and innovative new work activities and their related services
Touristic environment	The existing historic traces, the cultural identity and other attractions of the area are enhanced and systematized in this scenario with a new Tourist Office, various museums (e.g. an Archaeological one in Piazza Cavana) and various paths between the archaeological areas
Residential location	This scenario aims at creating a more livable environment by converting largest part of the spaces to residential buildings and services. It is in fact enhanced the cooperative use of spaces with a proposed Neighbourhood Community Center in Piazza Cavana, urban gardens and outdoor leisure areas

covers the 60% of the Private construction costs and that will be entirely returned to the Public only if profits will be obtained by the Private investors, has been assumed. In this perspective Public and Private investors are bounded by an economic and psychological agreement, which recalls the Organizational Commitment vision previously introduced, and activate the private interest as various cases - e.g. Hamburg [4], Berlin, Barcelona, London and finally Amsterdam [5] - suggest. Public sector thus coordinates and invests on the operation as it is interested in potential positive effects on the whole area and on the local community [24], while Private investors are encouraged to begin the renovation thanks to the significant profits that can be achieved thanks to the Public contribution. Both sectors share then economic and other indirect advantages that result from the success of the operation as, for example, the revitalization of public spaces and the returns on the Real Estate Market. Moreover, it is important to consider that any goals can be achieved with a detailed contract that is proposed and agreed at the start of the operation [19] (e.g. in Hamburg Public sector tied Private investments to strict criteria previously defined [4]). Other fund opportunities are not considered in the following analyses because of their different nature (as for the non-repayable Public, European and Private grants).

3.3 Development of the Discounted Cash-Flow Analysis

The economic evaluation of Private and Public Conveniences has been developed with the DCFA method that is useful to rationalize and quantify both the advantages and disadvantages of the proposals.

The analyses are based on parametric data that derive from a Property Market Analysis and on detailed hypothesis considering the solutions proposed by each scenario and the specific time frame. The two analyses that have been developed from the Public investor perspective and from the Private one for each scenario have been also



Existing	Design themes	Proposed intervention on open public spaces	
<ul style="list-style-type: none"> Private space Street Walking path Building object of the regeneration Green area and park Access to the area 	<ul style="list-style-type: none"> Public space Vacant lot Roof Urban furniture Green wall Enclosure 	<ul style="list-style-type: none"> Covered space Outdoor restaurant furniture Temporary structure Archaeological interest area Parking area Leisure and sport area 	<ul style="list-style-type: none"> Direction sign Urban garden Information point Cultural attraction Wi-fi point Park

Fig. 1. Proposed interventions [8] for the envisaged scenarios: (a) *Working setting*, (b) *Touristic environment*, (c) *Residential location*

interconnected in order to properly consider the Public fund provided at the beginning of the operation and the following Private returning contribution.

Time Frame of the Evaluation. In order to apply the Discounted Cash-Flow Analysis model, it is necessary to identify the duration of the evaluation [25] that corresponds to the time frame considered for the estimation of the investment feasibility. Due to the size of the operation, the analyses proposed for this paper are based on a periodization of both costs and benefits over a time frame of 30 years that include all the phases of the operation, from the properties acquisitions to the revenues resulting from the completion of the intervention (Table 2).

Table 2. Duration of the phases of the evaluation

Component	Start (year)	Duration (years)	Method
Acquisitions	1	4	Percentage
Construction	1	Private: 5	Percentage
		Public: 6	
60% Fund	1	5	Percentage
Private returning contribution	2	On the sales: 1	Sales plan
		On the rents: 3	Rents plan
Management costs	3	29 + Residual value (+)	Percentage
Sales	2	5	Sales plan
Rents	2	29 + Residual value (+)	Rents plan

Estimation of Costs. Various costs that differ from design and functional proposals have been quantified and distributed over the time frame, including the construction and management costs, the technical and general expenses and the financial charges.

Construction costs result from the interplay of various factors related to the envisaged projects [26] and have been estimated with a parametric approach, considering the good or bad state of conservation of the buildings. Moreover, with specific costs manuals [27], a time scheduling of a single building has been developed (Fig. 2) in order to quantify the percentage weight of the renewal operations over the years. The distribution of the works resulting from this analysis can be described as follows: 35.4% for the first year and 64.6% for the second one.

Annual values that have been used for the distribution over the time frame are shown in Table 3: due to the dimensions of the area and the high number of buildings involved time scheduling values have been refined considering an asynchronous beginning of the renewal operations (assumed to be of 20% on the first year, 30% on the second and third one and 20% on the fourth one).

Furthermore, other aspects have been considered for the Private perspectives, as the costs related to the capital invested for the operation and the taxes, considering constant values and real rates. In particular, the interest expenses and the loan interest have been included in the calculations and they have been assumed equal to 3% (considering TUS as 0.05% and SPREAD as 2.95%) and to 1%, respectively. With reference to the taxes,

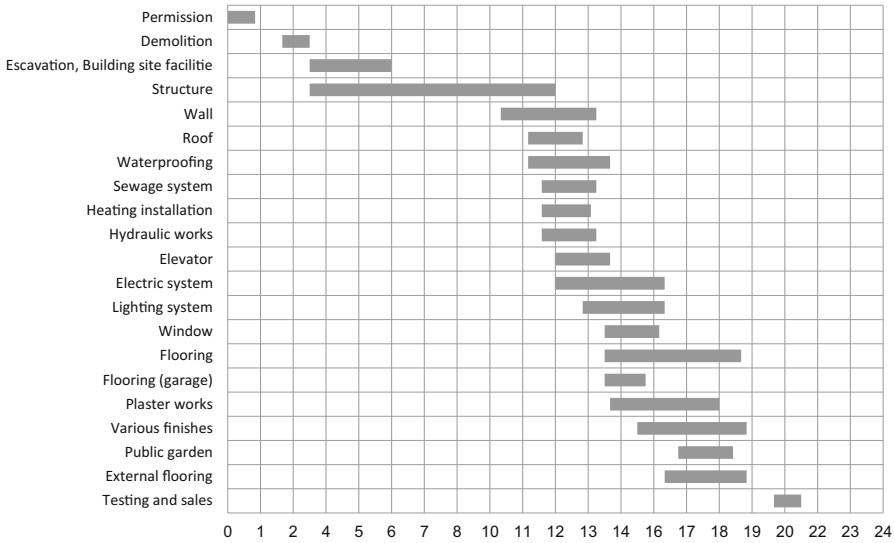


Fig. 2. Time scheduling of a case study building (months on the horizontal axis)

Table 3. Annual distribution of the construction costs

Distribution	1 st year	2 nd year	3 rd year	4 th year	5 th year
20%	7.1%	12.9%			
30%		10.6%	19.4%		
30%			10.6%	19.4%	
20%				7.1%	12.9%
TOTAL:	7.1%	23.5%	30.0%	26.5%	12.9%

they are represented by IRES (an income tax that deducts the previous losses from the taxable income) and IRAP (a regional tax on productive activities that considers as a taxable income the difference between the profits and the 70% of the costs). Subsequently, for both the cash-flows of Public and Private investments, a limited risk premium has been applied, i.e. a discount rate of 5%.

Estimation of Profits. Expected profits for each proposed destination are quantified with different approaches: selling prices and annual rents have been defined, thanks to parametric prices resulting from a Real Estate Market Analysis and considering also the case that some of the actual owners can maintain the property of their buildings.

The distribution over the time frame of the profits, which is different for the sales and the rents, is based on sales and renting plans that have been envisaged for this

research in order to further develop the method and to obtain a more precise result. In particular, the *Sales Plan* proposed for the present application is based upon percentages of 10% of the sales for the first year, 20% for the second one, 35% for the third one, 25% for the fourth one and 10% for the fifth one. The obtained annual profits are then distributed over a time frame of 29 years with a proposed *Rents Plan* that is based on the following cumulated percentages: 10% of successful rents during the first year, 20% of successful ones during the second year, 40% during the third one, 70% during the fourth one and 100% during the fifth one.

Relationship Between Public and Private Investments. As previously mentioned, in the evaluation model it has been assumed that the Public actor provides the 60% of the Private construction costs, contribution that will be returned by the Private investors only if profits are obtained.

The distribution on the time frame of the starting contribution is contextual to the construction operations, while the Private investors return the contribution contextually with the sales or rents. As it is shown in Table 4, the Public and Private involvements are different in each proposed alternative; in particular the Public direct costs are higher for the touristic scenario due to the expenses required for the construction of the proposed museums and for the enhancement of the archaeological areas. The highest Private investment is related to the working alternative and the lowest to the residential one.

Table 4. Public and Private investments required for the start of the intervention

Investment		Working setting	Touristic environment	Residential location
Public	Direct costs	4,476,204 €	11,766,312 €	6,730,041 €
	Contribution to private costs	6,558,142 €	5,770,645 €	5,749,008 €
Private direct costs		4,372,094 €	3,847,097 €	3,832,672 €
Public involvement		72%	82%	77%

4 Results

4.1 Evaluation of the Economic Convenience

The resulting Net Present Value (NPV) and the Internal Rate of Return (IRR) - which are useful to assess the economic convenience of the operation according to the DFCA methodology - have been calculated for the three envisaged scenarios both for Public and for Private investors (Table 5). As an example, Table 6 in Appendix A provides the DCFA table for the evaluation of the *touristic environment* scenario under the Private perspective. As it can be noted from Table 5, the minimum acceptable IRR value of 10% is always achieved and the highest and lowest resulting IRR values are both related to the *working setting* proposal, while the touristic scenario presents the highest IRR among the Public perspective. Furthermore, it is relevant to mention that the analysis performed for this paper does not consider the non-monetary benefits of a Public

investment, which can in particular influence the touristic scenario as it proposes a more profitable solution for the public spaces and the archaeological areas of Cittavecchia.

Table 5. Public and private internal rate of return for each scenario

	Working setting	Touristic environment	Residential location
Public IRR	13.1%	14.6%	14.2%
Private IRR	21.2%	20.3%	15.8%

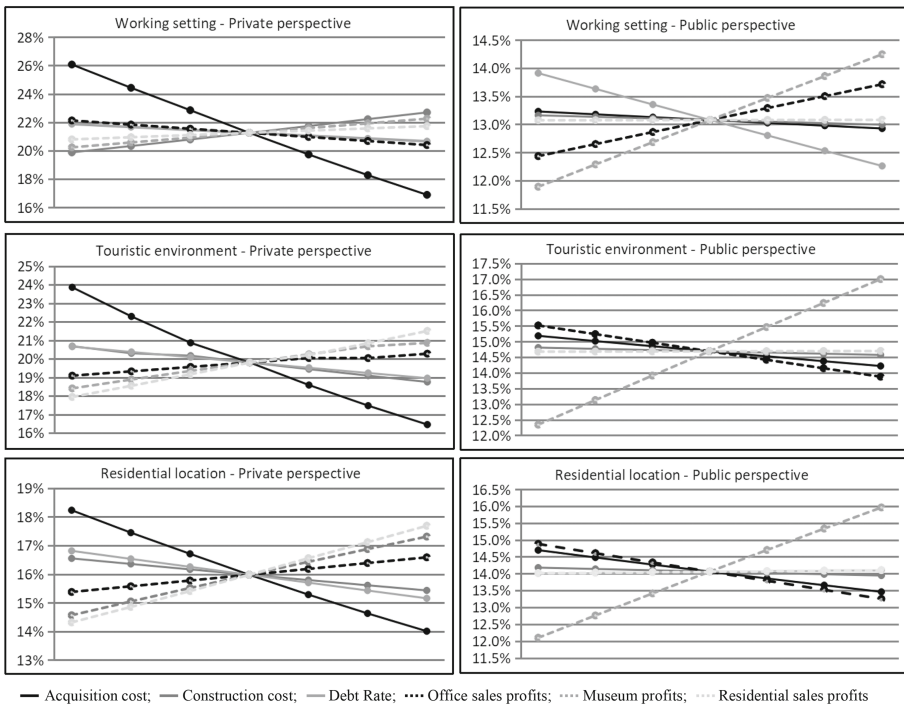


Fig. 3. Sensitivity Analyses of Private and Public perspectives for each scenario. A suggestion for the touristic scenario: the proposed archaeological museum [8].

4.2 Sensitivity Analysis

As other experiences proved, results may vary according to different elements: in fact, although many are not completed yet, some operations better succeed (e.g. Barcelona and Berlin) than others (e.g. Amsterdam) [5] in achieving developers' expectations, attracting Private investments and thus increasing common benefits.

For this reason, in order to better investigate the results of the analysis, Sensitivity Analysis is normally applied to test the robustness of the results of the DFCA model

taking different scenarios into account: key variables of the evaluation, most uncertain areas of the project and variation of the expected results are thus identified for implementing ad-hoc monitoring. Sensitivity analysis is concerned with a “what if” kind of question to see if the final answer is stable when the inputs are changed. In the present application NPV and IRR have been recalculated by modifying ($\pm 5\%$, $\pm 10\%$, $\pm 15\%$) the value of crucial cost and benefit entries (acquisition costs, construction costs, debt rate, office sales profits, museum profits and residential sales profits). The results are summarized in scatter plots where the x axis represents the percentage variation of the input while the y axis represents the percentage variation of the performance criteria (Fig. 3). The critical variables - represented by the highest angular coefficient - are acquisition costs for all the Private perspectives and museum profits, together with debt rate in working scenario, for the Public ones. More importantly, IRR values are higher than the minimum threshold in every scenario.

5 Discussion of the Results and Conclusions

From the economic point of view, it is important to consider the increasing relevance of the shared economy [28], where both Public and Private investors share resources and goals in order to obtain a more sustainable result. The development of the city and of urban regeneration processes are more and more based on inclusive decision making procedures with a greater balance between feelings of loyalty and responsibility where citizens and Institutions invest and share advantages. It is then increasingly important to accelerate the process motivating the Private investors and enhancing the feeling of trust in local Institution and their comprehension of the regeneration process potential. The DCFA developed for this paper offer a successful interpretation of the complexity that is related to such decision problems, as it is able to interpret and translate the psychological agreement in the economic process, easing the adaptation of the evaluation method to the complex existing dynamics, exploring and proposing innovative perspectives. In particular it is possible to notice that through an operation based on the proposal of a starting public fund that corresponds to the 60% of the Private construction costs subsequently returned with the Private profits, successful economic and non-economic goals can be reached for both Public and Private Investors. The Public profit is in fact obtained for every scenario and can be further enhanced if also non-monetary aspects are considered; at the same time Private actors are moved to invest and take advantages of the profits and of the increase of value resulting on their properties.

Considering the degree of detail that have been developed and the results obtained by the DCFA and the Sensitivity Analyses performed for this paper, it is possible to state that the best overall economic performance is obtained by the *touristic environment* scenario, thanks to the high IRR values resulting from the evaluation, the low influence of the variation on the results and the positive influence of non-monetary benefits that - despite the fact they have not been evaluated for the present paper - could in particular influence this scenario. The proposed application of the method and the obtained results are very useful in decision-making processes similar to the case study of Trieste as they permit to investigate and identify complex economic proposals

considering the various economic perspectives of the actors involved. The intention of this paper is in fact to offer a new perspective for the study of urban regeneration processes, thanks to a reasoning that can be further developed to better frame the existing complexity and the potential of each alternative. In particular, the mechanism of Public Private Partnership proposed in the present application seems to be very suitable for addressing the complex and interconnected objectives of urban regeneration policies. In fact, in the model the Public subject acts as a lending institution, granting capital to Private investors at a low interest rate and the loan is then reimbursed by private actors, with an increase of urban quality in the area under investigation and positive effects on local community.

With reference to the future perspectives of the present study, it would be of scientific interest to better develop the Discounted Cash-Flow analyses by means of specific risk analysis in order to include uncertainty in the evaluation model [29]. Further research could explore the application of Cost Benefit Analysis on this case study, focusing more on the integration of a shared economy perspective, considering non-monetary benefits and aspects and verifying their influence on the results [30–33]. Finally, for a better validation of the present application results, the method could be experimented in other contexts, promoting innovative Private investments, the research of non-refundable funds and deepening the weight assessment process.



Fig. 4. A suggestion for the touristic scenario: the proposed archaeological museum [8].

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