Financial MODELS for the Effectiveness of Urban Regeneration Initiatives

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Abstract: - With reference to the urban regeneration interventions issue, in the present research an innovative model for the ex-ante financial verification of the projects is proposed. The model starts from the logic underlying the Break-Even Analysis (BEA) and modifies some of its starting hypotheses that in specific situations are inconsistent with the real market mechanisms. In this sense, in the paper, the explanation of the proposed innovative model hypotheses is carried out and the comparison with those ordinarily used in the BEA is developed. In particular, the linearity of total revenues and total costs, including in the classic version of the BEA, is not considered among the assumptions of the innovative model, and new parameters are defined. The proposed model can represent an evaluation tool to support the decision-making processes for the private and public operators' investment choices, able to rapidly analyze the financial feasibility of the initiatives to be implemented on the territory. The outputs obtained from the application of the assessment model can guide the determination and the selection of the interventions to be developed and, integrated with more detailed evaluation analysis, can promote a successful cooperation between the public entities and the private investors for effective city development.

Key-Words: - financial sustainability, urban regeneration, urban development policies, BEA, break-even analysis, private investor, Public Administration.

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1 Introduction

Urban regeneration mainly concerns three areas of the cities, different in terms of building tissue, age, and function: the historic centers, the abandoned areas, and the suburbs. For the old town centers the significant value of the historical heritage connected to the importance of enhancing the local identity determines the need to redevelop the existing property asset, [1], [2]. For the disused public spaces, mostly resulting from the processes of relocation of industries which, with their surface extension, have been transformed into "urban voids", the urgency of functionally converting these areas through the introduction of new and consistent with the needs of the communities uses is increasingly crucial, [3], [4], [5]. Finally, for the peripheral areas, the development of interventions aimed at bridging the existing fractures in socio-economic terms is the focus of the urban development policies, [6].

In this framework, the definition of initiatives for the enhancement of the existing heritage (historic centers), for the functional reconversion (abandoned areas), and the redevelopment of the city portions characterized by degraded buildings and public spaces and with high unemployment levels, is needed. The property assets and urban areas recovery and redevelopment programs aim primarily at guaranteeing quality and safety of living both from the social and environmental points of view, [7].

The purpose of the wide debate carried out by political decision-makers, city designers, architects, planners, and professionals from various disciplinary sectors on the interventions to be implemented on the territory concerns the increase, with the participation of private investments, of the

infrastructural facilities in the degraded urban areas with the highest housing and occupational deprivation. The targeted measures to increase employment, promote social integration, and the adaptation of the housing supply are connected with the strong need for effective transformation initiatives, in line with the sustainable development goals, [8].

In the Italian context, during the recent decades, numerous government programs have been promoted. These have been adopted with specific laws and regulations establishing the subsidies granted to local entities for the urban regeneration interventions implementation. Among the first to be developed, the urban redevelopment programs (P.Ri.U.) - established by art. 2 of Law No. 179/1992, subsequently integrated and regulated by the Ministerial Decree of 21 December 1994 and by the subsequent provisions referred to in the Decrees of 04 February 1995 and 21 June 1995 - have been urban planning tools intended to promote, coordinate and integrate initiatives and public-private resources, to improve the urban quality and the services and infrastructures supply in the neighborhoods where they are absent or scarce, [9]. Furthermore, the Integrated Intervention Programs (PRINT) - are introduced and defined in art. 16 of Law No. 179/1992 – have contemplated not only the recovery of urban areas in an overall decay state but also the building and environmental redevelopment, by focusing on collateral aspects (social, housing, environmental, etc.) until such time neglected. Listed among the urban planning implementation plans of the General Regulatory Plan, the PRINT has referred to areas - "wholly or partly built or to be used also for new construction" - which require a coordinated action of interventions and resources.

The Ministerial Decree of 08 October 1998– subsequently modified and integrated by the Decree of 28 May 1999 – has introduced the Urban Requalification and Territorial Sustainable Development Plans (PRUSST), which are a specific form of the PRINT, at a larger scale. They are multifunctional and negotiated urban planning tools, capable of integrating i) different types of intervention, by pursuing the urban, environmental, and social redevelopment and ii) the public and private subjects' financial resources, for the construction, adaptation, and completion of infrastructures, [10], [11].

Established with Law No. 662/1996 (art. 2 paragraph 63 letter b), launched in 1998 with a first program and then confirmed with a second program in 2002, the District Contracts represent the most significant strategy carried out by the Ministry of Public Works for urban recovery. With reference to the public housing settlements, the goal of the program is to start transformation processes of the areas neglected by the urban refurbishment projects due to the lack of interest of real estate operators, by combining the building and urban interventions and targeted measures aimed at the increase in employment and the reduction of social unrest, [12].

In the last years, the Italian intervention program for urban redevelopment and the safety of the metropolitan cities and provincial capitals suburbs (introduced by the Stability Law for 2016 - art. 1, paragraphs 974-978, of Law No. 208/2015) has been aimed at carrying out urgent interventions for the regeneration of degraded urban areas through the promotion of projects to improve the quality of urban decor, to maintain, to reuse and to re-functionalize the public areas and the existing building stock. To i) increase the territorial security and the urban resilience capacity, ii) strengthen the urban services also with reference to sustainable mobility, iii) develop actions for social inclusion and the creation of new models of metropolitan welfare, the program also has intended to adapt the infrastructures for social and cultural, educational and didactic services, as well as cultural and educational activities promoted by public and private subjects.

With reference to small municipalities, the Law of 6 October 2017, No. 158 named "Measures for supporting and enhancing the small municipalities, as well as provisions for the redevelopment and recovery of the historic centers" has focused on the promotion of the sustainable economic, social, environmental and cultural development of these municipalities, by favoring the protection and the valorization of their natural, rural, historical-cultural and architectural heritage and the adoption of measures for the residents and the productive activities located in the small municipalities, with particular reference to the essential services system, to avoid their depopulation and to stimulate the tourist influx.

The attention paid to the existing building stock has been confirmed by the allocation of resources amounting to around 8.1 billion euros, for the buildings and the territory safety, for the period 2021-2033, assigned by the Regions and by the Ministry of the Interior to the municipalities (starting from those with a population not exceeding 5,000 inhabitants), established by the 2019 Budget Law (art. 1, paragraphs 134-148, of Law No. 145/2018). Furthermore, the Italian Law Decree No. 124/2019 has subsequently extended the use of the resources given to the municipalities by the Regions

(equal to 3.2 billion euros) also to the transport and road system sector, to reduce environmental pollution and promote investments for the urban regeneration, the energy conversion towards renewable sources, the social infrastructures development and the environmental remediation. In addition, urban regeneration has played a central role in the 2020 Budget Law (art. 1, paragraphs 42-43, of Law No. 160/2019) through the allocation of a total of 8.5 billion euros, for the period 2021-2034, to the municipalities with a population over 15,000 inhabitants, which are not provincial capitals, and to the provincial capitals or metropolitan city headquarters, for the investments focused on the reduction of the marginalization and social degradation phenomena, as well as the improvement of the urban, social and environmental tissue quality, up to a maximum of 150 million euros for the year 2021, 250 million euros for the year 2022, 550 million euros for each of the years 2023 and 2024 and 700 million euro for each of the years from 2025 to 2034. Within the same Law (art. 1, paragraphs 437-444, of Law No. 160/2019), the National Innovative Program for the Quality of Living (PINQuA) has been defined among the investment lines financed with the National Recovery and Resilience Plan, to reduce housing deprivation, with particular reference to the suburbs, in line with the sustainable goals, following the urban model of the smart, inclusive and sustainable cities, [13]. Finally, the 2022 Budget Law (art. 1, paragraphs 534-542, of Law No. 234/2021) has assigned to the municipalities with a population of fewer than 15,000 inhabitants which, in associated form, exceed 15,000 inhabitants, subsidies for investments up to a maximum of 300 million euros for the year 2022, in order to encourage the urban regeneration projects aimed at reducing the marginalization and social degradation phenomena.

The main urban planning operational tools in the Italian context that are focused on the regeneration and sustainable development of the territory require the integration between actions for the built environment redevelopment, the environmental quality improvement, the employment promotion and the social exclusion contrast. In this sense, the active role of the cities is essential, by determining the increasing need to involve public and private subjects in the planning and implementation of urban transformation programs, [14].

The urge for renewal processes, extended to the historic centers and the suburbs and referring to all the elements that are included in the urban tissue (public and private spaces) is strongly linked to the need of activating public-private partnership mechanisms in the recovery initiatives, [15], [16]. In fact, the use of adequate tools for assessing the intervention feasibility for the parties (public and private) involved is fundamental to implementing effective urban projects. From the point of view of the private investor, the convenience of participating in the procedure is strictly associated with the initial capacity to generate positive cash flows in the shortest possible time, [17].

The definition of valid models for the ex-ante assessment of the investments feasibility through the public-private partnership constitutes a key step in order to i) carry out a planning of the projects to be implemented consistent with the available monetary resources and funding and the outlined needs framework, ii) develop successful urban regeneration programs, avoiding bankruptcy operations or interruptions of work in progress and iii) monitor the initiatives profitability.

Borrowing the operative logic of the Break-Even Analysis (BEA), in the present paper a non-linear evaluation model is developed. It can be implemented in the first design stages to "quickly" verify the financial feasibility of urban regeneration projects, by overcoming the unrealistic - in specific conditions - hypotheses of unit selling price and unit variable cost stability (basic assumptions of the classical version of the BEA). In this sense, the proposed evaluation model represents an innovative tool to be used in the decision-making processes: in fact, it allows to include the reduction of the unit variable cost and the unit selling price in correspondence with the built gross floor area increase, due to discount mechanisms that occur in the real market. Therefore, the model tries to fill the gap in the reference literature related to the assessment methods based on the BEA, by proposing a model that considers the real trends of the economic parameters (costs and revenues).

2 Aim

The research is part of the outlined framework. With reference to the logical approach of the BEA, a model for the financial assessment of the interventions is proposed. The model modifies some starting hypotheses of the classic version of the BEA to include, in the evaluation assumptions, some more consistent with the real market mechanisms. The study intends to explain the proposed innovative model hypotheses, to compare them with those ordinarily used in the BEA. In situations in which the market supply is strictly close to the local market demand (for example in small urban centers where the number of existing

properties is substantially equal to that of the requested properties), or ii) in the cases of new planning concerning a relevant number of buildings and/or the possibility of re-functionalizing existing large building complexes, the simplifying assumptions of the linearity of total revenues and total costs, including in the classic version of the BEA, are inconsistent with the real market phenomena. In these cases, the implementation of the BEA could lead to wrong results and/or inconsistency with the real trends of the economic parameters (revenues and costs).

The aim of the research concerns the explanation of the developed model to highlight its potential, for inclusion among the support evaluation models of the private and public operator's investment choices.

The methodology could constitute a useful tool i) for private investors to rapidly verify the financial feasibility of the initiatives to be implemented and ii) for public entities to gain awareness of decision-making processes that provide the involvement of private subjects.

The paper is articulated according to the following sections: in the next section, the main hypotheses of the classic version of the BEA and those assumed for the model developed in the present research are highlighted. Then, the theoretical model aspects are illustrated and the main steps that constitute the logical procedure to be implemented are described. In the final section, the conclusions are introduced, and further insights of the research are listed.

3 The comparison between the BEA Classical Version and the Innovative Model Assumptions

The proposed model borrows the logical approach of the BEA, [18], [19], [20]. The identification of the number of goods/surfaces to be sold to break even the initiative (to achieve the balance sheet) and the determination of the time required to recover the initially invested capital are two crucial factors within the economic-financial evaluation of an investment project. In general terms, the BEA and consequently the developed model, aim to guide the investment decisions towards the maximization of the results through the efficiency and effectiveness of policy implementation. With reference to the construction sector, the break-even point identifies the surfaces (the gross floor area GFA) to be built and sold that allow obtaining the condition of equality between costs and revenues (condition of minimum financial feasibility for the investor), [21].

As widely analyzed by the microeconomic literature, the total revenues (Rt) are the result of the algebraic multiplication of the sold GFA quantity (q) by the unit selling price (p_u), whereas the total variable costs (Cvt) are equal to the algebraic multiplication of the built GFA quantities (q) for unit variable costs (Cv_u). The Eq.(1) and Eq.(2) show the mentioned mathematical relationships.

$$Rt = q * p_u \quad (1)$$

$$Cvt = q * Cv_u \quad (2)$$

It should be pointed out that the total costs (Ct) of investment are equal to the sum of the Cvt and the fixed costs, i.e. the expenditure items that are not correlated (are independent of) to the build GFA quantity, but are constant in correspondence of each surface.

The GFA amount in correspondence with the break-even point is obtained through Eq.(3):

$$Rt_{BE} = Cf_{BE} + Cv_{BE} \quad (3)$$

in which:

Rt_{BE} = revenues corresponding to breakeven

Cf_{BE} = fixed costs

Cv_{BE} = variable costs which correspond to the breakeven.

By taking into account Eqs. (1) and (2) and by replacing them in Eq.(3), the break-even algebraic relation can be defined by the following Eq.(4):

$$p_u * q_{BE} = Cf + (Cv_u * q_{BE}) \quad (4)$$

and making explicit the equation for q_{BE}:

$$q_{BE} = Cf / (p_u - Cv_u) \quad (5)$$

The GFA to be built and sold capable of balancing the sheet of the initiative (q_{BE}) is a variable depending on the ratio between the fixed costs and the unitary contribution margin obtained from the algebraic difference between the unit selling price and the unit variable cost. Consequently, if the built and sold GFA is larger than the break-even surface ($q > q_{BE}$), the initiative will generate a profit; whereas, on the contrary, if the sold GFA is lower than the GFA amount in correspondence with the break-even point ($q < q_{BE}$) financial losses are expected. It is evident that the break-even GFA depends on many factors: i) on the fixed costs (the higher (or lower) fixed costs correspond to the greater (or smaller) GFA

quantities to reach the break-even point, *ceteris paribus*. By reducing the fixed costs, a smaller GFA quantity to achieve the break-even point will occur); ii) on the unitary selling price (all other variables being equal, if the selling price increases, the GFA quantities that ensure the break-even decrease, since the variable p_u is the slope of the revenue curve and obtaining a greater line slope as the price increases); iii) on the unit variable cost (with the same selling price and fixed costs, the GFA that corresponds to the break-even decreases proportionally to the reduction of the unit variable cost: since this (Cv_u) is the variable cost line slope, the lower the Cv amount, the lower the slope of the variable cost line). In general terms, the classical version of the BEA and the model developed in this research constitute tools to support the decision-making processes for the instantaneous assessment of the initiative's financial feasibility, by analyzing the relationships between the costs, the GFA quantities, and the revenues. Both analyses do not consider the time variable among the factors to be evaluated, by implementing an *a-temporal* assessment, in which all costs and revenues are assumed to be attributed to the same time, i.e. the evaluation time (assumption 2) in Table 1). This hypothesis determines the exclusion of the discounting operations of the economic parameters (costs and revenues) which are, instead, fundamental for the dynamic analyzes (Cost-Revenue Analysis CRA and Cost-Benefit Analysis CBA). Although it represents a simplifying hypothesis, it is consistent with the BEA's goal, i.e. to provide the order of magnitude of the variables analyzed over a short time horizon, for the rapid verification of the financial feasibility of the initiative.

The assumption implies the simultaneous implementation of the intervention and the absorption of the related GFA quantities by the real estate market, i.e. at the reference evaluation time, [22]. With reference to this simplification, it should be highlighted that, although the building operations concern a period of time constituted by different years, the instantaneous analysis allows not to assume the temporal distribution of costs, the forecast of sales correlated to the greater or lowest market dynamism, the choice of the discount rate. Therefore, the BEA techniques and the proposed model constitute tools capable of providing initial indications about the financial feasibility of the initiative, to be explored with a greater quantity of information and more precise data through techniques that expressly require the amounts (costs and revenues) timing. Among the common hypotheses between the classical version of the BEA and the developed approach, i) the one according to which the overall urban transformation intervention costs can always be organized into fixed components and variable components (assumption 1) in Table 1) of the and ii) that for which all the data that contribute to defining the reference framework of the evaluation are known with certainty and will not change, should be pointed out (assumption 3) in Table 1).

The two hypotheses of the classical version of the BEA (assumptions 4) and 5) in Table 1), which are modified in the innovative model according to the real market trends, are reported below.

Assumption 4) concerns the linearity of the total costs, which are determined by the sum of the Cf (constant regardless of the built and sold GFA quantity) and of the Cv (equal to the multiplication of the Cv_u for the built and sold GFA quantity). In this sense, the Cv depends on the built quantity, as the unit variable cost (Cv_u) is constant, and, therefore, can be graphically represented by a straight line. The graph in Figure 1 shows the three cost linear curves (Cf, Cv, and Ct).

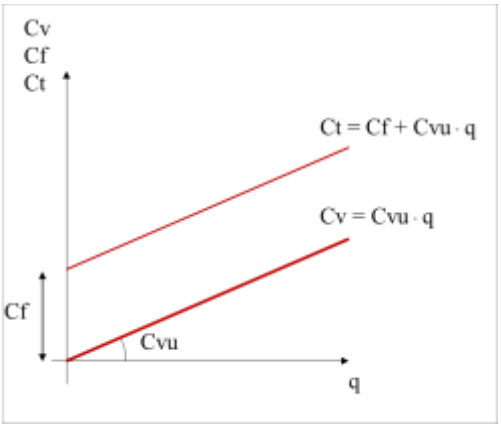

Fig. 1: The assumption of the classical version of the BEA: the cost linear curves (Cv and Ct)

Assumption 5) regards the linearity of total revenues, deriving from the invariance of the unit selling price. In this hypothesis, Rt depends exclusively on the produced and sold GFA quantity, since the unit selling price of each quantity is constant. The graph in Figure 2 shows the Rt straight line with the inclination on the x- axis equal to p_u.

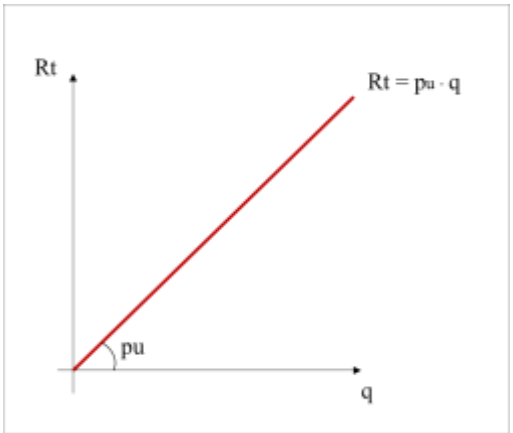

Fig. 2: The assumption of the classical version of the BEA: the Rt straight line

With reference to the evaluation model defined in this study, assumptions 4) and 5) are not introduced as they are inconsistent with the real empirical phenomena in situations in which the market supply exceeds the demand (i.e. in small urban centers, which the number of properties required by the local market is approximately equal to that offered for sale, or in the case of new planning of large building interventions or the re-functionalization of abandoned existing complexes. In the mentioned cases, both the variable unit cost and the unit selling price are not constant for each built GFA: discount mechanisms can be introduced. These mechanisms are associated with i) the reduction of the unit variable cost in correspondence with an increase of the built surface and, at the same time, ii) the decrease in the unit selling price (which represents the unit revenue) by increasing the GFA.

In the outlined contexts, discount policies are included, by determining lower p_u in correspondence with increasingly higher sold GFA quantities. By considering the construction cost and the expected profit margin, using the mark-up method, the sum of the average production cost and an additional value (mark-up) allows the determination of the minimum p_u amount to be applied on the reference market.

The greater the sold GFA quantity, the higher the alignment of the unit selling price with this threshold. Consequently, a greater p_u occurs in correspondence with smaller GFA quantities for which the amount of total revenue "mostly" derives from the selling price. Conversely, for high-sold GFA, the seller is willing to reduce the p_u as the amount of total revenue is associated with the larger sold quantity.

The microeconomic theory describes this phenomenon as a second-type price discrimination, i.e. a business strategy carried out by the investors (firm, company, etc.) that can offer discounts on the unit selling prices if the consumers buy larger quantities. Thus, the discriminating factor is the purchased quantity, based on which the discounts and/or the unit selling price of the good/service are determined and the self-selection of buyers is carried out, [23]. The seller fails to select the buyers in the different market segments according to their characteristics and, therefore, is unable to determine the price to apply to each of them. The Buyers with a higher sensitivity to price changes will tend to purchase a greater quantity of the good to enjoy the discount on the unit price, whereas those that are less susceptible to price variations will continue to buy a few good units.

The same logic underlies the hypothesis of the proposed model related to the non-linear trend of the total costs. According to the economic theory of production, the variable costs, directly dependent on the production level, include the cost of production factors that vary with the output quantity, such as raw materials and working hours, whereas the fixed costs are independent of the built quantity.

It should be observed that the classical version of the BEA does not consider the scale economies' mechanisms which attest to the inverse relationship between the variable cost's reduction and the increase in the good quantity in a specific production interval. In particular, as the built good quantity increases, the unit cost will tend to decrease due to the saturation of the fixed production factor, as discount dynamics are established between the building initiative promoter and the supplier of raw materials. In economic terms, the existing functional relationship between the increase in the production scale of a specific good and the decrease of the unit variable cost is included in the scale economies notion. The inverse proportionality between the unit cost of production and the size of the finished goods takes into account the prices of the input production factors. Therefore, a reduction in the price of the inputs occurs when the purchased inputs quantity increases as the scale of production grows, [24]. With reference to the competitive construction market and the subjects involved in the GFA realization processes - building initiative developer and raw material suppliers - if the supplier "decides" to increase the unit price of the materials (input production factors) to be introduced in the building process, the real estate entrepreneur should incur higher production costs and, thus, would choose to buy the materials from another seller, rather than grow the final selling prices. Although it is immediate and reasonable to associate the trend of the production cost with the GFA selling price,

alternative mechanisms could be activated to not weigh on the final prices. The existing correlations between the prices of the production factors and the quantity of the purchased factors and between the quantity of built GFA and the unit variable cost are interconnected and the logic underlying these mechanisms concerns the discount dynamics that are established between the subjects involved in these operations (purchase of raw materials, realization of GFA and sale of GFA).

By taking into account these considerations, the total cost, i.e. the sum of the Cf and Cv, is not characterized by a linear trend, due to the non-linear trend of the Cv because the Cv_u is not constant but decreasing. In this sense, the correlation between the increase in the production amount and the decrease in the unit production cost, given by the ratio between the total cost and the produced quantity, takes into account any policies to reduce the average production costs associated with bulk purchases and/or negotiations dynamics with the raw material suppliers. This mechanism allows for to reduction of the unit production cost and to use of the obtained savings to increase profits or to compete on price.

In practical situations, it is unusual to detect a perfectly linear relationship between the cost amount and the production volumes, as a more dynamic behavior is opposed to this static representation of the cost curves. In theoretical terms, the pecuniary economies of scale are those from which the firm benefits when it manages to pay lower costs for the production of the input in correspondence with the increase of the production quantity, i.e. of the growth of the factors to be used in the production processes (raw materials, transport, distribution of outputs, etc.). On the other hand, the real economies of scale are associated with the reductions in the quantity of inputs to be used, as the output levels of a specific firm rise.

With reference to an urban transformation intervention, in Table 1 the hypotheses of the model aimed at verifying the financial feasibility of an investment are summarized and the main differences in the assumptions with respect to the microeconomics theory between the classical version of the BEA are highlighted.

Table 1. Comparison in terms of the assumptions with respect to the microeconomics theory between the classical version of the BEA and the developed model

Assumption	Classical version of BEA	Innovative model
1) The overall costs of the urban transformation intervention can always be organized into fixed components and variable components	✓	✓
2) The costs and the revenues of the transformation intervention occur at the same time - the analysis is static as it does not consider the "time" variable	✓	✓
3) All the data that contribute to defining the evaluation reference framework are known with certainty and will not change	✓	✓
4) The variable cost curve (Cv) and the total cost curve (Ct = Cf + Cv, with Cf equal to the fixed costs) are linear, as the unit variable cost (Cv_u) is constant and $Cv = Cv_u \cdot q$ (with q equal to the amount of built and sold GFA)	✓	✗
5) The total revenue curve (Rt) is linear and the unit selling price (p_u) is constant ($Rt = p_u \cdot q$)	✓	✗

4 Model

Starting from the mathematical relationship used in the classical version of the BEA which expresses the equality between Ct and Rt to identify the quantity of GFA to be built and sold to break even the initiative (to achieve the balance sheet), the economic parameters to be introduced in the innovative model are defined.

These parameters take into account the mentioned hypotheses and, in particular, allow the non-linearity of costs and revenues to be included in the analysis. The need to build the "real" trend of Rt and Ct is associated with the variability of the p_u and Cv_u connected to the discount policies and scale economies which could occur in cases in which the market supply is close to market demand. In these situations, the analysis of the volatility of the reference market to changes in the market conditions (supply and demand) should be carried

out to determine a variation rate (r) capable of summarizing the market dynamism. Furthermore, with reference to the existing market supply, it is necessary to introduce the limit quantity of GFA (ql), i.e. the area able to satisfy the current demand for new real estate units, beyond which a surplus of supply that can be absorbed by the local market at lower unit prices compared to the current unit market values for similar properties, is generated.

On the basis of these remarks, the p_u trend is built by using the function reported below - Eq.(6) -, which takes into account the unit market value of the new units to be built in consideration of the current supply conditions ($\overline{p_u}$), [25], and the differential between the GFA quantities generated by the investment and the limited ones given the conditions of saturation of the current market demand ($\Delta q = \frac{q-q_l}{q_l}$).

$$p_u = \frac{\overline{p_u}}{(1+r)^{\Delta q}} \tag{6}$$

The unit variable cost trend is built by including i) the expense item that is independent of the unit selling price (Cv'_u), i.e. the construction cost, the technical and general expenses, the urbanization costs, the financial charges, and ii) the cost item correlated to the selling price that represents the unit profit expected by the ordinary investor who carries out the intervention, set equal to a $a \cdot p_u$, with a defined as the expected ordinarily profit margin, in percentage terms, on the unit selling price. Thus, the unit variable cost is the sum of the two components as expressed in Eq.(7).

$$Cv_u = Cv'_u + a \cdot \frac{\overline{p_u}}{(1+r)^{\frac{q-q_l}{q_l}}} \tag{7}$$

By recalling the relationship Rt = Ct for identifying the break-even point with $Rt = p_u \cdot q$ and Ct = Cf + Cv and by replacing the economic parameters included in the mathematical expression, with the variables related to the variation rate (r), the margin of ordinarily profit (a), the unit market value of the new units to be realized ($\overline{p_u}$), the limit quantity of GFA (ql) and the unit variable cost related to the expense items independent from the unit selling price (Cv'_u) the Eq.(8) is obtained:

$$\frac{\overline{p_u}}{(1+r)^{\frac{q-q_l}{q_l}}} \cdot q = C_f + \left(Cv'_u + a \cdot \frac{\overline{p_u}}{(1+r)^{\frac{q-q_l}{q_l}}}\right) \cdot q \tag{8}$$

A protocol of phases to be implemented for the determination of the GFA to be built capable of ensuring the condition of minimum financial convenience for the investor is provided below. The quantification of the economic parameters included in the defined mathematical expression in relation to the specific characteristics of the investment, its typology, and size, the geographical context in which it is located, and the conditions of the reference market segment, should be carried out.

Starting from an analysis of the project solution whose financial feasibility has to be evaluated, phase 1 provides for the clarification of the hypothesis according to which the initiative is promoted by a private entrepreneur, after verifying the financial feasibility of the investment, using the proposed assessment model.

Phase 2 concerns the collection of urban planning, physical, regulatory, and market information for the area in which the investment is located. Phase 3 aims to define, with reference to the average market situations, the financial balance sheet of the operation for the private investor: this scenario constitutes the ordinary situation that could occur in that specific market and time, by considering the general validity of the conditions of the investors involved in these initiatives. In this sense, the scenario could vary with respect to the specificities of the subject involved, by taking into account not the ordinariness of the existing situations but the specific characteristics of the subject (i.e. the relationships with the suppliers, the agreements with banks, his specializations, the internal cooperation network, etc.).

The different level of specificity that characterizes the different scenarios that could be outlined is connected to the subject who carries out the evaluation: if the analysis is developed from the point of view of the public subject, the judgment expressed will be based on the theory of ordinariness and aims to support the Public Administration in the formulation of the request to the private subject (if the market conditions allow it) after the verification of the minimum financial convenience for the investor. The analysis, on the other hand, developed by the private part that promotes the initiative determines a "specifically valid" output, commensurate with the specificities of this subject.

In phase 3, the cost and revenue items are quantified, in the following phase 4, to reorganize the monetary positive (revenues) and negative (costs) amounts into fixed and variable components.

In particular, for the equation term related to the Rt (i.e. $\frac{\overline{p_u}}{(1+r)^{\frac{q-q_l}{q_l}}} \cdot q$), i) the unit selling prices ($\overline{p_u}$) are determined by consulting the databases of the Observatory on the Real Estate Market of the

Revenue Agency, validated and possibly adjusted through a direct survey carried out among the local market operators, ii) the quantity of limit GFA (ql), through an analysis of the reference market, to verify the maximum quantity of admissible floor area according to the prescriptions set by the existing urban planning tools and the ratio between the number of existing buildings (current supply) and the demographic trend (current and expected demand), iii) the variation rate (r) taking into account the average of the revaluation/devaluation rates of the half-yearly quotations published by the Observatory on the Real Estate Market of the Revenue Agency for the analyzed urban area and the intended use, [26].

With reference to the member of the equation relating to the Ct (i.e. $C_f + (Cv'_u + a \cdot \frac{\overline{p_u}}{(1+r)^{\frac{q-q_l}{q_l}}}) \cdot q$), i) the fixed costs of the intervention (Cf) are estimated, by analyzing the expense items characterized by a constant monetary amount, ii) the unit variable cost (Cv'_u) is assessed by considering the expenses related to the quantities of built and sold GFA, which vary proportionally to the floor area quantity changes, iii) the ordinary profit margin (a) expected by the entrepreneur, in percentage terms on the unit revenues, by assuming the average profit rate that, in the reference market, an investor ordinarily aims to obtain, based on the overall technical and financial risk incurred by the initiative.

Phase 5 provides for the determination of the GFA quantity to be built and sold to achieve the balance sheet of the operation for the private investor, to verify the condition of minimum financial feasibility, by assuming the aforementioned economic parameters.

Phase 6 concerns the sensitivity analysis aimed at identifying the "critical" variables of the model, i.e. those whose variations significantly influence the results of the financial plan.

Figure 3 shows a summary diagram of the phases in which the proposed methodology is articulated.

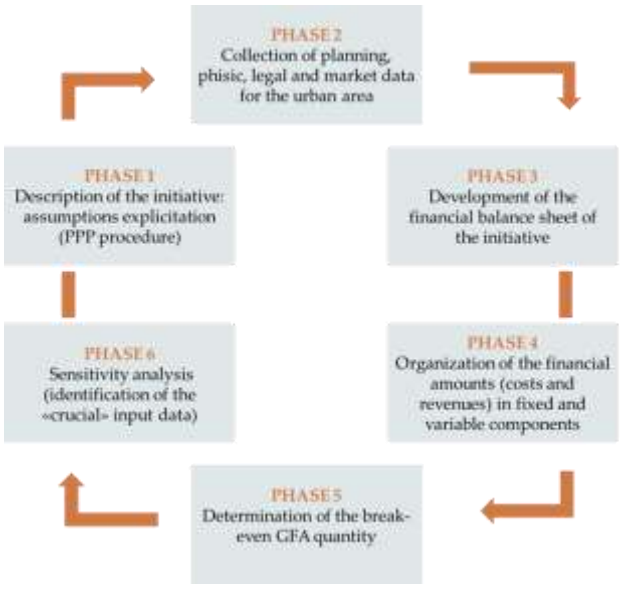

Fig. 3: Phases of the proposed model

5 Conclusion

The involvement of private investors in urban territory development initiatives is currently essential, due to the significant attention to sustainable redevelopment interventions and the scarce public spending capacity, [27]. The current framework of the contributions to local entities for the urban regeneration projects implementation as opposed to the limited managerial skills of public governments. In this sense, the private investors provide their business ability to define and start effective and complex territorial operations. The need to develop investments capable of generating relevant social, environmental, financial, and economic positive effects, is always increasing. This is strictly associated with the crucial role played by the ex-ante assessments for the verification of the feasibility of the intervention that allows to preliminarily determine the financial convenience to invest. The evaluation disciplines cover all the feasibility fields (technical, socio-economic, financial, administrative, environmental, etc.) and, in different terms, aim to support the decision-making processes for the start of successful interventions on the territory. With reference to the financial context, the BEA constitutes an evaluation tool to guide the decisions of private and public entities involved in urban transformation investment, mainly applied for the rapid verification of the financial feasibility of an intervention to be carried out. Starting from the operative logic of the BEA, the updated version of this methodology has been developed in the present research, by taking into account the real market mechanisms related to

discount policies and economies of scale. In this sense, the proposed methodological approach introduces the non-linear trends of the economic parameters (costs and revenues), by neglecting the linear ones included among the simplifying assumptions of the classical version of the BEA. The reduction of the unit variable cost and the unit selling prices in correspondence with the built GFA quantity allows us to effectively replicate the empirical market phenomena and to obtain more consistent results in terms of financial feasibility verification. The developed methodology could be used in the first phases of urban intervention planning to orient the choice processes according to real market dynamics.

The main novelty of the evaluation model developed in the present research compared to the classical version of the BEA concerns the introduction of the real trend of the economic parameters (revenues and costs). The proposed model allows us to overcome the "strict" starting hypothesis about costs and revenues that cannot actually occur, by taking into account conditions more consistent with the real market phenomena. In fact, by considering the reduction of the unit variable cost and the unit selling price in correspondence with the built GFA increase, the innovative model is able to provide more valid outputs in terms of the financial feasibility of the intervention compared to the classical version of the BEA. In line with the current need for models for the assessment of the project solutions to define a priority list of effective interventions to be implemented on the territory, the model constitutes a significant support tool for the decision-making processes related to territorial redevelopment policies.

Future developments of the research will concern the implementation of the methodology with reference to specific case studies to test the validity of the developed approach. In this sense, it can be applied to define the GFA quantity to be built and sold that ensures the condition of minimum financial feasibility for the investor in line with the trend of the unit selling prices and with that of unit variable costs detected in the reference local market. Therefore, the evaluation model proposed in this research may be included among the ex-ante evaluation techniques aimed at preliminarily assessing the feasibility of the investment to orient the definition of valid and effective territorial strategies.

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Conflict of Interest

The authors have no conflict of interest to declare.