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New Metropolitan Perspectives

Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages Perspectives

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Editors

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Preface

This volume contains the proceedings for the fifth International "NEW METROPOLITAN PERSPECTIVES. Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages' Perspectives", scheduled from May 25–27, 2022, in Reggio Calabria, Italy.

The symposium was promoted by LaborEst (Evaluation and Economic Appraisal Lab) of the PAU Department, Mediterranea University of Reggio Calabria, Italy, in partnership with a qualified international network of academic institution and scientific societies.

The fifth edition of "NEW METROPOLITAN PERSPECTIVES", like the previous ones, aimed to deepen those factors which contribute to increase cities and territories attractiveness, both with theoretical studies and tangible applications.

This fifth edition coincides with what is most likely the end of the COVID pandemic that began in 2020. The global health emergency, despite having been a phenomenon limited in time, has acted as an accelerator of some changes in behavior and in the organization of activities associated with the ever-increasing spread of ICT.

The phenomena are too recent and still ongoing to fully understand the implications they will have on settlement systems, but the conclusion reached at the previous edition of New Metropolitan Perspectives seems to be confirmed: from many of the works presented at the Symposium, a reduction in the relevance of the localization factor emerges with ever greater clarity, at least in the ways known so far from the times of the Industrial Revolution, bringing to light more and more a paradigm shift in the center-periphery dualism.

In fact, the phenomenon that in the past led to the birth of the modern city, the need to concentrate people and activities in small areas, seems to be decreasing: the progressive spread of smart working and the digital modality for the provision of services (just think, e.g., of the digital services of the Public Administration or online commerce) significantly reduces the gaps in terms of accessibility to goods and services between metropolitan cities and marginalized areas, such as inland areas.

But this edition of the symposium also coincides with the start of a new phase for European policies, guided toward the green and digital transition, for the period 2021-27, by the European Green Deal, especially through the tool of the Next Generation EU.

The links between new technologies and sustainability tend to focus on the role played and that can play the city at EU level in fighting climate change.

Many of the contributions collected in this volume address the issue of the green transition through multidisciplinary points of view, dealing with very different issues such as, for example: infrastructures and mobility systems, green buildings and energy communities, ecosystem services and the consumption of soil, providing interesting information on the main trends in progress.

The changes in individual behavior and social organization, associated with the digital transition, are illustrated by the contributions that have addressed the issue of rules and of social innovation practices that are prefiguring new forms of governance for the regeneration of settlement systems. In this context, the issues of the new declinations of the concept of citizenship were also addressed, also with reference to the need to create favorable contexts for individual initiative and entrepreneurship, especially for young people, as a possible response to the challenge of employability for the new generations.

In this context, territorial information systems take on a leading role, together with apps capable of making territories increasingly smart.

The substantial investments planned by the EU to support the green and digital transition in the coming years require multidimensional evaluation systems, capable of supporting decision makers in selecting the interventions most capable of pursuing the objectives. The financial resources used for the implementation of the policies are borrowed from future generations, to whom we will have the obligation to be accountable for our work.

Unfortunately, at the time of writing we must also register serious concerns for the future of humanity, stemming from the risks of the spread of the conflict between Russia and Ukraine. In addition to the obvious concerns about the suffering that wars always cause to civilian populations, this situation makes future scenarios even more uncertain: It is clear that the circulation of goods, people and ideas will be increasingly conditioned by future geopolitical balances.

The ethics of research, in the disciplinary sectors that the Symposium crosses, invites us to feed, with scientific rigor, policies and practices that make the territory more resilient and able to react effectively to catastrophic events such as the pandemic or the war: We hope to know the outcomes of these courses in the next editions of the New Metropolitan Perspectives symposium.

For this edition, meanwhile, the more than 300 articles received allowed us to develop 6 macro-topics, about “Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages’ Perspectives” as follows:

1. Inner and marginalized areas local development to re-balance territorial inequalities

2. Knowledge and innovation ecosystem for urban regeneration and resilience
3. Metropolitan cities and territorial dynamics. Rules, governance, economy, society
4. Green buildings, post-carbon city and ecosystem services
5. Infrastructures and spatial information systems
6. Cultural heritage: conservation, enhancement and management.

And a Special Section, Rhegion United Nations 2020-2030, chaired by our colleague Stefano Aragona.

We are pleased that the International Symposium NMP, thanks to its interdisciplinary character, stimulated growing interests and approvals from the scientific community, at the national and international levels.

We would like to take this opportunity to thank all who have contributed to the success of the fifth International Symposium "NEW METROPOLITAN PERSPECTIVES. Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages' Perspectives": authors, keynote speakers, session chairs, referees, the scientific committee and the scientific partners, participants, student volunteers and those ones that with different roles have contributed to the dissemination and the success of the Symposium; a special thank goes to the "Associazione ASTRI", particularly to Giuseppina Cassalia and Angela Viglianisi, together with Immacolata Lorè, for technical and organizational support activities: without them the Symposium couldn't have place; and, obviously, we would like to thank the academic representatives of the University of Reggio Calabria too: the Rector Prof. Marcello Zimbone, the responsible of internationalization Prof. Francesco Morabito, the chief of PAU Department Prof. Tommaso Manfredi.

Thank you very much for your support.

Last but not least, we would like to thank Springer for the support in the conference proceedings publication.

Francesco Calabrò
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Contents

Urban Regeneration and Real Estate Dynamics: A Non-linear Model of the Break-Even Analysis for the Assessment of the Investments

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Abstract. With reference to the redevelopment of brownfields areas, in the present research a non-linear model aimed at assessing the conveniences of regeneration initiatives of the parties involved has been proposed. The model is part of the assessment methods aimed at verifying the financial feasibility of an urban redevelopment intervention carried out through the public-private partnership procedure. By borrowing the operative logic of break-even analysis, the model omits the hypothesis related to the non-linearity revenues: in the specific cases in which the mentioned assumption is not valid, i.e. when the market supply significantly overcomes the market demand, the proposed model represents a useful tool to orient the renovation initiatives decisions towards effective and profitable choices.

Keywords: Break-even analysis · Brownfields · Urban regeneration interventions · Real estate dynamics · Decision-making processes

1 Introduction

Within the current urban contexts of the cities, the presence of brownfields sites constitutes a relevant issue for the definition of territorial development policies. The regeneration of degraded and abandoned areas, in fact, represents a strategy of sustainable land use and a driving force for urban revitalization in conjunction with the significant interest in environmental protection [1, 2]. According to the United States Environmental Protection Agency (EPA), the brownfield is defined as "a property, the expansion, redevelopment, or reuse of which may be complicated by the (potential) presence of a hazardous substance, pollutant, or contaminant" [3]. A research carried out by EPA in 2020, aimed at analysing environmental benefits that occur when brownfield sites are redeveloped, has found that (i) these are often "efficiently located" due to their central location and to the existing infrastructure links and (ii) their redevelopment and functional reconversion generate several benefits in economic, environmental and social terms. Haninger and Timmins have detected that cleaning-up brownfield properties leads to residential property value increases of 5–15.2% within 1.29 miles of the sites [4].

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The awareness of community organizations and local governments to identify, address and clean-up brownfield sites aims at a subsequent functional reconversion of the site for its safe use, in order to satisfy the needs of the community and to reduce the contaminating threats to public health and environment [5].

In general, unsafe levels of environmental contamination on a brownfield may result from former or current industrial, commercial, residential, agricultural or recreational uses and practices, causing the formation of contaminants in soil, water or air. Cleaning-up brownfield sites reduces or eliminates potential health risks to residents, workers, pets and the surrounding environment. The "size" or the typology of the rehabilitation depends on the specific contaminants found, on the extent of contamination and on the reuse modalities of the property, in order to carry out an effective brownfields land reclamation and to protect the community from potentially harmful exposures by removing or containing site contaminants.

The brownfield site redevelopment implies its transformation to satisfy the many different needs that exist within a community, by representing urban voids potentially useful for uses different from the original ones [6–9].

These polluted sites included in the urban contexts or in immediate suburbs have generally specific characteristics that allow valuable transformation and enhancement processes that are capable of producing - if they are properly managed - financial and economic benefits and new opportunities for sustainable development for the community [10].

In the context of the Next Generation EU (NGEU) [11], aimed at promoting a "sustainable, uniform, inclusive and equitable recovery" following the crisis caused by the Covid-19 pandemic, in Italy the National Recovery and Resilience Plan (NRRP) - definitively approved with the Council's Implementation Decision on 13 July 2021 – includes the issue related to the urban regeneration among the measures as a transversal and specific goal to be achieved. In particular, among the measures described in the six Missions of the plan, the measure M5C2.2 provides for 9.02 billion in loans for urban regeneration and social housing interventions [12].

Specifically, the resources are distributed with different shares in three investment lines relating to (i) investments in urban regeneration projects, aimed at reducing situations of marginalization and social degradation and improving the urban quality as well as the social and environmental context; (ii) integrated urban plans, dedicated to the suburbs of metropolitan cities which provide for participatory urban planning with the aim of transforming vulnerable territories into smart and sustainable cities, limiting the land consumption, (iii) innovative programs of the living quality that provide for the construction of new public housing structures and redevelopment of degraded areas [13].

In order to minimize marginalization and degradation situations, urban regeneration interventions intend to have significant impacts on the recovery of the most vulnerable urban tissues, i.e. peripheral and internal areas of the cities [14, 15].

In the current economic situation, the lack of funding is the most frequently cited barrier to brownfield redevelopment, i.e. a constraint compounded by uncertainty surrounding the possible cost of environmental assessments, remediation and subsequent recoverty project. The involvement of private investors represents an alternative and

effective form of financing and management of the interventions [16, 17], based on the cooperation between the Public Administrations and private subjects in which the public entities are able (i) to split the resources on other interventions for the community, (ii) to restore the image of the city portion currently abandoned by introducing new functions, (iii) to carry out the redevelopment project at no cost. On the other hand, the private investor does not burden the costs relating to the purchase of the buildable area.

Furthermore, in order to guarantee the financial sustainability of the initiative, private brownfields redevelopment projects often require relevant dimensions and, therefore, economic parameters (costs and revenues), associated with significant investment risks. In these situations, reliable assessment tools, able to appropriately analyse the convenience of the subjects involved in terms of the number of units, surfaces and volumes provided for by the initiative considered, are needed.

2 Aim

The aim of the present research concerns the development of an evaluation model to support Public Administration decision processes in planning brownfields recovery initiatives to carry out through public-private partnership mechanisms. By borrowing the operative logic of break-even analysis, the proposed model intends to solve one of the main limitations of the technique in specific situations: (i) in contexts characterized by a real estate supply that already tends to absorb local demand before the realization of the initiative, (ii) where a new planning aimed at an abundant construction of new buildings and/or the possibility of re-functionalising existing disused complexes - often numerous in Italian cities – is provided. In these contexts, in which the new surfaces to be placed in the reference market are significant and abundantly satisfy the current real estate demand, the hypothesis of linearity of the increasing revenue curve - that means the invariance of the unit selling price - does not reflect the reference market: therefore, it is necessary to recall the logarithmic function of the curve of total utilities, according to which the unit selling price decreases in correspondence of an increase of the amount of gross floor area (GFA).

In this sense, the hypothesis assumed for which the unit selling price is constant whatever the quantity produced does not represent a reasonably valid assumption, as discount policies are applied in the situation in which a significant quantity of good or service are built and sold. In a context in which the supply is characterized by a greater elasticity than the reference demand, the unit selling price is characterized by a progressive decrease. In empirical terms, in fact, the unit selling prices are inversely proportional to the realized GFA, due to the reduction in the marginal utility attributed by the potential buyer in contexts of overabundant supply.

The proposed model could allow Public Administrations to orient and verify the planning decisions for the identification, under different scenarios of prices and costs, of the GFA to be built and to be sold, able to break-even the financial balance of the initiative. Furthermore, the model could allow private investors to quickly verify the financial convenience of an investment to be implemented, by neglecting the hypothesis of linearity of revenues which in some cases (real estate demand close to the available supply, construction of new buildings that involve the realization of a significant

number of units, possibility of re-functionalization of existing disused complexes, etc.) constitutes a scarcely valid condition.

The paper is structured as follows. In Sect. 3 the proposed model in the research is illustrated and some considerations related to the model implementation are presented. In Sect. 4 the conclusions of the work are discussed.

3 Model

Within the financial analysis aimed at verifying the convenience of the transformation initiatives, the break-even analysis represents a technique that rapidly allow to define the GFA to be built and sold, i.e. able to determine the quantity of GFA for which the total costs and the total revenues are equal [18]. By considering in the total costs the ordinary ("normal") profit expected by the private investor, this quantity of GFA defines the condition of minimum convenience of the initiative (the "break-even" quantity): therefore, in the situations for which the total revenues are higher than the total costs, the initiative will generate an "extra-profit" (EP), that is a further compensation for the private investor or a possible maximum burden that the Public Administration could require to the private entrepreneur. As the break-even quantity of GFA indicates the minimum financial threshold for the private investor, the convenience to activate the initiative is not verified for lower quantities. In general, the implementation of the BEA in the context of the public-private partnership initiatives allows to quickly verify the financial convenience for the subjects involved through (i) the assessment of the fixed transformation costs of the initiative; (ii) the determination of the unitary variable production costs; (iii) the estimation of the unit selling prices. Starting from the mathematical relationship for which the extra-profit is equal to the algebraic difference between the total revenues and the total costs - that are constituted by the sum of the *fixed* costs (C_f), i.e. cost items defined without considering the amount of the products to be realized (e.g. acquisition of land, its environmental remediation and restoration, the urbanization and the infrastructure for mobility, the recovery of existing buildings, the establishment of spaces and equipment of collective interest), and the *variable* costs (C_v), i.e. cost items defined considering the amount of the products to be realized and sold within the initiative (e.g. energy costs, cost of raw materials directly used in the production, costs for the distribution and sale of the products, workers' salaries based on flexible contracts) – and, by assuming that the extra-profit is equal to the value zero (EP = 0), the break-even GFA represents the surface quantity to be sold, in correspondence to which the total costs (C_t - including the normal profit for the investor) are equal to the total revenues.

The developed model in the present research borrows the expression to determine the break-even GFA amount (q), that is:

$$p_u \cdot q = C_f + Cv_u \cdot q \tag{1}$$

where:

p_u is the unit selling price of GFA [€/m^2];
q is the quantity of GFA [m^2];
C_f represents the fixed costs [€];
Cv_u represents the unit variable cost [€/m^2].

The term on the left of (1) indicates the total revenues (R_t), whereas on the right the total costs (C_t) are included. In the hypothesis of linearity of R_t and C_t functions, the formula for the determination of the break-even quantity is:

$$q = \frac{C_f}{p_u - Cv_u} \tag{2}$$

In the proposed model, the construction of the "real" trend of the marginal price curve p_u, characterized by a logarithmic and decreasing trend, is carried out. The development of this trend requires the introduction of two new variables, i.e. (i) r = rate of variation, which expresses the volatility of the reference market due to changes in real estate supply/demand, (ii) q_l = threshold quantity of GFA, that is the surface capable of satisfying the current demand for new real estate units, beyond which a surplus of supply is triggered that can be absorbed by the market at unit prices lower than the current market values for similar property units.

By indicating with $\overline{p_u}$ the unit market value of the new units to be built by taking into account the current supply conditions (thus *before* the introduction of new surfaces) and with $\Delta q = \frac{q-q_l}{q_l}$ the differential between the quantities of GFA generated by the investment considered and by those of saturation of the current market demand, the logarithmic function of the unit price will be:

$$p_u = \frac{\overline{p_u}}{(1+r)^{\Delta q}} \tag{3}$$

By inserting (3) into (1) the mathematical form obtained is:

$$\frac{\overline{p_u}}{(1+r)^{\frac{q-q_l}{q_l}}} \cdot q = C_f + Cv_u \cdot q \tag{4}$$

Having determined the starting parameters – the unit market value of the units to be built ($\overline{p_u}$), estimated with reference to current market conditions; the quantity of limit GFA (q_l), defined following a market analysis (e.g. taking into account the forecasts of current urban planning tools, the relationship between demographic trend and existing real estate stock, etc.); the fixed costs (C_f) and variable unit cost (Cv_u) of the investment; the rate of change (r), assessed by considering the geometric mean of the revaluation/devaluation rates of the half-yearly quotations published by the Real Estate Market Observatory (OMI) of the Revenue Agency for the trade area, the city and the intended use analyzed -, the amount of break-even GFA (q), through an iterative calculation, is estimated.

The model represents a highly valid tool in public-private partnership initiatives, where, in the cases of a specific request from the Public Administration - included in the amount of fixed costs -, the market conditions could not allow the private investor to satisfy in any case this burden: in this sense, the model returns a Pareto front - for different values of the variation rate r - of the optimal combinations of the surfaces to be realized (q) and the maximum request of the Public Administration (C_f).

A comparison between the "classic" graphic representation of the break-even point with the linear model – Figure (a) - and that related to the proposed non-linear model – Figure (b) - is reported in Fig. 1.

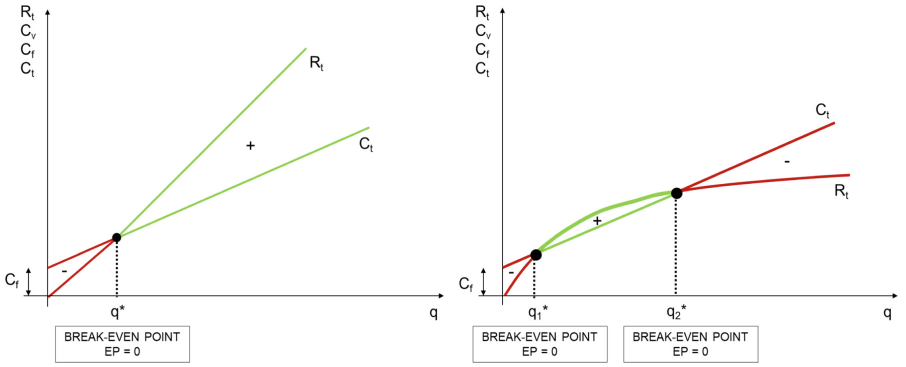

Fig. 1. Comparison between the "linear model" representation of the break-even point (Figure a) and the "non-linear model" one (Figure b)

From the analysis of the graph in Figure (a), it should be highlighted that in the linear model, starting from the quantity "0" to q^* (quantity of break-even), an absence of convenience in implementing the investment is observed, whereas from q^* an extra-profit situation for the private investor is detected. From this point, in fact, the Public Administration could require the private operator an "extra-burden" monetary sum, having already verified the convenience of the initiative for the private investor, taking into account the inclusion of a normal profit in the total costs.

The graph in Figure (b) shows that in the non-linear model the extra-profit area is limited and included between two regions, in which the investment convenience is not recorded: moreover, in the non-linear model, two break-even points, that verify the condition of minimum financial convenience for the investor (EP = 0), occur.

The revenue curve trend in Figure (b) highlights different conditions not only for the quantities to be produced, but also for the unit selling price. In fact, having estimated the GFA quantity to be placed on the market which saturates the current demand, a first phase in which the unit price is increasing, is identified. This condition reflects a sort of "anxiety effect" in the market demand, in which the first quantities of GFA are initially realized and the subsequent quantities planned by the project are not yet sufficiently known: a "bubble" of the unit selling price is outlined, for which a first break-even point (q_1*) is determined with a unit selling price higher than that initially estimated. Since the normal profit is function of the total revenues/costs, observing the graph in Figure b), it is evident that the entrepreneur should increase the quantities of GFA to be realized, also generating an extra-profit that could constitute an additional monetary sum that could be required by the Public Administration. As the projected or advertised GFA quantities increase, the market bubble deflates and the unit selling price begins to decrease: at this stage for the investor it is still convenient to increase the quantity of GFA to be realized, up to q_2*, i.e. the quantity beyond which the total revenues are lower than the total costs, and the normal profit is not guaranteed. Therefore, the private investor should aim at the q_2* quantity, which constitutes a sort of economic optimum, capable of maximizing the normal profit, whereas the Public Administration should try to remain within the range

q_1* and q_2*, in order to both ensure the normal profit for the investor and negotiate the extra-profit.

A possible logarithmic trend of the unit selling price in the non-linear model is reported in Fig. 2.

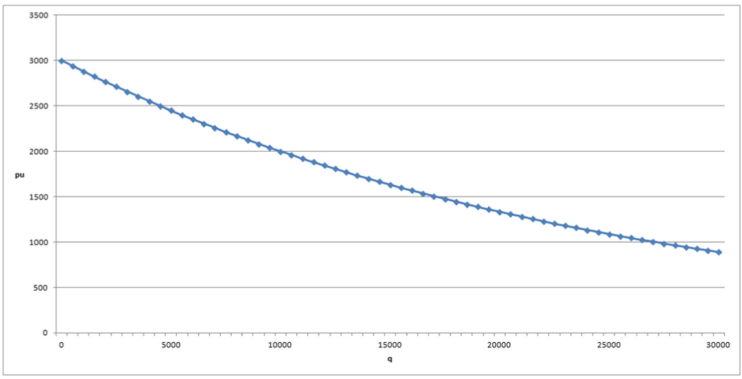

Fig. 2. Logarithmic trend of unit selling price in the non-linear model

4 Conclusions

The brownfield areas redevelopment constitutes an important opportunity to (i) recover contaminated, abandoned and/or damaged city portion [19, 20], (ii) implement larger-scale regeneration initiatives, (iii) kick-start the local economic growth [21, 22].

In the present research a non-linear model of break-even analysis for the evaluation of investments has been developed.

By borrowing the logic procedure of BEA, the model proposed does not consider the lineary of revenues (invariance of unit selling prices), i.e. the hypothesis that in contexts with a real estate demand close to the available supply or where large edification are planned, is not very consistent. The "quick" model for the identification of the minimum threshold financial convenience of the private subjects involved in the urban interventions has been applied, by starting from the "real" trend of the marginal price curve, characterized by a logarithmic and decreasing trend.

The model could be implemented in the first phases of assessment brownfields renovation investments, in order to provide a first indication of the interventions feasibility that should be completed through the implementation of more detailed evaluation techniques [23, 24].

Future insight of this research may concern the definition of a Pareto front of the optimal combinations of surfaces to be realized, able to ensure the initiative financial feasibility and the maximum request of the Public Administration. Thus, the model can be applied to an urban regeneration initiative in order to build a "Paretian optimal" range, i.e. the boundary combinations (quantity of GFA/maximum burden), able to guarantee the financial sustainability of the initiative for the private investor.

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