A Procedure to Evaluate the Extra-Charge of Urbanization

Maria Rosaria Guarini[1(✉)], Pierluigi Morano[2], and Alessandro Micheli[3]

[1] Department of Architecture and Design, Sapienza University of Rome, 00196 Rome, Italy
mariarosaria.guarini@uniromal.it
[2] Department of Science of Civil Engineering and Architecture, Polytechnic University of Bari, 70125 Bari, Italy
pierluigi.morano@poliba.it
[3] Doctoral School of Architecture and Construction, Department of Architecture and Design, Sapienza University of Rome, 00196 Rome, Italy
alessandro.micheli@uniromal.it

Abstract. The Public-Private Partnership is also used, at international level, to carry out interventions in urban variant on areas or buildings that, by enhancing the value of (private) real estate properties, guarantee an economic return for the local community through an extraordinary contribution of urbanization (ECU) paid to the Administration by the private entity. The Italian Regions and Municipalities that have regulated the ECU calculation adopt a procedure of transformation value that does not specify either the duration or the risk-related rate of return of the real estate operation, which are essential factors for its balanced quantification. The paper defines a procedure that integrates methodologies, diffused in practice and literature, with official datasets to determine objectively the ECU, also evaluating its sensitivity to the critical variables of the transformative process. The proposed procedure is easy to apply and adaptable to a wide range of interventions and to different phases of the public-private (re) negotiation. It is in line with the Italian case and it is consistent with the international evaluation standards (IVS), having a general validity in the estimation field.

Keywords: Extra charge of urbanization · Public–private partnership · Discount rate · Capital gain appraisal · Land value capture · Real estate development · Discounted cash flow analisys

Conceptualization, M.R.G., P.M. and A.M.; Data curation, A.M.; Formal analysis, M.R.G., P.M. and A.M.; Investigation, M.R.G. and A.M.; Methodology, M.R.G., P.M. and A.M.; Resources, M.R.G. and A.M.; Supervision, M.R.G. and P.M.; Validation, M.R.G. and P.M.; Visualization, M.R.G., P.M. and A.M.; Writing—original draft, M.R.G., P.M. and A.M.; Writing—review & editing, M.R.G., P.M. and A.M.

© Springer Nature Switzerland AG 2020
O. Gervasi et al. (Eds.): ICCSA 2020, LNCS 12251, pp. 981–999, 2020.
https://doi.org/10.1007/978-3-030-58808-3_70

1 Introduction

At least since the second half of the 20th century, the Public Private Partnership (PPP) has been a very present topic in the international scientific debate, also in reference to urban settlement transformation projects. Both contractual and institutionalized PPP [18], concerns a bundle of legal institutions that Member States have transposed from the European Policy Framework. It is recognised that the quality of urban processes derives from the capacity for interaction between the public and private sectors, according to advanced cooperative forms [11].

The current scarcity of resources increases the need for the Public Administration (PA) to finance, including from private funding, the public investments that make the city live without increasing public debt [12]. Urban land income is a logical, rather than economic, approach to the issue: it can be at least partially taxed because its value depends significantly on the investments (and decisions) that the PA and other private entities make in/around the city [5].

The purpose of taxation is not necessarily the values of the land and property stock (already strongly affected) but concerns the emerging or extra capital gain (ECG), i.e. its variation (capitalized in the value/price of the land) generated by the processes of real estate (re)development or urban rigeneration and transformation of land uses, from greenfiels to brownfields sites or from blighted areas to renewal ones [26].

In most advanced countries, the private actor is called to contribute to the regeneration and development costs of the city, sharing with the public sector the surplus value generated by urban transformation, through various modalities (generally combined and used with different intensities) [7, 14]. The French *taxe d'aménagement*, the Spanish *cargas de urbanizaciòn*, the American *impact fees* and the English *development permit* are tools for this purpose [8].

Even in less developed and developing countries, agencies and large international study centres are increasingly oriented towards differentiated practices and forms of *value recapture* - i.e. the recovery (in favour of the community) of surplus values created directly by public action or investment - and *value sharing* - i.e. the fair distribution between public and private of surplus values in urban transformation (from agricultural use to residential and productive land use) - through national and local rules or negotiated agreements between PA and real estate operators [8].

Among the most common practices in Europe, the partial recovery by the public of the capital gains of private urban transformation is typical of the Spanish and Italian case. In Italy this extraordinary charge of urbanisation (ECU) is calculated by the municipal administration as an additional planning permission burden; it must beat least equal to 50% of the ECG produced by interventions on buildings in urban variant which, in general, presupposes a negotiated agreement between the parties.

Operationally and in literature, the procedure of the Transformation Value (TV) is used to quantify the ECG; this criterion requires a duration of the initiative and a Discount Rate (DR) to be estimated in a prudential way because it is crucial to assess the sustainability of the project [26] also using the Discounted Cash Flow (DCF).

The most used techniques to determine the DR are the Weighted Average Cost of Capital (WACC), the Build-Up Method and the Capital Asset Pricing Model (CAPM) [17, 20].

It should be noted that the analysis of medium/long-term public-private relationships (at least 5–10 years) cannot be limited to the start of the implementation phase and it shoud overcome the conviction that the initial commitments and balances must be preserved even in subsequent variants [26]: in fact, the implementation of the contracted projects may require changes due to: renewed market needs, objective construction difficulties (not attributable to developers), etc.

It therefore seems appropriate to focus on the transformation capital gains that emerge in the valuation processes, ex-*ante* and ex-*post*, about the initial and final net property values, and how these are calculated [26].

The definition of a method that makes this capital gain assessable, with effective and conditional parameters, can be a valid support also to re-negotiate the economic-financial relationships, in the final stage or working progress [26].

The paper defines a relatively straightforward method that, integrating commonly used techniques and data easily available (online) from authoritative sources, allows the determination of the DR and the ECU of a real estate initiative. This is in order to: i) contribute to the discussion of the real estate development and urban regeneration initiatives, also in PPPs, focusing on the partial recovery to the community - as a *benefit sharing* [30] - of the properties transformation value (lands or buildings) because their added value can be understood as *public value* [25]; ii) investigate how the economic-financial evaluation can seek a satisfactory balance between public benefits and private convenience also in view of the extraordinary contribution (ECU) envisaged - at European level [8] - for the private players; iii) limit the subjectivity in public-private negotiations which often have very different outcomes depending on the actors involved and their contractual capacity [26].

The following are presented and discussed in the next section: 2) the regulation of the ECU, the procedure to estimate the TV and the techniques to determine the DR; 3) the proposed procedure to quantify the ECU congruently, correlating it to its sensitivity to critical variables such as time, market values and DR; 4) conclusions and future prospects of the research undertaken.

2 Materials and Methods

2.1 Preamble

Considering that the regulation of PPPs and the application of the ECU in Italy are in line with European and international practice, this section is a preamble to the proposed procedure and includes: an excursus on the regulation and calculation methods of the ECU that are based on the TV criterion but without explicating the ‘time’ and ‘risk’ factors (although these significantly affect the DR, the consequent TV and thus the ECU); a description of the main methodologies and techniques used to determine the TV and the DR.

2.2 Extraordinary Charge of Urbanization (ECU)

Law no. 164/2014, which has regulated the payment of the ECU in Italy, is inspired by the most advanced international laws on the subject and allocates the private resources of the revenue produced to carry out public works or services (urban regeneration, environmental protection, social reform) [12]. This legislative (and not regulatory) [1] provision treats the ECU as a consensual and negotiated planning permission burden - in addition to the primary and secondary urbanisation costs - in relation to the increase in real estate value due to urban variant (UV), derogations from the current General Plan (GP) or changes in use.

However, the building and urban planning matter concerns the "shared" legislative power of the State-Regions, but more than five years (2019) since the approval of the national law, as a general principle, only 4 out of 20 Regions have legislated on the subject (Emilia-Romagna, Liguria, Piemonte, Puglia) and only Piemonte and Puglia seem to have fully implemented its content [12] while Liguria (LR 16/2008, as amended by LR 41/2014) has not specified the calculation method. The deliberations of these Regions show differences in the calculation methodology of the ECU to be adopted, the way it is applied and the provision of incentives or disincentives [12].

Operationally, the analytical and synthetic methods are identified. The Regions Piemonte (DGR 222974/2016), Puglia (LR 18/2019), Emilia-Romagna (DGR 186/2018) and many municipalities apply the first one according to the Formula 1:

$$\begin{aligned} \text{ECU} &= 50\%\,\text{ECG} = 50\%\,[\text{TV1} - \text{TV0}] \\ &= 50\%\,[(\text{MV1} - \text{K1}) - (\text{MV0} - \text{K0})] \end{aligned} \tag{1}$$

where TV-Transformation Value of the property is given by the difference between the Market Value of the goods produced by transformation (MV), inferred from the quotations published by the Italian Tax Agency's Real Estate Market Observatory (OMI), and all transformation costs (K) (see as example Table 1).

The second one is provided by Emilia-Romagna for interventions located outside the urbanised territory and without any project complexity; it calculates the ECG (Formula 2) as the difference between the market values after (V *post*) and before (V *ante*) the transformation generated by the UV. These values are deduced from market analysis or from building areas value for municipal tax purposes and, for V *ante*, also from the "average farm values" of the Region.

$$\text{ECU} = 50\%\,\text{ECG} = 50\%\,[\text{V}\,post - \text{V}\,ante] \tag{2}$$

Formulas 1 and 2 do not consider the discount factor and even the analytical method, although more defined than the synthetic one, presents many inconsistencies [13].

A survey conducted online to identify the municipal regulations on the ECU, showed that, as at 31 March 2020, 37 municipalities have adopted, in essence, one of these two methods but with different variants and various coefficients; few municipalities set the ECU in a percentage (on the ECG) higher than the minimum (50%), including the Municipality of Rome which was among the first administrations to

regulate the calculation of the ECU, adopting a measure of 66% (Rome Assembly Resolution 128/2014).

In the Regions that have ignored or opposed national law, such as Lombardia [9] and Veneto, the municipalities have not transposed it or have adopted targets and methods for determining the ECU with their own criteria. Many regional and municipal measures have then tried to decrease the potential of the rule by reducing, during the evaluation, the surplus value generated by the interventions [12] through deductible charges, overestimations of the initial land value, overestimations of works or land disposals, miscellaneous interest and extra-profits that are abnormal and not-ordinary [8].

The heterogeneity and obvious contradictions of the calculation mechanism adopted by most Regions and municipalities hinders the effective application of the law [12].

The evaluation models of the ECU found in the literature [4, 26], referring to the same scheme of the TV, calculate the riskiness of the intervention within the percentage of the Promoter's profit (empirically established) and determine the discount factor only over its entire theoretical duration (5 years) on the basis of a predetermined interest rate [26].

2.3 Methodologies for Determining the Transformation Value (TV)

In the Italian estimative tradition, TV is applied both as an estimative procedure - valid for the generality of market operators - and as a criterion of estimation or economic aspect (derivative), referring to a particular operator and expression of economic convenience judgements.

The IVS distinguish the MV and values different from it: they are not logically different from the "derivative" and typical economic aspects of the Italian school such as TV [23]. Internationally, TV is part of the concepts of *highest and best use* and *value in use* [2, 17].

In the Italian estimative tradition, the analytical criterion for determining the TV of an asset is given by the difference between the revenues obtained from the marketing of goods produced by transformation (Market Value post-transformation - MV_P) and the transformation costs (K), direct (DC: technical construction cost) and indirect (IC: charges and other costs necessary to start and carry out the transformation), including the promoter's profit (Up) to remunerate his investment on the basis of its risk. These quantities are discounted with a discount factor $1/q^n = 1/(1 + r)^n$ which is a function of the discount rate r and the time of the normal transformation n (Formula 3):

$$TV = MV_P/q^n - (K + Up)/q^n \tag{3}$$

As already pointed out, in practice Italian PAs use an 'atemporal' formula (without q^n) to determine TV and thus quantifying the ECU amount.

In order to estimate the MV_P (such as revenues from: sale, rent, management; etc.) it is possible to use the analysis of [15]: a) historical data (income achieved in the recent past), b) potential income (fully operational), c) market data (through goods comparable to those in question), d) average income (considering all above points).

The MV is usually determined synthetically or parametrically by reference to the target market data from official sources or direct market research.

In the absence of a detailed design, direct costs (DC) can be deducted from: a) similar interventions through the synthetic-comparative procedure, which identifies a parametric unit cost (€/sqm, €/cm); b) commercial publications (e.g. Italian publisher Maggioli, DEI) by means of statistically surveyed and, if necessary, adjusted parametric costs; c) summary cost estimate, generally attached to the feasibility study or to the general project.

Indirect costs (IC) are generally derived as a percentage of MV_P and DC: Italian technical literature and municipal regulations for calculating the ECU use different terms and percentages, but the cost items are substantially the same. By way of example, Table 1 shows those contained in the Resolution of the Municipal Administration of Rome.

The DCF [21] considers a more detailed distribution of costs /revenues and determines TV as Net Present Value (NPV), given by the algebraic sum (Σ) of costs (excluding Up) and revenues (expected cash flows (Ft)), discounted using a discount factor ($1/q^t$) according to their time sequence (t) within a suitable duration (n) (Formula 4).

$$TV = \text{NPV} = \sum_{t=1}^{n} \frac{F_t}{q^t} = \sum_{t=1}^{n} \frac{F_t}{(1+r)^t} \tag{4}$$

Table 1. Methods of calculating transformation costs (Rome assembly resolution no. 128/2014)

Cost items	Calculation mode
DC - Direct Costs	
C_0 – technical construction cost;	Parametrically[a]
IC - Indirect Costs	
C_1 – cost of area adaptation and connection to utilities/networks;	2–5% C_0
C_2 – urbanization charges (Presidential Decree no. 380/2001, art.16)	10% C_0
C_3 – professional and supplementary charges and contingencies;	8–12% (C_0 + C_1)
C_4 – marketing charges;	2–3% MV_P
C_5 – borrowing costs on debt *D*, with $q^n = (1 + i)^n$ and interest rate *i* = Spread + EurIRS or Euribor (loan duration 15 years)[b]	D%(C_0 + C_1 + C_2 + C_3) * (q^n–1)
C_6 – Promoter's profit (gross) Up	15–25% MV_P
K - Total cost of transformation	C_0 + C_1 + C_2 + C_3 + C_4 + C_5 + C_6

([a]) calculated using the €/sqm values of the "Prezziario del Collegio Ingegneri e Architetti di Milano" (DEI, latest edition available at the time of the estimate) for specific uses;

([b]) only a first pre-amortisation period of 5 years (n = 1, 2, …, 5) is considered as follows: 10% (1st year); 30% (2nd year); 40% (3rd year); 20% (4th year); 0% (5th year).

In both cases, the DR (which is difficult to deduce from the market) is decisive because the TV varies considerably even at small rate deviations and can therefore influence the amount of the ECU. The construction of the discount rate (DR) in the DCF is based on the concept of risk-return, also taking into account debt capital [3, 29].

In general, Ft are gross of interest payable on debt and subjective income taxes as these costs would lead to different values for the same property as the financing choices and subjective tax situation change.

The exclusion of the tax variable does not influence or weaken the methodology.

The possible growth rate of Ft can be appropriately analyzed according to the expected trend of the market or business sector concerned.

Due to the uncertainty of price development trends, a constant price exercise is frequently used, generally adopting the last data availability. While this allows to focus on quantity forecasts, price changes and inflation can have a major impact on the project's valuation. [19]. Alternatively, to use current discount and interest rates, both price and quantity forecasts should be made by assumptions about trend increases in price/cost and price/revenue rather than applying a uniform expected inflation rate (probably elusive for periods longer than 3–5 years) [19].

Assuming the expected inflation, it is theoretically equivalent to express Ft at nominal or real value but they must be consistent with DR [22]. Assuming that a discount rate before interest is used, in fact, part of the real loss in value of capital is incorporated [19].

The minimum duration of the analysis period (n) is 5 years but in particular cases it may exceed 10 years, depending on the duration of the lease contracts or the forecast of significant transformations over a long period [15, 26].

2.4 Discount Rate (DR)

The direct research of DR requires the detection of a sufficiently large and homogeneous sample of contracts, which is often difficult. In the absence of income and market prices in the specific real estate segment (or to verify the estimated rate), its indirect estimation is used by comparing the operators expectation in this sector with those found in other markets, considering that the expected return on the investment is proportional to its risk degree. The most widely used models for this purpose are:

- WACC, derived from the corporate field and widespread in the practice of the DCF [11, 15, 16, 26, 27, 32], is based on the assumption that the invested capital derives from a mix of financial sources, debt (D) and equity (E), according to the Formula 5:

$$\mathrm{WACC} = \mathrm{kd} * (1 - \mathrm{t}) * \mathrm{D}/(\mathrm{E} + \mathrm{D}) + \mathrm{ke} * \mathrm{E}/(\mathrm{E} + \mathrm{D}) \tag{5}$$

where *Kd* is the cost of debt, *Ke* is the cost of equity, and *t* is the tax rate.

In general, *Kd* is assumed to be equal to the EurIRS increased by the Spread (remuneration for the credit institution granting the loan) [15, 32], inferred from the main Central National Banks (Deutsch Bank, BNP Paribas, Credit Agricole etc.), and the costs related to the loan structuring (Literature Fees) [11].

- The Build-Up Approach [15], an "additive method" that identifies the expected return on investments by adding the different economic return differentials (dx) (Formula 6). These differentials d represent the risk within the variability of the yield (ymin = minimum yield; ymax = maximum yield) specific to each factor defining the risk of a real estate iniziative, such that: ymin < d (n) < ymax.

$$r = d(1) + d(2) + \ldots + d(n) = n \sum x = 1\, d(x) \tag{6}$$

- CAPM [28] based on the idea of systematic risk (non-diversifiable) and market risk premium MRP as compensation for the investor given by the *Rm* return of a market portfolio minus the *Rrf* return of a risk free bond; it is extended to real estate to determine Ke [11, 15, 16, 26, 27, 32] according to the Formula 7:

$$Ke = Rrf + (\beta_{imm} * MRP) + \gamma = Rrf + [\beta_{imm} * (Rm - Rrf)] + \gamma \tag{7}$$

where: β_{imm} (or β) is the covariance index of the real estate sector and measures the sensitivity of the return on investment to movements of the entire market; γ is the premium for the additional risk component depending on the characteristics of the specific real estate project (location, type, size, etc.).

To determine *Rrf*, β_{imm}, *MRP* it is possible to refer to official sources or online datasets used in international evaluation practice [32] which make available freely numerous data in the economic and financial field (Bloomberg, Damodaran etc.) (Table 2).

In general, the γ estimate requires a market survey of similar real estate development projects already carried out, in order to gather their most relevant data considering their specific characteristics. The Italian Tax Agency (ITA) has proposed a model of real estate risk assessment γ based on the dataset of 42 real estate development projects carried out in Rome and analyzed by means of several concatenated statistical-economic estimation methods (DCSEOMI Methodology) [10]. This model, in relation to the market segment investigated and the information available, selects the investment risk factors from those indicated in TEGoVA's reports (2003, 2010) and describes each one by a level/nomenclature associated with a scale of conventional importance (the level associated with a higher rate of return corresponds to the highest score). Having defined the various differentials characterising each factor and assigned the specific value (risk level) of each differential, the expected γ of the initiative is given by the sum of the values corresponding to the individual risk components (Table 3).

The γ of real estate development projects may therefore vary within these values:

$$\gamma_{min} = 0,18\% + 0,03\% + 0,06\% + 0,06\% + 0,12\% = 0,45\% \tag{8}$$

$$\gamma_{max} = 9,35\% + 1,58\% + 2,87\% + 2,94\% + 6,20\% = 22,94\% \tag{9}$$

Table 2. Official sources and data platforms to determine the components of: a) Ke; b) Kd

Factor	Source	Benchmark
a) components of Ke		
Rrf	National Central Bank; Bloomberg	Nominal yields on government bonds with a maturity comparable to the duration of the operation (average reference period)
MRP	Bloomberg	Inferable values for the national market concerned
	Damodaran	Equity Risk Premium (ERP) for the country concerned
β	Damodaran	Beta of the sector: *Real Estate (Development)* - Western Europe
b) components of Kd		
EurIrs (o Euribor)	www.Euribor.it (or Il Sole 24Ore, for Italy)	Average of the values recorded backwards for a period representative of the market trend
Spread	Deutsch Bank, BNP Paribas, Credit Agricole, ecc	Percentage value determined by the main European Banks (estimated at around 2%)
	Damodaran	Annual published value for "Western Europe"
Success + arranging fee	Technical literature	Costs related to the structuring of funding quantifiable respectively in the order of 0.7% + 0.9% = 1.6% (Literature Fees)

Table 3. Model proposed by the Italian RA to assess the specific risk γ of property investments

Specific risk factor levels	Location	Dimensional factors	Building equipment	Property size	Presence of competitors	
	0,0948316	0,0160615	0,0291632	0,0298292	0,062866	Weights
	40,74%	6,90%	12,53%	12,82%	27,01%	% on the total
1	0,18%	0,03%	0,06%	0,06%	0,12%	
2	2,01%	0,65%	1,18%	0,82%	2,54%	
3	3,83%	1,58%	2,87%	1,78%	6,20%	
4	6,59%			2,94%		
5	9,35%					

3 Proposed Procedure for Determining the ECU

3.1 Structure and Steps of the Procedure

The proposed procedure to calculate the ECU of a real estate development intervention in urbanistic variant (UV), public or private initiative referable to building land or consolidated urban planning, considers the most representative variables of the trans-formative process, declined both in the scenario 'before' and 'after' the Event or Variant (*with-without-principle*), including factors that normally are not considered in

the methodologies used by the Italian PA, such as duration and riskiness of the investment.

In the role of PAs, this tool can be used to evaluate a hypothesis of urban transformation in order to: i) establish the fundamental parameters and essential contents of the possible urban planning programme (as a basis of the tender); ii) verify the data proposed by the Promoter, compared to those considered "ordinary" by the PA with reference to the sources established in the procedure; iii) determine and/or verify a fair distribution of the costs and benefits of the initiative, ex-*ante* ex-*post* or in progress.

Given the elements of uncertainty and the temporal distance of the assumptions necessary for the procedure, it is important for the PA not to apply it uncritically. Here it is assumed that the Promoter formulates a proposal to the PA articulated in the two intervention scenarios (*ante/post* UV) according to the data reported in Table 4.

Table 4. Input data of the proposed model to enhance a free area in derogation of the GP

Data typology	Parameters per scenario (S)	Description /formula /note
Data urban planning	Typology intervention	New building, urban renovation, etc.
	Land Area (of intervention)	LA (mq), (for area)
	Land Use Index	LUI_S (smq/sqm or cm/sqm)
	Gross Floor Area (building)[a]	$GFA_S = LUI_S * LA$
	Building Types Areas	$(BTAi)_S = [(\%i)*GFA]_S$
Timing (analysis period)	Time span transformation	n_S (in years); t = generic year of duration *n*
	Time distribution MV, K	$[(\%MV)t, (\%DC)t, (\%ICK)t, (\%ICR)t]_S$
Revenue of transformation	Market Value (MV)	$(MV)_S = \Sigma(MVi)_S = \Sigma(UMVi)_S * (BTAi)_S$
	Average Unit MV	$UMV_S = [\Sigma(UMVi*BTAi)_S] / GFA_S$
Cost of transformation $(K)_S = DC_S + IC_S$	Direct Cost (DC)	$DC_S [= \Sigma(UDCi_S*BTAi_S)]$
	average Unit DC	$UDC_S = [\Sigma(UDCi_S*BTAi_S)] / GFA_S$
	Indirect Costs $IC = ICK_S + ICR_S$	$ICK_S = [\Sigma(\%_K)*DC]_S$, $ICR_S = [(\%_R)*MV]_S$
	Extra Charge ofUrbanization	ECU
Financial parameters	Cost of financing/funding	Ke (cost of Equity), Kd (cost of Debt)
	Leverage ratio	D/E

([a]) according to the rules of Presidential Decree 138/98, also used to determine OMI quotations

The procedure is structured in 6 phases; their logical-operational steps are illustrated in detail in the following paragraphs and summarized in Fig. 1.

The data proposed by the Promoter in the initiative (private) or in an interlocutory phase of the public evidence procedure, are re-determined by the PA (step 1) and compared with each other (step 2) in order to select the most advantageous values for the PA, in the *ante* and *post* scenarios, as input data of the calculation system (according to the DCF) to determine the ECU ("reference value") as the difference of the *post/ante*-UV NPVs (step 3). The variation tables of the ECU, constructed as UMV and DR vary - starting from their reference values (step 4) - and extending the duration of *m* years (step 5), highlight its sensitivity to these critical variables and therefore the randomness degree of the results. This *what-if-analisys* can lead to confirm the "reference value" or to repeat the calculation (step 6), modifying the input data (step 1 and 2).

Given its repetitive nature, the procedure maintains its validity also by diversifying the characteristics of the scenarios. This makes it suitable to a wide range of interventions and to the various phases of the iniziative, starting from the pre-contractual one.

Step 1 – Determination and Verification of the Data. The PA verifies the urban planning data proposed by the Promoter for the *ante*-UV scenario, in compliance with the current GP, and assesses at its discretion the eligibility of: those proposed for the *post*-UV scenario, as an exception to the GP; duration of the operation (n) and time distribution of the expected flows, proposed by the Promoter (which is responsible for the organization of the overall transformation process) assuming them if they are consistent with the governance strategies of the territory. Instead, PA redetermines for each scenario, the other data of the proposal, i.e.: i) estimates the DCs, using parametric unit costs (UDCi) derived from landmark sector publications or from online applications (provided by organizations of proven reliability), possibly by applying corrective coefficients in relation to location and environmental context, time of estimation, consistency and coherence of the comparative work categories (quality level); ii) quantify the MV_P revenues using the average quotations (usually expressed in €/sqm) published by the OMI for the area concerned (or neighbouring /similar areas) and for each building type envisaged by the transformation (or assimilable) in the assumed state of maintenance. The new building values, if not specified in OMI, are assumed to be equal to the maximum value of the "normal" state of maintenance increased by 30%; iii) identifies the economic-financial parameters to quantify the DR, consulting official sources and online datasets/platforms commonly used at international level, also by reworkable excel files (Table 5).

Step 2 – Data Comparison. The comparison between the data calculated by the PA (^A) and those proposed by the Promoter (^P) is aimed at selecting the values that (tend to) maximize the ECG of the initiative as input of the DCF (Table 6). Indirect costs (IC) are determined at the same time and proportionally (in percentage terms) to the input parameters (MV_P, DC) according to the specific municipal regulation. The PA then determines the DR indirectly (WACC method) by the Formula 10 which, prudentially (in relation to the calculation of NPV and ECU), does not report the tax rate *t* deductible from the *Kd*.

$$\begin{aligned} DR &= (ke)/[(D/E) + 1] + (kd) * (D/E)/[(D/E) + 1] \\ &= (Rrf + \beta * MRP + \gamma)/[(D/E) + 1] + (Eurirs + Spread + Fee) * (D/E)/[(D/E) + 1] \end{aligned} \tag{10}$$

Table 5. Technical-financial parameters to quantify the DR and their sources/references.

Index	Font	Reference				
Rft	Central National Bank	Average yield on government bonds - by residual life span comparable to the analysis period of the transformation - in the year closest to the time of the estimate for a period sufficiently representative of their performance				
	es. for Italy: https://www.bancaditalia.it/compiti/operazioni-mef/rendistato-rendiob/					
β	Damodaran	Factor "Beta" of the "Real Estate (Development)" (Industry name)				
	http://people.stern.nyu.edu/adamodar/ link "Europe" of Current data set "Levered and Unlevered Betas by Industry" (Topic: "Discount Rate Estimation"), downloading Regional datasets (Excel)					
MRP	Damodaran	The most recent "Equity Risk Premium" value assigned to the country concerned				
	http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/ctryprem.html or http://people.stern.nyu.edu/adamodar/ click on "Current Data" – "Risk Premiums for Other Markets"					
D/E	Damodaran	"D/E Ratio" of the "Real Estate (Development)" (Industry name)				
	Download the Regional datasets from http://people.stern.nyu.edu/adamodar/ (see β)					
Eurirs	European Banking Federation	Average of the reference interbank rate recorded backwards from the time of the estimate and with a maturity (years) comparable to the analysis period.				
	https://www.ebf.eu (data are published in the main newspapers/magazines specialized in the financial sector (e.g. in Italy: ilsole24ore) or can be inferred from other sources/bank institutes etc.)					
Spread	Damodaran	Last percentage of "Adj. Default Spread" assigned to the country concerned				
	http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/ctryprem.html					
γ	Italian Tax Agency	DCSEOMI Methodology (see par. 2.4, Table 3)				
	https://www.agenziaentrate.gov.it/portale/web/guest/schede/fabbricatiterreni/omi/pubblicazioni/quaderni-osservatorio					
Factor	*Location*	*Dimensional Factors*	*Building Equipment*	*Property Size*	*Presence of Competitors*	*Total*
Level	L_1 (from 1 to 5)	L_2 (from 1 to 3)	L_3 (from 1 to 3)	L_4 (from 1 to 4)	L_5 (from 1 to 3)	$\Sigma(L)_i$

Table 6. Data comparison and DCF input parameter selection (^A-administration,^P-promoter)

Scenario	Unit Direct Cost (UD^A, UD^P)	Unit Market Value (UMV^A, UMV^P)	Cost of Equity (Ke^A, Ke^P)	Borrowing Cost (Kd^A, Kd^P)	Ratio Leverage (D/E^A, D/E^P)
Post UV	MIN	MAX	MIN	MIN	MAX
Ante UV	MAX	MIN	MAX	MAX	MIN

Step 3 - Implementation of Calculation Scheme. By entering the input data in the calculation scheme (DCF), the PA determines the Ft of each scenario as the algebraic sum of costs and revenues (MV-ΣCi)t for each year (t) of the analysis period (n) and discount them by the factor 1/(1 + DR)t based on their time allocation within that duration. The difference (NPV*post*-NPV*ante*) returns the ECG potential of the initiative and the ECU ($\geq$ 50%ECG) as "reference value" - obtained by applying the procedure - that already allows to assess the adequacy of the ECU offered by the Promoter. This "reference value" will then be confirmed or not as a result of the following two steps.

The procedure also aims to limit the number and discretion of the choices necessary for its application but it is clear that the DR and all the hypotheses, concerning the amount of Ft and the transformation timing, have a strong impact on the amount of NPV and ECU.

Indeed, the subsequent sensitivity analysis (*What-if-analisys*) concerns the impact and variation of critical inputs on the ECU and in particular the DR/UMV pair (step 4) and the duration *n* (step 5). This is intended to structure a framework of risk-price-duration variability to validate the reference value that, within this framework, can guarantee a fair distribution between public and private costs and benefits.

Step 4 - What if Analisys: ECUas DR and UMV Changes. The ECU variation is determined in relation to a range of DR and UMV variation (Table 7) by processing 4 double input matrices having the same structure (Table 8): the first two contain, for each scenario, the multiple NPVs corresponding to each DR/UMV pair which vary – starting from the reference values - within the ranges and according to the percentage unit of increase/decrease (Δ) indicated in Table 7.

Table 7. DR and UMV variation range (UMV-related ICs will also vary)

Factor	Min	Max	Range (max-min)	Range discretization	Δ%
DRi	DR (γ_{min}) **	DR (γ_{max}) **	δDR = + DR (γ = 0,45%) − DR (γ = 22,94%)	2x = (max − min)/ΔR	ΔR = ± 0,50%
UMVj	−20% UMV*	+20% UMV*	δMV = |40% UMV|	2y = (max − min)/ΔV	ΔV = ± 2,50%

Note. if DRP ≠ DRA *the %*ΔR *will be an appropriate (sub)multiple of* |DRP-DRA| *and will vary within a narrower common range:* δ'DR = DRA(γ-*min*)-DRP(γ-max*) if* DRA > DRP *(and vice versa) with* 2x' = δ'DR/ΔR

(*) equal to twice the commonly accepted alea estimative; (**) see Sect. 2.3.

Table 8. ECU values (or similarly ECG, NPVs) as DR-UMV changes

Scenario POST	$DR_{P\text{-}MIN}$	DR_P-pΔR%	**DR_P**	DR_P+pΔR%	$DR_{P\text{-}MAX}$	
0,80*UMV_P	ECU(min,min)	(…)	ECU(med,min)	(…)	ECU(max,min)	0,80*UMV_A
(1-uΔV)*UMV_P	(…)	(…)	(…)	(…)	(…)	(1-uΔV)*UMV_A
UMV_P	ECU(min,med)	(…)	**ECU(med,med)**	(…)	ECU(max,med)	**UMV_A**
(1+uΔV)*UMV_P	(…)	(…)	(…)	(…)	(…)	(1+uΔV)*UMV_A
1,20*UMV_P	ECU(min,max)	(…)	ECU(med,max)	(…)	ECU(max,max)	1,20*UMV_A
	$DR_{A\text{-}MIN}$	DR_A-aΔR%	**DR_A**	DR_A+aΔR%	$DR_{A\text{-}MAX}$	**Scenario ANTE**

Note. u *varies between 1 and y*; a *and* p *vary between: 1 and x, if* DR_P=DR_A, *1 and x′ if* $DR_P \neq DR_A$.

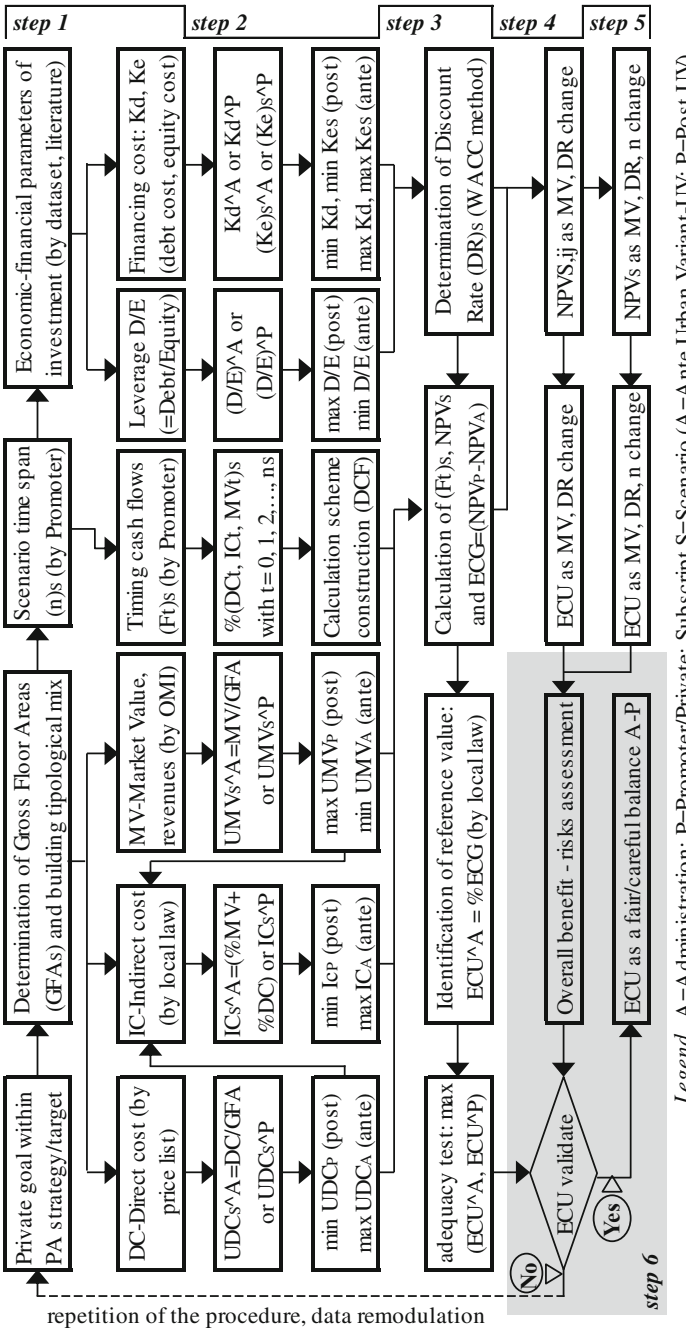
The 3rd matrix contains the multiple ECGijs obtained by subtracting from each NPV of the *post*-UV scenario the analogous NPV of the *ante*-UV scenario; the 4th matrix contains therefore the corresponding ECUijs, calculated in percentage on the ECG.

If the two scenarios present a different level of risk ($DR_P \neq DR_A$) and/or market ($UMV_P \neq UMV_A$), the difference between the multiple NPVPs contained in the two variation tables/matrices (NPV_P-NPV_A) will occur between the values corresponding to the pairs (DRi, UMVj) that have the same gap, namely $|UMV_P\text{-}UMV_A|$ e/o $|DRi_P\text{-}DRi_A|$.

Step 5 - What if Analisys: ECU as the Time (*n*) Changes. The elaborations of step 4 are replicated as *n* is increased, by moving (delaying) the start of the operation up to - at least - 3 years (m). A reasonable discretization of the ranges established for DR and UMV can facilitate the computational phase and a better clarity of presentation.

Step 6 - End or Reiteration. The procedure ends if the "reference value" of the ECU (step 3) is confirmed as a balance between risks and opportunities of Promoter and PA in the overall frame emerging from step 4–5; otherwise it needs to be repeated from step 1 (by varying the data).

The greater awareness of the PA about the possible options and the main aspects of the investment (e.g. timing) may correspond to a greater confidence of the investor which, in any case, may be based on a high level of sharing choices



Legend. A=Administration; P=Promoter/Private; Subscript S=Scenario (A=Ante Urban Variant-UV; P=Post UV)

Fig. 1. Outline of the proposed procedure for determining the ECU

3.2 Utilities of the Procedure

The procedure described allows a relatively simple use also for PA (with a possible predefined excel sheet) and a more detailed-accurate determination of the ECU than the simplified methods used by Italian municipalities, including the critical factors in the quantification of TV (and the ECU itself). It can be a potential analysis and evaluation tool which, besides the verification of the data proposed by the Promoter, offers the PA various utilities in the different phases of a partnership agreement (Table 9). In times of economic and financial instability or crisis, this procedure can introduce elements of flexibility that make it possible to extend the amounts due over time [12] and to include new updated information, monitoring the variables (to be pre-established) that have an impact on the profitability of the real estate investment (e.g. prices, time) and simulating alternative intervention scenarios to reduce uncertainty about its possible outcomes.

Table 9. Utility and support of the proposed procedure regarding the transformation process

Phase	Utilities and PA support
Preliminary (pre-contractual)	Aware choice of parameters (UMV etc.) and/or valid references to: i) activate the renegotiation of the agreement, also in relation to any pre-defined value thresholds (e.g. % lower revenues, longer authorization process); ii) renegotiate the contents of the agreement
Negotiation	To pursue the most advantageous balance by repeating the procedure as the inputs vary - GFA, UMV, typological mix (e.g. presence of social housing) etc. - and public "guarantees" regarding one or more components of real estate risk (and consequent financial benefits).
Contractual (implementation)	To monitor factors of economic-financial equilibrium and facilitate the contractual revision by objective/measurable variation of pre-established parameters (price level, difficulty in accessing credit, etc.) within a framework of less legal/factual uncertainty
Closure	To find the contractual terms/conditions - parameterised in advance, from pre-established sources - also to establishing the postponement and/or the amount of any final rate of the ECU
Check (final)	To verify the compliance of the completed intervention with the agreed conditions (e.g. price/revenue of goods produced/sold, price/construction cost, also with the aid of BIM technology

4 Conclusions and Perspectives

The law that introduced the ECU in Italy is in line with the advanced international legislation on the subject, but it has been ignored and weakened (2019): in practice, a 'fair' distribution between public and private of the surplus values emerging from

urban transformations is far from being achieved; the current distribution rewards the private, land income or real estate finance to the detriment of public investment in the city [6].

The paper illustrates an experimental procedure conformed on the Italian case to quantify the ECU owed by the private actor to the PA, on the basis of the respective economic and financial advantages, and can be extended, also in international contexts, where applicable: contractors' contributions for urbanization and territorial infrastructure; urban requalification of lands or buildings (with or without change of use) or valorisation of agricultural areas; programmes/projects (also in PPP) that presuppose an *ante/post* transformative events of the *status quo*.

Compared to the methods used in practice and in the literature, the procedure: (i) duly considers time and risk factors of the initiative, allowing the DR of the investment to be easily estimated; (ii) 'measures' the level of uncertainty inherent in the final result through sensitivity analysis versus *MV, DR, n* as performance indicators - or their combinations - that can be easily interpreted by the parties involved. This also in order to strengthen: the awareness of operators and PA about the most critical project drivers; fairness and transparency of public action towards investors and the community.

The socio-economic context becomes increasingly uncertain and complex, making investments more difficult and risky; therefore the use of the proposed procedure may support a different culture of "governing by contract" [31] that goes beyond the traditional antinomy of the parties and is based on the transparency of public-private relations, on effective and loyal cooperation, and on the awareness of the real mutual convenience for the success of the agreement established.

The potential of the proposed procedure can be further tested with regard to: i) more types of interventions, related to buildings or areas (including services); ii) different phases of the transformation process, ex *ante*/ex *post*; iii) various combinations of subjects (promoter/builder/owner/PA); iv) quick check of more complex analyses. It could be usefull to use: methodologies that also take into account the correlations between the critical factors (e.g. Montecarlo); parameters that make the sensitive aspects of the procedure objectifiable (e.g. random real estate market coefficient) [24] or that allow the inclusion of the inflation and/or revaluation/evaluation parameter of real estate values; further and better sources or reliable datasets to easily quantify the economic and financial parameters, including the ICs of the intervention.

References

1. ANCE, Il contributo straordinario per maggior valore nelle regole di regioni e comuni. http://www.anceaies.it/wp-content/uploads/2016/03/Dossier-Ance-sulcontributo-straordinario-per-maggior-valore-Allegato-contributostraordinario__marzo2016.pdf. Accessed 05 Apr 2020
2. Boyce, B.N.: Real Estate Appraisal Terminology. Bullinger Publishing Company, Cambridge (1975)
3. Cacciamani, C. (ed.): Real Estate, 3rd edn. Egea, Milan (2012)

4. Calabrò, F., Della, S.L.: The public-private partnerships in buildings regeneration: a model appraisal of the benefits and for land value capture. Adv. Mater. Res. **931–932**, 555–559 (2014)
5. Camagni, R.: Il finanziamento della città pubblica. In: Baioni, M. (ed.) La costruzione della città pubblica. Alinea, Firenze (2008)
6. Camagni, R.: Verso una riforma della governance territoriale: area vasta e controllo della rendita fondiaria e immobiliare (2011). https://storicamente.org/quadterr2/camagni.htm. Accessed 05 May 2020
7. Camagni, R.: Risorse per la qualità urbana. In: Cecchini, D., Castelli, G. (eds.) Scenari, risorse, metodi e realizzazioni per città sostenibili, pp. 39–52, Gangemi, Roma (2012)
8. Camagni, R.: La riforma della fiscalità urbanistica. In: Petretto, A., Lattarulo, P. (ed.) Contributi sulla riforma dell'imposizione locale in Italia, Carocci, Roma (2016)
9. Camagni, R.: Il mistero del "contributo straordinario (2019). https://www.arcipelagomilano.org/archives/51773. Accessed 05 Apr 2020
10. Caravella, G., Lisi, G., Pizzirani, F.: Costruzione di un modello di valutazione del rischio immobiliare: fondamenti teorici e prime evidenze empiriche, Quaderni dell'Osservatorio, Direzione Centrale Osservatorio del Mercato Immobiliare e Servizi Estimativi (DCSEOMI) - Agenzia delle Entrate (2019)
11. Copiello, S.: Progetti urbani in partenariato. Studi di fattibilità e piano economico finanziario. Alinea, Firenze (2011)
12. Crupi, F.: Rigenerazione urbana e città pubblica. Il Contributo Straordinario di Urbanizzazione nelle leggi regionali. In: XVI edn Urbanpromo, "Città Contemporanea Gigante dai Piedi d'Argilla, Torino (2019)
13. Crupi, F.: Fiscalità urbana e governo del territorio. Tra integrazione delle riforme e complementarietà degli strumenti. In: Talia, M. (a cura di) Il bisogno di giustizia nella città che cambia. Planum Publisher, Roma-Milano (2018)
14. Curti, F.: Le condizioni di sostenibilità del welfare urbano. In: Curti, F. (ed.) Lo scambio leale, Officina edizioni, Roma (2006)
15. Direzione Centrale Osservatorio del Mercato Immobiliare e Servizi Estimativi - Agenzia del Territorio, Manuale Operativo delle Stime Immobiliari, FrancoAngeli, Milano (2011)
16. Del Giudice, V.: Estimo e valutazione economica dei progetti. Loffredo, Napoli (2015)
17. Dotzour, M.G., Grissom, T.V., Liu, C.H., Pearson, T.: Highest and best use: the evolving paradigm. J. Real Estate Res. **5**(1), 17–32 (1990)
18. European Commission, Green Paper on public-private partnerships and Community law on public contracts and concessions, COM 327 (2004)
19. Florio, M.: La valutazione degli investimenti pubblici. I progetti di sviluppo nell'Unione Europea e nell'esperienza internazionale, vol. 1, 2nd edn., Franco Angeli, Milano (2003)
20. Hoesli, M., Morri, G.: Investimento immobiliare. Hoepli, Milano (2010)
21. International Valuation Standards Council – IVSC, International Valuation Standards, London (2013)
22. Lanzavecchia, A.: L'analisi finanziaria degli investimenti immobiliari. In: Cacciamani, C. (ed.) Real Estate. 3rd edn., pp. 331–352, Egea, Milan (2012)
23. Manganelli, B.: A proposal for a synopsis in real estate appraisal between the Italian doctrine and international valuation standards. Valori e valutazioni **18**, 9–16 (2017)
24. Manganelli, B., Morano, P., Tajani, F.: Risk assessment in estimating the capitalization rate. WSEAS Trans. Bus. Econ. **11**, 199–208 (2014)
25. Micelli, E.: Partenariato e Urbanistica. Il cofinanziamento dei servizi e infrastrutture per mezzo degli strumenti di piano. In: Codecasa, G. (a cura di) Governare il Partenariato pubblico e privato nei progetti urbani, Politecnica Maggioli, città (2010)

26. Modigliani, D., Camagni, R., Dongarrà, A., Fonti, R., Messina, G., Tamburini, M.: Definizioni e determinanti della rendita urbana: metodologia di calcolo e sue applicazioni alla Città Metropolitana di Roma. INU Edizioni, Roma (2016)
27. Rubeo, F.: Partenariato pubblico-privato per lo sviluppo urbano, 3rd edn. Politecnica Maggioli, Santarcangelo di Romagna (RN) (2012)
28. Sharpe, W.F.: Capital asset prices: a theory of market equilibrium under conditions of risk. J. Financ. **19**, 425–442 (1964)
29. Tajani, F., Morano, P., Di Liddo, F., Locurcio, M.: An innovative interpretation of the DCFA evaluation criteria in the public-private partnership for the enhancement of the public property assets. Smart Innov. Syst. Technol. **100**, 305–313 (2019)
30. Togni, R.M., Ferrante, G.: Clausole di benefit sharing: equità ed efficienza nell'affidamento dei contratti di PPP. In: Ricchi, M., Cartei, G.F. (ed.) Finanza di progetto e partenariato pubblico-privato 2015. Editoriale scientifica, Napoli (2015)
31. Valaguzza, S.: Collaborare nell'interesse pubblico. Editoriale Scientifica, Napoli (2019)
32. Vecchi, V.: Le analisi economico-finanziarie per la valutazione e gestione di progetti di PPP. In: Ricchi, M., Cartei, G.F. (a cura di) Finanza di progetto e partenariato pubblico-privato 2015. Editoriale scientifica, Napoli (2015)