U.Porto Journal of Engineering, 9:2 (2023) 174-192
ISSN 2183-6493
DOI: 10.24840/2183-6493_009-002_001907

Received: 3 November, 2022
Revised: 14 December, 2023
Published: 31 December, 2023

A market-based instrument to capture betterments from planning decisions towards environmental ecosystems

Emília Malcata Rebelo
Faculdade de Engenharia, Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 PORTO, Portugal (emalcata@fe.up.pt) ORCID 0000-0003-4257-9017

Abstract
Any planning decision to develop and implement a territorial plan or to make a public investment will engender different kinds of externalities, such as increased land values.
This article aims to show that the capture of, at least, part of the betterments entailed by planning decisions or public investments, will generate additional funds to municipalities to cover the costs with environmental services.

Author Keywords: Information Systems, Land Use, Land Policies, Environmental Sustainability Fund, Urban Management

Type: Research Article
Open Access Peer Reviewed CC BY

1. Introduction

Environmental, ecosystem or natural services are those services provided by nature, which are essential for human survival, as they tackle climate challenges, and increase communities' quality of life and well-being (Daily, Matson, and Vitousek, 1997). Environmental services include (Costanza *et al*.,1997): (i) regulation of climate by absorbing carbon dioxide from the atmosphere and releasing oxygen, regulating the water cycle and moderating local temperatures; (ii) water purification, as natural ecosystems help to filter and purify water, removing impurities and pollutants; (iii) pollination, as insects and birds help to fertilise plants, which is essential for food production; (iv) provision of food, such as agricultural products, fish and wild plants; (v) development of recreational and tourist activities in natural areas such as parks, forests and beaches; (vi) protection against natural disasters, because ecosystems such as wetlands act as natural barriers, reducing the impacts of storms, floods and coastal erosion; (vii) biodiversity, through a variety of species that guarantee the adaptability of ecosystems to environmental changes, reinforcing their resilience and stability; (viii) disease regulation, as some species of plants and animals can help control pests and diseases, reducing the need for pesticides and chemical products**;** and (ix) supply of materials such as wood, fibres or medicinal products.

These services, in turn, can be classified as (Chan, Balvanera, Benessaiah *et al*., 2016; Daily and Matson, 2008; De Groot, Alkemade, Braat *et al.,* 2010): (i) provisioning services - capacity of ecosystems to provide goods, namely food, raw materials for energy production, biochemical and energy resources, water and ornamental plants; (ii) spiritual and aesthetic services - benefits that result from ecosystems´ regulation, such as climate control, purification and regulation of air and water cycles, erosion and flood control, pest and disease control; (iii) cultural services - capacity of ecosystems to provide recreational, educational, aesthetic and spiritual benefits; and (iv) services of support, including pollination and seed dispersal, cycles

of nutrients, agriculture and forestry production, and land formation, which are required by all ecosystem services.

A healthy and sustainable environment for future generations is based on the preservation and conservation of environmental services. The degradation of ecosystems and the loss of biodiversity reduce these services and have a negative impact on people's quality of life.

But keeping high quality standards in ecosystem and environmental services entail costs, which are growing in the face of climate change and environmental claims (Bateman, Mace, Fezzi *et al.*, 2011; Costanza, d'Arge, De Groot *et al.*, 1997; Daily, Polasky, Goldstein *et al.* 2009). The costs of a city's environmental ecosystems depend on various factors, such as population density, the type of industries, conservation efforts and the environmental challenges it faces. These costs can be classified into several categories, taking into account their negative externalities on human health, the economy and general well-being (Hartwick, 1990; IPCC, 2007; OECD, 2006; Repetto, 1986; World Bank, 1992): (i) cost of environmental degradation, associated with, soil degradation, depletion of water resources and pollution, which can result in loss of ecosystem services such as climate regulation, pollination and water purification; (ii) cost of biodiversity loss, which can generate direct externalities in agriculture, medicine and other industries that depend on it, as well as the reduction or elimination of vital ecosystem services, such as the pollination of food crops; (iii) cost of air, water and soil pollution, with implications for health, including increased medical expenses and loss of productivity at work; (iv) costs associated with climate change, such as extreme weather events and rising sea levels, exacerbating the costs of damaged infrastructure, loss of property and displacement of communities; (v) cost of the loss of ecosystem services, including clean water, crop pollination and climate regulation, which are extremely expensive to replace with artificial technologies; (vi) cost of the loss of recreation and tourism in certain areas, implying reduction in the associated revenue; (vii) cost of adapting to climate change and mitigating environmental impacts; and (viii) cost to human health, as pollution and environmental degradation can trigger respiratory diseases, skin diseases and allergies, with direct costs to the health system.

Thus, these services should somehow be paid to their providers and keepers. These payments assume that the environmental services´ providers develop lasting clear and effective actions, which should be monitored by an independent body, to ensure they provide environment gains.

Recognizing these costs is important to inform public policies, business practices and individual behaviour that help protect environmental ecosystems and avoid future costs due to environmental degradation (Alberti, 2017; Tidball and Krasny, 2014). Cities are increasingly aware of the importance of healthy urban ecosystems, investing in sustainable development practices to protect and preserve their natural resources in order to reduce the costs associated with pollution, public health and adaptation to climate change, among others (Andersson, Barthel, Borgström *et al.*, 2014; Ernstson and Sörlin, 2009). Environmental conservation and development strategies are essential to minimize these costs and promote a healthier and more balanced future for the planet and its communities.

Despite being a complex challenge, there are several possible strategies to finance the costs with environmental ecosystems (Muradian, Corbera, Pascual, *et al.*, 2010; Pagiola, Bishop and Landell-Mills, 2002), namely: (i) taxing activities that cause environmental degradation, such as emissions of pollutants, or excessive extraction of natural resources; (ii) establishing carbon trading systems where cities or companies can buy carbon credits to offset their greenhouse gas emissions; (iii) payment by governments, non-governmental organisations and companies to landowners and local communities for environmental services, such as preserving

biodiversity, conserving forests or protecting water sources; (iv) provision of subsidies or financial incentives for sustainable agricultural and industrial practices, and for the implementation of green technologies and renewable energy; (v) establishing public-private partnerships between governments, the private sector and civil society organizations to finance ecosystem conservation and restoration projects; (vi) use of crowdfunding platforms and donations from individuals and organizations to support initiatives that promote sustainability and environmental protection; (vii) investment in funds and companies that adopt environmentally responsible practices with a positive impact on ecosystems; (viii) creation of specific funds, financed by contributions from governments and national or international organizations; (ix) better access to credit; (x) improved provision of public services; and (xi) provision of technology and technical training.

Besides adapting these strategies to the specific needs and contexts of each region or country, raising public awareness of the importance of ecosystems, and the need to invest in their conservation is outstanding in gathering financial support for these initiatives.

However, considering their relevance in promoting sustainable development in urban areas and in increasing people´s and communities´ wellbeing, and considering the municipal/local budget shortcomings, public authorities should promote planning policies and tools - beyond more conventional ones - to financially support these services. The use of market instruments to implement public environmental policies allows for more effective management of resources to deal with the externalities of urban systems than the strict application of authoritarian urban planning instruments (Micelli, 2002). Those instruments are based on the principle of equalizing urban development rights among all the owners involved in the plan, and include land use tools such as land value capture, voluntary land-readjustment, or swapping of development rights (Micelli, 2002). They enable the adoption of nature-based solutions in urban and peri-urban areas (Ronchi, Arcidiacono and Pogliani, 2020), in order to increase and improve the supply of different ecosystem services (Von Haaren, Lovett and Albert, 2019).

Land value capture instruments involve recovering part of the value generated by the development of urban areas or the implementation of public policies in a given region (Brueckner, 1997; Oates, 2005). They can be used to finance improvements in public infrastructures and services, including environmental management of air and climate, wastewater, waste, soil and water, noise and vibration, biodiversity and landscape. These include: (i) the application of environmental charges and tariffs on air pollution, discharge of industrial wastewater, and generation of waste and other polluting activities; (ii) levying a tax on the increase in land value when urban areas are developed or rezoned; (iii) exchange of development rights from environmentally sensitive areas to areas more suitable for construction; (iv) charging a fee to property owners who benefit from environmental infrastructure improvements, such as sewage systems and flood control; (v) implementation of emissions trading systems where companies or cities can buy permits to emit pollutants, and/or auction these permits; (vi) charging fees to drivers entering congested areas to reduce traffic and pollutant emissions; (vii) collecting compensation from companies that cause significant environmental impacts; (viii) issuing value capture certificates that represent the right to develop certain areas, which can be sold or exchanged on the market.

It is important to conduct feasibility analyses and involve stakeholders when implementing value capture instruments. In addition, transparency in the allocation and use of captured resources is key to ensuring public trust and the success of these environmental financing strategies.

However, the concept of "payment for environmental services" has been criticized, especially when it involves direct payments in cash or credits. Criticism is mainly of two kinds. On the one hand, misuse or mismanagement by beneficiaries entails risks - notably in value assignment -, which may engender conflicts. On the other hand, payment for environmental services can be seen as a 'bribe' or a threat to the sovereignty of local authorities.

Considering this framework, this article shows that the capture of betterments[1] that result from planning decisions or public investments will enable municipalities to efficiently complement their funding of environmental services.

2. Policies and instruments of land value capture

2.1. How public interventions affect land values

The factors that drive land values´ rises relate to original land productivity (Hong and Brubaker, 2011; Ingram and Hong, 2012; Walters, 2012a, 2012b), private investment, planning decisions, public investment in infrastructure and facilities (Alterman, 2011, 2012; Ingram and Hong, 2012; Smolka and Amborski, 2003; Walters, 2012a, 2012b), population growth, and local economic development. The influence of each of these factors can occur separately or together, but the impacts of public investment decisions and planning decisions are especially relevant, especially during the urbanisation phase (Figure 1). In fact, urban planning decisions can generate or destroy value that results from both externalities and related urban aspects that underpin urban rents and the betterments thus generated (Micelli, 2002).

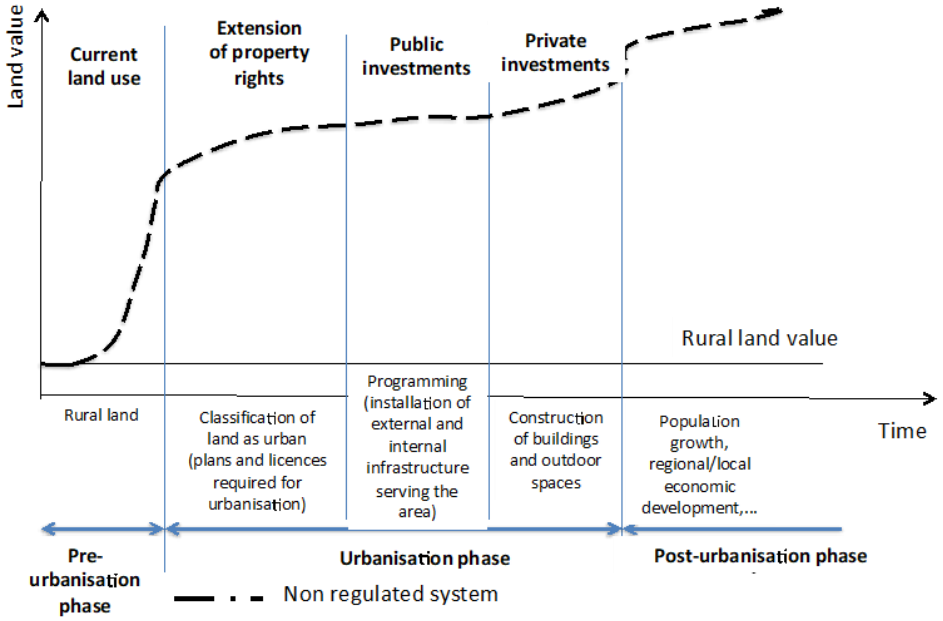


Figure 1: Evolution of land values after public intervention (Hendricks et al., 2017, adapted).

[1] Betterment designates any increase in land value caused directly by a planning or public investment decision (that is not the result of any effort or initiative by its owner)

2.2. Social, economic, political and legal debate on the concept of land value capture

Public investments or planning decisions (territorial plans, changes in land use or intensities of use) are the main responsible for land value rises.

"Land value capture" is a generic term for policies and instruments aimed at capturing land betterments (increases in land values that directly result from planning decisions and public investments), reallocating them to public infrastructure, equipment and social purposes.

The growing constrains on public finance, the adoption of private management models by public services, the general increased concern with environmental issues, the fiscal decentralization to public bodies, the influences exerted by multilateral agencies that promote public value capture, and the functioning of property markets – among other variables - create favourable conditions for the development of land value capture policies and instruments.

Indeed, the public sector is no longer expected to be the sole responsible for financing infrastructure, facilities and social services (Altshuler and Gomez-Ibanez, 1993; Brown and Smolka, 1997; Callies and Suarez, 2005; Ingram and Hong, 2012; Nelson et al., 2008; Rosemberg, 2006; Sacco et al., 2019; Smolka and Amborski, 2000, 2003; Walters, 2011). And many argue that urban development should not be a burden to municipalities but shall, instead, contribute to support non-profitable public services and responsibilities - namely the payment of environmental services – as urban development promoters and landowners straightly benefit from public decisions. Betterments´ capture does not depend on the type of land use or whether land is used or not, lowers the value of betterments appropriated by the landowner, does not discourage urban developments and building activities, does not distort market mechanisms, and does not imply deadweight losses (Fainstein, 2012; Ingram and Hong, 2012; Netzer, 1998).

The partial capture of these betterments and their application on behalf of the community and/or the environment is generally faced as socially just and balanced from social, economic and financial perspectives. However, betterments are hard to compute and even controversial. In addition, it is difficult the identification of the relationship between planning decisions or public investments and the betterments generated (Adair et al., 2003, 2011; Piketty, 2014; Sassen, 2000). Thus, it is vital to assess the impacts of investments, infrastructure, equipment, or public land uses on the surrounding private land from scientific and empirical perspectives (Correia,1993; Pardal, 2006; Rebelo, 2009).

Control over the generation of betterments and their appropriation can be exerted through fiscal mechanisms, local improvements or land use regulation (such as rezoning, allocation of additional building rights, or loosening of land use regulation). These interventions allow public authorities to control land price levels (Figure 2).

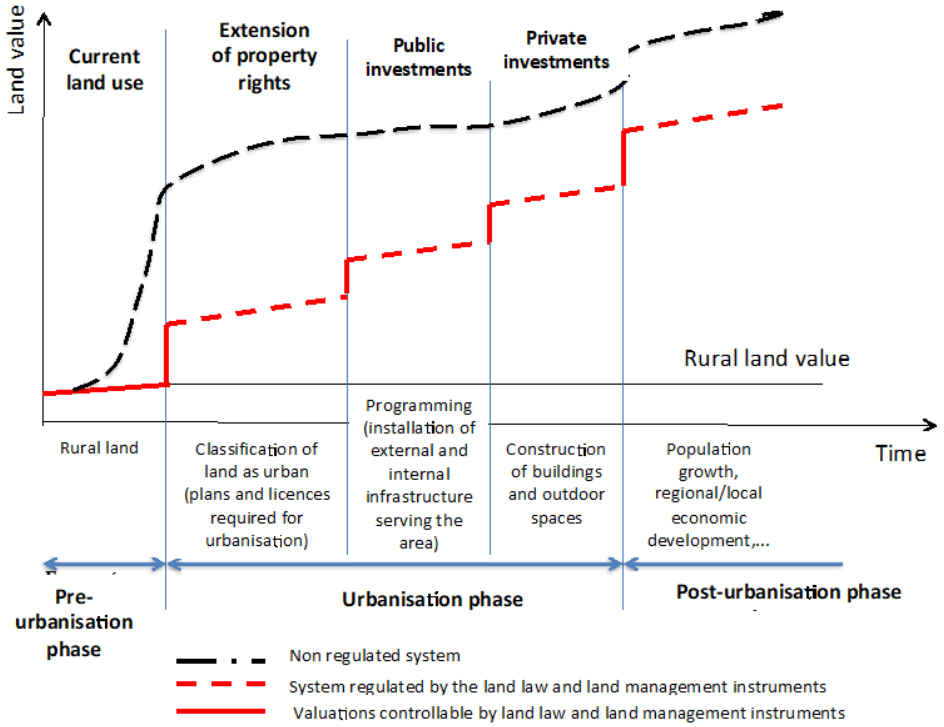


Figure 2: Possible mechanisms to control increases in land values.

2.3. Basis for defining a market-based land value capture instrument

The operationalization of a mechanism efficient in controlling land betterments´ generation and distribution requires the assessment of land value, and the definition of equal distribution mechanisms, according to land status. The land evaluation system, by its turn, requires the definition of a "land-base value", the settlement of a reasonable profit margin for the urban development activities, and the establishment of scheduled payments to be made in exchange for urban uses above reference use values.

Designing and implementing land value capture instruments is challenging and complex, especially due to the following shortcomings and constraints identified in the literature:

- It is hard to identify the specific factors responsible for land value rises, and their respective weights: (i) which amounts in land price rises are due to private initiative (leading to profits), and which are due to planning decisions (leading to betterments); and (ii) investors' interests and the interests of local communities should be balanced in planning decisions
- How far should private individuals be responsible for helping the achievement of public goals versus social goals?
- Decisions of the municipal/local decision makers are political-administrative decisions (Aalberts, 2016; Adair et al., 2003; Bartke, 2013; Beswick and Tsenkova, 2002; Correia,1993; Degen and Garcia, 2012; DGOTDU,2011; Dikeç, 2007; Eshuis et al., 2013; Theurillat and Crevoisier, 2013; Torrence, 2008), which questions: (i) How and to what extent to tackle stakeholders' interests, and expectations on future uses and intensities of land use?; (ii) How to apply collected taxes/betterments? In infrastructure/facilities? In public services? In social concerns? In environmental concerns? And how to distribute them to respond to these different goals? How to coordinate the interests of different municipalities, taking synergistic advantages for all of them? (Alterman, 1988, 2011; Altshuler and Gomez-Ibanez, 1993; Bowers, 1992; Callies and Suarez, 2005; Faludi, 2009;

Ingram and Hong, 2007, 2012; Ko and Rosemblatt, 2013; Nelson et al., 2008; Plevoets and Sowinska-Heim, 2018; Rosemberg, 2006; Walters, 2012a, 2012b; Webster, 1998)

- The classification of betterment capture is unclear: should it be considered as a tax or as an instrument of wealth redistribution? (Alterman, 2010, 2011; Brown and Smolka, 1997; DGOTDU, 2011; Hendricks and Tonkin, 2010; Skaburskis and Qadeer, 1992; Smolka and Amborski, 2003; United Nations, 1976; Walters, 2011; 2012a, 2012b).
- Tension persists between private property rights and citizens' social rights on value increases that result from public decisions (Booth, 2012; Fainstein, 2010, 2012; Gielen and van der Krabben, 2017; Harvey, 2000; Ingram and Hong, 2007; Mata, 2011; Needham, 2006; Netzer, 1998; Pinilla, 2019; Rebelo, 2009, 2012, 2022; Smolka and Amborski, 2007): (i) private entities have been increasingly involved in decisions traditionally taken by public bodies (e.g. provision of urban equipment, infrastructure, public spaces, and public services) (Birch and Siemiatycki, 2016; Kitson and Michie, 1997; O´Connor,1973); (ii) the risk of funding and responsibilities of public authorities have been increasingly transferred to private parties (Adair et al., 2011; Torrence, 2008); (iii) the efficiency of public authorities have, thus, been reinforced concerning fund gathering to support charges with social and affordable housing, urban facilities, parks, roads, climate change adaptation, and mitigation of respective consequences, as well as with other environmental services (Calavita and Mallach, 2009; Cardoso et al., 2011); (iv) land policies that replace the welfare state by the regulatory state have been increasingly adopted (Fainstein, 2010; Harvey, 2008; Soja, 2010); (v) these neo-liberal policies found more and more in spatial planning communicative rationality, which resort to negotiation, deliberation, mediation, and stakeholders´ self-regulation (Healey, 1992; Samsura, 2013).
- It is hard to practically assess land (UN_Habitat, 2020). The land market prices mostly depend on how much promoters or developers are willing to pay, and not so much on landowners´ costs, due to the high land supply inelasticity for specific uses. But it is difficult to: (i) assess beforehand the impact of public decisions concerning land use or use intensity on its value; (ii) to clearly determine the betterments generated; and (iii) to defend taxes on land betterments. Furthermore, property assessment is more reliable in locals, regions or countries more used to assess properties for tax purposes.

Efficient betterment capture instruments require: (i) knowledge of local property markets, and property rights; (ii) believe that these instruments will create sustainable neighbourhoods, and support urban development/rehabilitation (Ko and Rosemblatt, 2013); (iii) existence of a political will, a public body, and administrative capacity to implement them (Bahl and Wallace, 2008; UN_Habitat, 2020); (iv) an ongoing updatable management information system that enables the clear identification of indicators and classes of land registration; (v) assessment of betterments and respective land impacts, which is accurate and expeditious (Bahl and Wallace, 2008; Walters, 2012b); and (vi) the definition of parameters for these instruments, found on scientific knowledge (including the sources of betterment, the amount to recover, who will benefit, when should it be collected, and how should the collected levy be applied).

The implementation is pursued from different perspectives: (i) legal (which refers to land property rights); (ii) political (proficiency and hindrances faced by policies of land value capture, namely lobby groups´ interests, taxes on property, integrated management of land use), and effective authority to implement this kind of instruments (Smolka and Amborski, 2003); (iii) technical and operational (accurate and efficient updated assessment, identification of betterments resulting from planning decisions or from public investments,

and awareness of the range of value capture tools); (iv) market; and (v) pragmatic (choice of each circumstance´s better instrument) (Smolka and Furtado, 2003).

2.4. Land value capture debate in Portugal

The reasons that led to the revision of the law on the general bases of public policy for land, spatial planning and urban development were: (i) the lack of flexibility and ability to adapt to territorial dynamics; (ii) complex overlapping models and plans; (iii) excessive time to develop and review plans; (iv) difficulty in controlling urban expansion, urban land markets and the proliferation of vacant land; (v) excessive weight of urban land in real estate final costs; (vi) appropriation by landowners of betterments resulting from planning decisions and public investment; and (vii) land and property speculation, which often led to corruption.

These shortcomings led to mismatches between market operation, taxation, and land use planning; inefficiencies in land use instruments´ current application; lack of strategic perspectives; difficulties in land assessment; and lack of control over speculation.

The objectives settled in the new basic law of public policy for land, spatial planning, and urban development (Law nº 31/2014) consist, thus, in: (i) strengthen territorial policies´ integration; (ii) increase plan implementation effectiveness; (iii) reinforce the sustainability of urban development; (iv) simplify and streamline the conditions for carrying out urban planning operations; and (v) promote equity and social cohesion.

These objectives set the basis for the economic-financial sustainability of urban development through: (i) the clarification of duties and rights of land occupation, use and transformation stakeholders; and (ii) the explanation of property and building rights relationships, balancing the distribution of the urban development costs and benefits in fair, transparent, and efficient ways (DGOTDU, 2011; Guinote, 2019).

One major innovation of this Law consists in the creation of a municipal fund for environmental and urbanistic sustainability (FMSAU), fed by the collection of taxes on betterments, in order to promote urban rehabilitation, the sustainability of ecosystems, and the provision of environmental benefits. It will certainly cover part of the ecosystems´ costs supported by municipalities.

The preparation of technical documents to support urban development operations´ economic and financial sustainability - including environmental services´ costs - is remitted to the Municipal Master Plans by the Law nº 31/2014.

3. Case study: Porto, Portugal

The city of Porto was chosen as the case study for the research reported in this article for a number of reasons: (i) this city has a high population density, historically characterised by mixed processes of urbanisation and industrial development, which have entailed major environmental challenges, such as pollution, waste management, water conservation and the preservation of biodiversity; (ii) the city's adoption of initiatives, policies and instruments related to environmental sustainability, in areas such as public transport, waste management, renewable energies or the management of urban spaces, and how they have been implemented; (iii) the fact that Porto is a centre of innovation in environmental technologies and has been incorporating innovative solutions such as environmental monitoring systems, sustainable construction and environmentally friendly technologies; (iv) the city shows a sustainable economic development balanced with the preservation of the environment, especially through the attraction of sustainable investment and the creation of green jobs; (v) as Porto is a coastal city, it is often subject to risks related to climate change, such as rising sea levels or extreme weather events, so it is a good example of resilience to climate change; and

(vi) the fact that Porto's Municipal Master Plan (PDM) is one of the few at national level that already contains a set of rules that support the economic and financial sustainability of urban development operations, and the regulation of their implementation, in accordance with the basic law of public policy for land, spatial planning and urban development (Law nº 31/2014).

3.1. Analysis of the economic and financial regime of Porto's Municipal Master Plan

Chapters II and III of the Regulation of the Porto Municipal Master Plan (Notice nº 12773/2021), and the Equal Distribution Regulation of Buildability and Urban Rates (Regulation nº 616/2021) establish a set of concepts and instruments, and their respective form of implementation that support the economic and financial sustainability of urban planning operations.

Article 3 provides some definitions, with the building area (ae) being the sum of the area of each floor, expressed in m^2, of all the buildings that exist or can be built on the plots (with some exceptions).

Article 131 - which refers to the economic and financial regime - recognises that all the abstract construction permitted in this PDM and specifically permitted in the municipal prior control translates into the creation of betterments in the buildings to which it refers. The criteria for parameterizing and distributing betterments are established here (as stipulated in the basic law), through: (i) identifying average buildability; (ii) distributing that buildability among owners and a Municipal Fund for Environmental and Urban Sustainability (FMSAU); and (iii) distributing buildability equally among land owners.

Article 132 clarifies the concepts linked to buildability, so:

- The term buildability refers to the building permitted on each site (plot or group of plots), in accordance with the quantitative and qualitative provisions of the plan and other applicable regulations.
- Average buildability refers to each of the Operational planning and management units (UOPGs) delimited in the PDM for equalisation purposes (Territorial Units), and is given by the ratio between the total area of permitted building (including existing building) and the respective territorial area.
- Abstract buildability is the buildability allocated by the Municipal Master Plan (PDM) to the owner of each plot (or set of plots), and corresponds to the difference between the average buildability and the buildability allocated to the FMSAU.
- Concrete buildability refers to the legal buildability that already exists on a given plot of land or that will be established in the urban management process.

Article 133 considers 3 territorial units for the purposes of building equal distribution: (i) Central Area; (ii) Western Area and Outer Arc; and (iii) Eastern Area. Within these there may be areas with biophysical constraints on building, and areas earmarked to economic activities, which are encouraged.

Article 148 considers the following components in the valuation of land for the purposes of expropriation for public utility: (i) the abstract buildability assigned to each of the plots (article 134); (ii) the urban development charges inherent to the buildability, to be deducted from the value of the buildability (article 138 and complementary regulations); (iii) the value of the building, if it legally exists, considering its state of repair; and (iv) other parameters defined in municipal regulations (Regulation nº 616/2021).

Article 150 explains what the municipal environmental and urban sustainability fund consists of and how it is fed (FMSAU). The aims of this fund consist of (i): operationalization of the processes of betterment redistribution, according to the principles of equity and justice

established in this plan; (ii) provision of land and/or financial resources to support the implementation of the plan, particularly with regard to environmental and/or urban safeguarding and enhancement operations; and (iii) provision of land for infrastructure, equipment and public green spaces, as well as for the implementation of the municipal housing policy. The income from this fund comes from: (i) transfers of buildable land and/or pecuniary compensation for excess buildability, and resulting from operations under the inclusive zoning system (intended for the construction of social housing); (iii) compensation for insufficient provision of general infrastructure; and (iv) other funds that the City Council decides to allocate to it. The FMSAU's charges are intended to: (i) compensate owners whose concrete building capacity is lower than the abstract´s, or whose contribution to general infrastructure is higher than the average; and (ii) help support actions to safeguard and enhance the environment and/or urban development.

Article 151 states that the plan can be implemented either non-systematically (through individualized operations) or systematically (through municipal programming), preceded by the completion of the necessary infrastructure. In areas undergoing consolidation, execution procedure is mainly systematic (Article 153). This type of implementation stems from the municipal programme and is included in the respective activity plan, accompanied by the delimitation of the respective implementation units (article 154). These execution units must form a perimeter with urban unity and autonomy, ensure that they do not prevent the creation of other execution units on the rest of the land, and guarantee the correct functional and formal articulation of the urban intervention with the pre-existing consolidated urban space (Article 155).

The Operational Planning and Management Units (UOPGs) - identified in the Zoning Map: Land Qualification Map - are areas that are intended to be structured, enhanced and integrated into the urban fabric, may include one or more implementation units, and justify specific rules regarding their objectives, urban planning parameters, implementation methods and deadlines (Articles 159 and 160) (Figure 3).

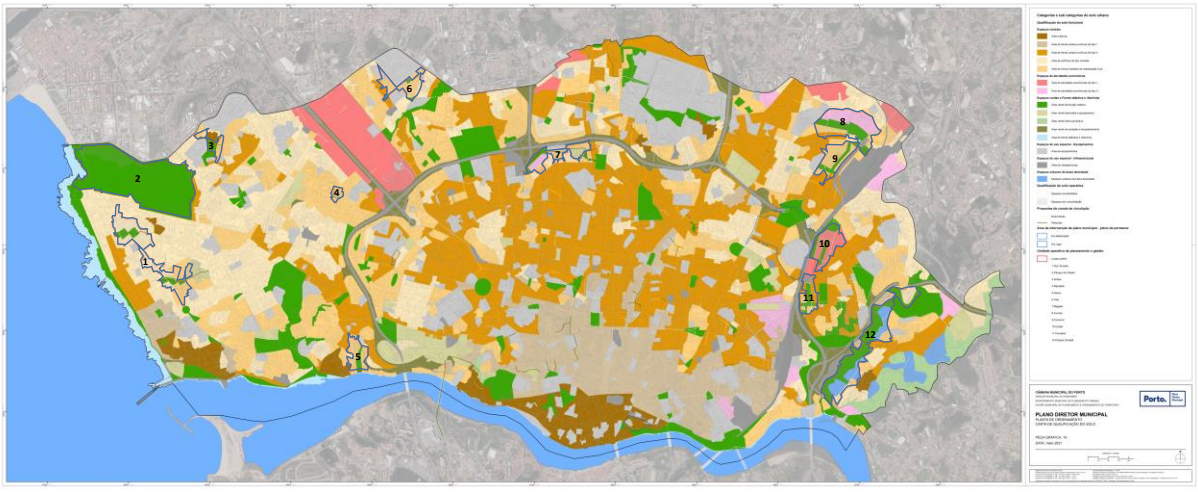


Figure 3: Zoning Map: Land Qualification Map (Porto Municipal Master Plan, 2021)

3.2. Methodology

This article seeks to demonstrate that capturing the betterments of the urban interventions foreseeable in the operational planning and management units (UOPGs) provided for in Porto's Municipal Master Plan for the next ten years will cover an important part of the environmental investments planned by this municipality.

In methodological terms, the following steps were followed: (1) identification of the building capacity per square metre of land in each UOPG allocated to the Municipal Environmental and Urban Sustainability Fund (FMSAU), based on the PDM; (2) computation of the areas of each UOPG; (3) estimate of the amount of compensation to the municipality for urban development works, in accordance with the Equal Distribution Regulation of Buildability and Urban Rates (Regulation nº 616/2021); (4) valuation of the areas of each UOPG that will feed the FMSAU, according to the PDM, foreseeable for the decade 2020 to 2029; (5) calculation of the predicted market sale price over the next five years, according to the average annual sale price per square metre in Porto (based on data from the company Imovirtual); (6) calculation of the betterment per square metre that will revert to the FMSAU in each UOPG, based on the difference between the sale price/square metre of built area, the cost of general infrastructure[2]/square metre of land, the cost of local infrastructure/square metre of land, the construction cost/square metre of built area ,and the cost of the land; and (7) computation of the total betterment value that will revert to the FMSAU over the ten-year period considered.

3.3. Outcomes

The buildability values for each UOPG earmarked to the FMSAU were determined from the difference between the respective average and abstract buildability, both expressed in m^2 of built area per m^2 of land (parameter values taken from the PDM). The building area allocated to the FMSAU [6] in each UOPG was calculated by multiplying the building area allocated to the FMSAU [4] by the area of the UOPG [5] (Table 1).

UOPG		Area of the Plan for the purposes of equal distribution of buildability	Average buildability (m^2 ae/m^2) [1]	Abstract buildability (m^2 ae/m^2) [2]	Buildability allocated to the FMSAU [4] = [1] - [2]	Area of UOPG (m^2) [5]	Building area allocated to the FMSAU [6] = [4] x [5]
UOPG 1	Nun´Alvares	Western Area and Outer Arc	0,7	0,6	0,1	62 500,0	6 250,0
UOPG 2	Parque da cidade	Western Area and Outer Arc	0,7	0,6	0,1	214 844,0	21 484,4
UOPG 3	Aldoar	Western Area and Outer Arc	0,7	0,6	0,1	11 718,7	1 171,9
UOPG 4	Ramalde	Western Area and Outer Arc	0,7	0,6	0,1	7 812,5	781,3
UOPG 5	Aleixo	Western Area and Outer Arc	0,7	0,6	0,1	25 390,6	2 539,1
UOPG 6	Viso	Western Area and Outer Arc	0,7	0,6	0,1	23 437,5	2 343,8
UOPG 7	Regado	Central Area	1,2	1	0,2	27 343,7	5 468,7
UOPG 8	Currais	Eastern Area	0,25	0,2	0,05	64 453,1	3 222,7
UOPG 9	Contumil	Eastern Area	0,25	0,2	0,05	31 250,0	1 562,5
UOPG 10	Cartes	Eastern Area	0,25	0,2	0,05	33 203,1	1 660,2
UOPG 11	Corujeira	Eastern Area	0,25	0,2	0,05	23 437,5	1 171,9
UOPG 12	Parque oriental	Eastern Area	0,25	0,2	0,05	72 265,6	3 613,3
Total						597 656,3	51 269,5

Table 1: Computation of the buildability and of the building area allocated to the FMSAU.

Next, the amount of compensation corresponding to the value of the transfer to Porto City Council of the concrete buildability that exceeds the abstract buildability (article 4 of Regulation nº 616/2021) was calculated (Table 2), according to the formula set out in article 5 of this regulation:

$$CE = dae\ x \left(\frac{cL}{cL}\ m\acute{a}x.\ x\ 0{,}15\right) x\ C \quad (1)$$

[2] General infrastructures serve the municipal territory as a whole, and local infrastructures directly serve each built-up area (article 137 of the Porto Municipal Master Plan Regulations).

where:

dae – difference between the concrete buildability and the abstract buildability (expressed in m^2 of built-up area).

C – reference cost of m^2 of ae for affordable housing, according to ordinance no. 62/2019, and, more recently, by ordinance no. 281/2021 (considered as 710 €/m^2, according to Regulation nº 616/2021).

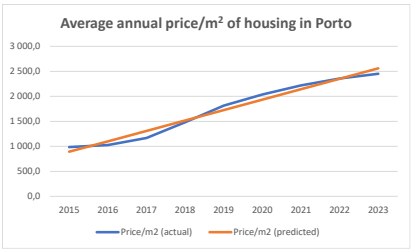
cL – location coefficient, according to the Municipal Property Tax Code (CIMI), considering residential use.

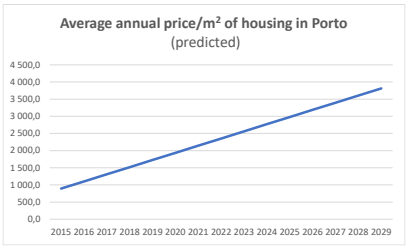
cL máx – maximum location coefficient for Porto, considering residential use.

UOPG	Buildability allocated to the FMSAU [4] = [1] - [2]	Building area allocated to the FMSAU [6] = [4] x [5]	Location coefficient cL [7]	Maximum location coefficient cL max. [8]	cL/cL máx [9] = [7]/[8]	Compensation [10] = [4] x [9] x 0,15 x710 €/m^2	Selling price [11] = [6] x 3 291,8 €/m^2	General infrastructure costs [12] = [6] x 85 €/m^2	Local infrastructure costs [13] = [6] x 60 €/m^2	Construction costs [14]	Land cost [15] = 25% x [14]	Total betterment in favour of FMSAU (€)
UOPG 1	0,1	6 250,0	2,1 a 2.3	2,3	0,91	607 745	20 573 750	531 250	3 750 000	4 437 500	1 109 375	11 855 000
UOPG 2	0,1	21 484,4	2,4 e 2,8	2,8	0,86	1 961 219	70 722 348	1 826 174	12 890 640	15 253 924	3 813 481	40 751 610
UOPG 3	0,1	1 171,9	1,5	1,5	1,00	124 804	3 857 562	99 609	703 122	832 028	208 007	2 222 803
UOPG 4	0,1	781,3	1,5	1,5	1,00	83 203	2 571 719	66 406	468 750	554 688	138 672	1 481 875
UOPG 5	0,1	2 539,1	1,4 a 2	2	0,70	189 287	8 358 078	215 820	1 523 436	1 802 733	450 683	4 816 089
UOPG 6	0,1	2 343,8	1,3	1,3	1,00	249 609	7 715 156	199 219	1 406 250	1 664 063	416 016	4 445 625
UOPG 7	0,2	5 468,7	1,6	1,6	1,00	582 421	18 001 998	464 843	1 640 622	3 882 805	970 701	12 013 728
UOPG 8	0,05	3 222,7	1,3	1,3	1,00	343 213	10 608 336	273 926	3 867 186	2 288 085	572 021	4 179 139
UOPG 9	0,05	1 562,5	1,3	1,3	1,00	166 406	5 143 438	132 813	1 875 000	1 109 375	277 344	2 026 250
UOPG 10	0,05	1 660,2	1,2	1,2	1,00	176 807	5 464 898	141 113	1 992 186	1 178 710	294 678	2 152 889
UOPG 11	0,05	1 171,9	1,2	1,2	1,00	124 805	3 857 578	99 609	1 406 250	832 031	208 008	1 519 688
UOPG 12	0,05	3 613,3	1,1	1,1	1,00	384 814	11 894 195	307 129	4 335 936	2 565 429	641 357	4 685 702
Total		51 269,5				4 994 332	168 769 055	4 357 910	35 859 378	36 401 370	9 100 342	92 150 397

Table 2: compensation values and total betterment in favour of the FMSAU.

The location coefficients for each area of the city were calculated using the Municipal Property Tax (IMI) simulator, with the maximum location coefficient being the upper limit of the area in which each UOPG falls. The average cost values for general infrastructure and local infrastructure considered were 85€/m^2 and 60€/m^2, respectively, in accordance with Regulation nº 616/2021. The average annual sale price for each year, obtained from the monthly average sale values per square metre of housing in Porto, was taken from Imovirtual, and a linear extrapolation was made for the decade from 2020 to 2029 (Figure 4). 3 291.8 €/m^2 - which corresponds to the average of the values predicted by the model for the years 2024 to 2029 - was taken as the average reference value.





Year	Price/m^2 (actual)	Price/m^2 (predicted)
2015	985,3	892,8
2016	1 028,3	1 101,4
2017	1 167,9	1 310,0
2018	1 481,8	1 518,6
2019	1 815,0	1 727,2
2020	2 037,0	1 935,9
2021	2 220,2	2 144,5
2022	2 356,6	2 353,1
2023	2 453,3	2 561,7
2024	-	2 770,3
2025	-	2 978,9
2026	-	3 187,5
2027	-	3 396,1
2028	-	3 604,7
2029	-	3 813,3

Figure 4: (a) Average annual price/m^2 of housing in Porto city between 2015 and 2023 (actual and predicted by the model); (b) Average annual price/m^2 of housing in Porto city between 2015 and 2029 (predicted by the model); (c) actual and predicted prices/m^2 of housing in Porto (2015-2023 and 2015-2029, respectively)

It was also assumed that the land values corresponded to 25 per cent of the average sale price of the foreseeable property in the respective UOPG (in accordance with article 39 of the IMI Code). Thus, the expected betterment over the next ten years from all the UOPGs earmarked to the FMSAU - which is the result of subtracting the construction costs, the general and local infrastructure costs and the value of the underlying land from the sale price - amounts to around 92,150 million euros (Table 2). To this figure is added the compensation corresponding

to the transfers (previously calculated), which leads to a foreseeable figure of 97 144 729 euros (92 150 397 + 4 994 332 €).

3.4. Application of the collected betterments on behalf of environmental ecosystems in Porto

The evolution of environmental investments in Porto in recent years (expressed in thousand euros) has been as follows (Figure 5):

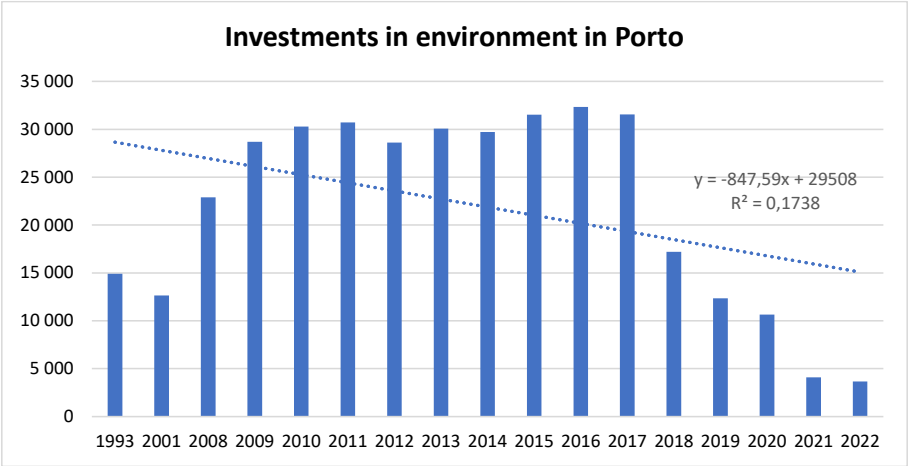


Figure 5: Spending on environmental management and protection, namely in air and climate, wastewater, waste, soil and water, noise and vibration, biodiversity and landscape in Porto City (expressed in thousand euros)

It can be noticed a downward trend, especially since 2017.

The adoption and implementation of the value capture instruments foreseen in the PDM of Porto, as exposed, will certainly improve the efficiency in land use planning and management, through its unequivocally payment for, at least, part of the environmental services.

For example, the value of 97,144 million euros expected to feed the FMSAU previously computed (exclusively from the public lead urban development initiatives foreseen in the PDF for the decade 2020-2029) will make it possible to support environmental investments of the order of the maximum 2016 level over the next five years (32 344 000 €/year x 5 years = 161 720 000; subtracting the effective investment level between 2017 and 2022 of 31 561 + 17 199 +12 361 +10 662 + 4 084 + 3 671 thousand euros = 79,538 million euros, which leads to 161 720 000 – 79 538 000 = 82,182 million euros). This value could, thus, cover part of the expenditure on environmental management and protection, such as air and climate, waste water, waste, soil and water, noise and vibration, and biodiversity and landscape.

This study only considers systematic urban interventions by Porto City Council, excluding non-systematic property developments, which are the responsibility of private individuals, and which could also be the object of betterment capture, substantially reinforcing this fund. It can therefore be concluded that, although the FMSAU also has other charges of an urban nature, it is nevertheless a fundamental contribution to complementing the financing of the city's environmental charges.

Anyway, the implementation of this kind of instruments requires the dissemination of its objectives, concerns, and methodology to general communities and to municipal technicians.

It further involves municipal technicians´ training and empowerment, and the reinforcement of their awareness and knowledge of these policies and instruments so that they can better apply them. It is also important to develop ongoing/updatable management information

systems, computer programs and digital cartographic interfaces, fostering the exchange of information and experiences, as well as cooperation networks.

References

Aalbers, M. B. 2016. The Financialization of Housing: A Political Economy Approach. Abingdon: Routledge.

Adair, A. S., J. N. Berry, and W. S. McGreal. 2003. "Financing property´s contribution to regeneration." Urban Studies 40 (5-6): 1065-1080. DOI: 10.1080/0042098032000074326.

Adair, A. S., J. N. Berry, and W. S. McGreal. 2011. "Hedonic modelling, housing submarkets and residential valuation." Journal of Property Research 13 (1): 67-83. DOI: 10.1080/095999196368899.

Alterman, R. 1988. "Exactions American style: The context for evaluation." In Private Supply of Public Services: Evaluation of Real-Estate Exactions, Linkage and Alternative Land Policies, edited by R. Alterman, 3-21. New York: NYU Press.

Alberti, M. 2017. Advances in urban ecology: Integrating humans and ecological processes in urban ecosystems. Springer.

Alterman, R. 2010. Takings International: A Comparative Perspective on Land Use Regulations and Compensation Rights. Chicago: American Bar Association Publications.

Alterman, R. 2011. "Is capturing the "unearned increment" in land value still a viable idea? A cross-national analysis." In COBRA 2011 - Proceedings of RICS Construction and Property Conference, edited by L. Ruddock, P. Chynoweth, C. Egbu, M. Sutrisna and A. Parsa, 458-477.

Alterman, R. 2012. "Land Use Regulations and Property Values: The "Windfalls Capture" Idea Revisited." In The Oxford Handbook on Urban Economics and Planning, edited by N. Brooks, K. Donanghy, G.-J. Knapp, 755-786. Oxford University Press.

Altshuler, A. A., and J. A. Gomez-Ibanez. 1993. Regulation for Revenue: The Political Economy of Land Use Exactions. Washington, DC: Brookings Institution Press.

Andersson, E., S. Barthel, S. Borgström, J. Colding, T. Elmqvist, C. Folke, and Å Gren. 2014. "Reconnecting cities to the biosphere: Stewardship of green infrastructure and urban ecosystem services." AMBIO 43 (4): 445-453. DOI: 10.1007/s13280-014-0506-y.

Bah, R., and S. Wallace. 2008. "Reforming the property tax in developing countries: a new approach." International Studies Program Working Paper 08-19. Georgia State University: Andrew Young School of Policy Studies.

Bartke, S., ed. 2013. Science for Environment Policy – Thematic Issue: Brownfield Regeneration. European Commission. http://ec.europa.eu/environment/integration/research/newsalert/pdf/39si.pdf/

Bateman, I. J., G. M. Mace, C. Fezzi, G. Atkinson, and K. Turner. 2011. "Economic analysis for ecosystem service assessments." Environmental and Resource Economics 48 (2): 177-218. DOI: 10.1007/s10640-010-9418-x.

Beswick, C., and S. Tsenkova. 2002. "Overview of urban regeneration policies." In Urban regeneration: Learning from the British experience, edited by S. Tsenkova, 9-17. Calgary: University of Calgary, Faculty of Environmental Design.

Birch, K., and M. Siemiatycki. 2016. "Neoliberalism and the geographies of marketization: The entangling of state and markets." Progress in Human Geography 40 (2): 177–198. DOI: 10.1177/0309132515570512.

Booth, P. A. 2012. "The unearned increment: Property and the capture of betterment value in Britain and France." In Value capture and land policies, edited by G. K. Ingram and Y.-H. Hong, 74-93. Cambridge, MA: Lincoln Institute of Land Policy.

Bowers, J. 1992. "The economics of planning gain: a re-appraisal." Urban Studies 29 (8): 1329-1339.

Brown, H. J., and M. O. Smolka. 1997. "Capturing public value from public investments." In Land use and taxation: Applying the insights of Henry George, edited by H. J. Brown. Cambridge, MA: Lincoln Institute of Land Policy.

Brueckner, J. K. 1997. "Infrastructure financing and urban development: The economics of impact fees." Urban Studies 34 (3): 361-376. DOI: 10.1016/S0047-2727(97)00036-4.

Calavita, N., and A. Mallach. 2009. "Inclusionary housing, incentive and land value recapture." Land Lines 21 (1): 15-21.

Callies, D. L., and A. Suarez. 2005. "The Law and Politics of Local Governance: Privatization and the Providing of Public Facilities Through Private Means." Journal of Law and Politics 21: 477-504.

Cardoso, I. M., L. M. Almeida, E. Vilares, and F. Ferreira. 2011. Análise Comparativa das Leis dos Solos de Países Europeus – Estudo de Enquadramento para a Preparação da Nova Lei do Solo. Documento Técnico DGOTDU 8/2011. Portugal: Ministério do Ambiente e do Ordenamento do Território, Direcção Geral do Ordenamento do Território e Desenvolvimento Urbano.

Chan, K. M., P. Balvanera, K. Benessaiah, M. Chapman, S. Díaz, E. Gómez-Baggethun, R. Gould, N. Hannahs, K. Jax, S. Klain, G. Luck, B. Martin-López, B. Muraca, B. Norton, K. Ott, U. Pascual, T. Satterfield, M. Tadaki, J. Taggart, and N. Turner. 2016. "Why Protect Nature? Rethinking Values and the Environment." Proceedings of the National Academy of Sciences 113 (6): 1462-1465.

Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. O'Neill, J. Paruelo, R. Raskin, P. Sutton, and M. van den Belt. 1997. "The Value of the World's Ecosystem Services and Natural Capital." Nature 387 (6630): 253-260. DOI: 10.1038/387253a0.

Correia, P. V. D. 1993. Políticas de Solos no Planeamento Municipal. Lisboa: Fundação Calouste Gulbenkian.

Daily, G.C., P. A. Matson, and P. Vitousek. 1997. "Ecosystem Services Supplied by Soil." In Nature's Services: Societal Dependence on Natural Ecosystems, 113–132.

Daily, G. C., S. Polasky, J. Goldstein, P. M. Kareiva, H. A. Mooney, L. Pejchar, T. H. Ricketts, J. Salzman, and R. Shallenbergger. 2009. "Ecosystem Services in Decision Making: Time to Deliver." Frontiers in Ecology and the Environment 7 (1): 21-28. DOI: 10.1890/080025.

Daily, G. C., and P. A. Matson. 2008. "Ecosystem Services: From Climate Regulation to Biodiversity." Annual Review of Environment and Resources 33: 195-222.

Degen, M., and M. García. 2012. "The Transformation of the 'Barcelona Model': An Analysis of Culture, Urban Regeneration and Governance." International Journal of Urban and Regional Research 36 (5): 1022–38. DOI: 10.1111/j.1468-2427.2012.01152.x.

De Groot, R. S., R. Alkemade, L. Braat, L. Hein, and L. Willemen. 2010. "Challenges in Integrating the Concept of Ecosystem Services and Values in Landscape Planning, Management and Decision Making." Ecological Complexity 7 (3): 260-272. DOI: 10.1016/j.ecocom.2009.10.006.

DGOTDU. 2011. Preparação do Projecto da Nova Lei do Solo: Workshop com Especialistas. Documento de Apoio ao Debate. Lisboa, Portugal: Direcção Geral do Ordenamento do Território e Desenvolvimento Urbano.

Dikeç, M. 2007. Badlands of the Republic – Space, Politics and Urban Policy. MA, USA: Blackwell Publishing.

Ernstson, H., and S. Sörlin. 2009. "Weaving Protective Stories: Connective Practices to Articulate Holistic Values in the Stockholm National Urban Park." Environment and Planning A 41 (6): 1460-1479. DOI: 10.1068/a40349.

Eshuis, J., E. Braun, and E.-H. Klijn. 2013. "Place Marketing as Governance Strategy: An Assessment of Obstacles in Place Marketing and Their Effects on Attracting Target Groups." Public Administration Review 73 (3): 507-516.

Faludi, A. 2009. "A Turning Point in the Development of European Spatial Planning? The 'Territorial Agenda of the European Union' and the 'First Action Programme'." Progress in Planning 71 (1): 1-42. DOI: 10.1016/j.progress.2008.09.001.

Fainstein, S. 2010. The Just City. Ithaca and London: Cornell University Press.

Fainstein, S. 2012. "Land Value Capture and Justice." In Value Capture and Land Policies: Proceedings of the 2011 Land Policy Conference, edited by G. K. Ingram and Y.-H. Hong, 21-40. Cambridge, Massachusetts: Lincoln Institute of Land Policy.

Gielen, D. M., and E. van der Krabben. 2017. "Developer Obligations Towards Better Urban Infrastructure." Working paper, Lincoln Institute of Land Policy.

Guinote, J. 2019. "A Afetação Social das Mais-Valias no Planeamento Urbano – A Nova Lei de Solos em Portugal." Revista de Geografia e Ordenamento do Território 17 (6): 93-121. DOI: 10.17127/got/2019.17.005.

Hartwick, J. M. 1990. "Natural Resources, National Accounting, and Economic Depreciation." Journal of Public Economics 43 (3): 291-304. DOI:10.1016/0047-2727(90)90002-Y.

Harvey, D. 2000. "Possible Urban Worlds." Megacities Lecture 2000. Amersfoort: Twynstra Guide.

Harvey, D. 2008. The Right to the City. New Left Review.

Healey, P. 1992. "Planning Through Debate: The Communicative Turn in Planning Theory." Town Planning Review 63 (2): 143-162.

Hendricks, M., and A. Tonkin. 2010. Land Value Capture/Taxation (LVC/T) Scoping Study: Final Report. Cape Town, South Africa: Development Action Group.

Hendricks, A., T. Kalbro, M. Llorente, T. Vilmin, and A. Weitkamp. 2017. "Public Value Capture of Increasing Property Values—What Are the 'Unearned Increments'?" In Land Ownership and Land Use Development - The Integration of Past, Present, and Future in Spatial Planning and Land Management Policies, edited by E. Hepperle, R. Dixon-Gough, R. Mansberger, J. Paulsson, J. Hernik, and T. Kalbro. Zurich, Switzerland: vdf Hochschulverlag.

Hong, Y.-H., and D. Brubaker. 2011. "Integrating the Proposed Property Tax with the Public Leasehold System." In China´s Local Public Finance in Transition, edited by J. Y. Man and Y.-H. Hong, 165-189. Cambridge, Massachusetts: Lincoln Institute of Land Policy.

Ingram, G. K., and Y.-H. Hong. 2007. Land Policies and Their Outcomes. Cambridge, MA: Lincoln Institute of Land Policy.

Ingram, G., and Y.-H. Hong. 2012. "Land Value Capture: Types and Outcomes." In Value Capture and Land Policies: Proceedings of the 2011 Land Policy Conference, edited by G. K. Ingram and Y.-H. Hong, 3-18. Cambridge, Massachusetts: Lincoln Institute of Land Policy.

IPCC (Intergovernmental Panel on Climate Change). 2007. Climate Change 2007: Synthesis Report. IPCC.

Kitson, M., and J. Michie. 1997. "Does Manufacturing Matter?" International Journal of the Economics of Business 4 (1): 71-95. DOI: 10.1080/758532195.

Ko, K., and B. Rosenblatt. 2013. "Land Value Capture 101: How to Fund Infrastructure with Increased Property Values." Accessed August 19, 2013. http://blog.tstc.org/2013/08/19/land-value-capture-101-how-to-fund-infrastructure-with-increased-property-values/.

Law nº 31/2014. Portuguese Land Territorial Ordering and Urbanism Act.

Mata, J. 2011. Economia da Empresa. Fundação Calouste Gulbenkian.

Micelli, E. 2002. "Development Rights Markets to Manage Urban Plans in Italy." Urban Studies 39 (1): 141-154.

Muradian, R., E. Corbera, U. Pascual, N. Kosoy, and P. H. May. 2010. "Reconciling Theory and Practice: An Alternative Conceptual Framework for Understanding Payments for Environmental Services." Ecological Economics 69 (6): 1202-1208. DOI: 10.1016/j.ecolecon.2009.11.006.

Needham, B. 2006. Planning, by Law and Property Rights Reconsidered. London: Ashgate.

Nelson, A., L. Bowles, J. Juergensmeyer, and J. Nicholas. 2008. A Guide to Impact Fees and Housing Affordability. Washington, DC: Island Press.

Netzer, D. 1998. "Land Value Taxation: Could it Work Today?" Land Lines 10. http://www.lincolninst.edu/pubs/426_Land-Value-Taxation—Could-It-Work-Today-/.

Notice nº 12773/2021. Regulation of Porto Municipal Master Plan.

Oates, W. E. 2005. "Toward a Second-Best Theory of Local Public Finance." International Tax and Public Finance 12 (3): 349-373.

O'Connor, J. 1973. The Fiscal Crisis of the State. New York: St. Martin's Press.

OECD (Organisation for Economic Co-operation and Development). 2006. Cost-Benefit Analysis and the Environment: Recent Developments. OECD Publishing.

Pagiola, S., J. Bishop, and N. Landell-Mills. 2002. Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development. Earthscan Publications.

Pardal, S. 2006. "Os Planos Territoriais e o Mercado Fundiário." Paper presented at the XVI Congresso da Ordem dos Engenheiros, Açores.

Pinilla, J. F. 2019. "Developers´ Obligations as a Land Value Capture Tool: Practice and Lessons from Colombia." In Public Infrastructure, Private Finance – Developer Obligations and Responsibilities, edited by D. M. Gielen and E. van der Krabben. London: Routledge.

Piketty, T. 2014. Capital in the Twenty-First Century. Cambridge, MA and London, England: The Belknap Press of Harvard University Press.

Plevoets, B., and J. Sowińska-Heim. 2018. "Community Initiatives as a Catalyst for Regeneration of Heritage Sites: Vernacular Transformation and Its Influence on the Formal Adaptive Reuse Practice." Cities 78 (8): 128-139.

Rebelo, E. M. 2009. "Land Economic Rent Computation for Urban Planning and Fiscal Purposes." Land Use Policy 26 (3): 521-534. DOI: 10.1016/j.landusepol.2008.07.008.

Rebelo, E. M. 2012. “Planning to Fight Speculation: Outstanding Influences on Land Rent.” In Agricultural Economics: New Research, edited by T. H. Lee, 89-111. Nova Science Publishers.

Rebelo, E. M. 2022. “Betterment Capture for Social Redistribution: A Developer Obligation for Touristic Developments.” Progress in Planning 161(7):1-20. DOI: 10.1016/j.progress.2021.100615.

Regulation nº 616/2021. Equal Distribution Regulation of Buildability and Urban Rates in Porto City.

Repetto, R. 1986. “Economic Incentives for Environmental Protection: Integrating Theory and Practice.” Land Economics 62 (4): 333-347.

Ronchi, S., A. Arcidiacono, and L. Pogliani. 2020. “Integrating Green Infrastructure into Spatial Planning Regulations to Improve the Performance of Urban Ecosystems. Insights from an Italian Case Study.” Sustainable Cities and Society 53 (2020) 101907. DOI: 10.1016/j.scs.2019.101907.

Rosenberg, R. H. 2006. “The Changing Culture of American Land Use Regulation: Paying for Growth with Impact Fees.” Southern Methodist University Law Review 59 (1): 177-264.

Sacco, P. L., S. Ghirardi, M. Tartari, and M. Trimarchi. 2019. “Two Versions of Heterotopia: The Role of Art Practices in Participative Urban Renewal Processes.” Cities 89 (6): 199-208. DOI: 10.1016/j.cities.2019.02.013.

Samsura, D. A. 2013. Games and the City; Applying Game-Theoretical Approaches to Land and Property Development Analysis. Trail Thesis Series, Delft.

Sassen, S. 2000. Cities in the World Economy. Thousand Oaks, CA: Pine Forge Press.

Skaburskis, A., and M. Qadeer. 1992. “An Empirical Estimation of the Price Effects of Development Impact Fees.” Urban Studies 29 (5): 653-667. DOI: 10.1080/00420989220080.

Smolka, M. O., and D. Amborski. 2000. Value Capture for Urban Development: An Inter-American Comparison. Cambridge, MA: Lincoln Institute of Land Policy.

Smolka, M., and D. Amborski. 2003. “Recuperación de Plusvalías para el Desarrollo Urbano: Una Comparación Inter-Americana.” EURE – Revista Latinoamericana de Estudios Urbanos Regionales 29 (88): 55–77. DOI: 10.4067/S0250-71612003008800003.

Smolka, M. O., and D. Amborski. 2007. “Value Capture for Urban Development: An Inter-American Comparison.” Working Paper, Lincoln Institute of Land Policy. http://lincolnint.edu/pubs/download.asp?doc_id=576&pub_id=1279/.

Smolka, M. O., and F. Furtado. 2003. The Value Capture Debate in Latin America. Land Lines 15 (3). http://www.lincolnint.edu/pubs/832_The-Value-Capture-Debate-in-Latin-America.

Soja, E. 2010. Seeking Spatial Justice. London: University of Minnesota Press.

Theurillat, T., and O. Crevoisier. 2013. “The Sustainability of a Financialized Urban Megaproject: The Case of Sihlcity in Zurich.” International Journal of Urban and Regional Research 37 (6): 2052-2073. DOI: 10.1111/j.1468-2427.2012.01140.x.

Tidball, K. G., and M. E. Krasny. 2014. Greening in the Red Zone: Disaster, Resilience and Community Greening. Springer.

Torrence, M. I. 2008. “Forging Glocal Governance? Urban Infrastructures as Networked Financial Products.” International Journal of Urban and Regional Research 32 (1): 1–21. DOI: 10.1111/j.1468-2427.2007.00756.x.

United Nations. 1976. The Vancouver Action Plan – Recommendation D.3. United Nations Conference on Human Settlements. Vancouver, Canada.

United Nations Human Settlements Programme (UN_Habitat), and Global Land Tool Network (GLTN). 2020. "Where to Start? A Guide to Land-Based Finance in Local Governance – A World in Which Everyone Enjoys Secure Land Rights." Accessed April 7, 2020. https://gltn.net/2020/04/07/where-to-start-a-guide-to-land-based-finance-in-local-governance/.

Von Haaren, C., A. A. Lovett, and C. Albert. 2019. Landscape Planning with Ecosystem Services. Springer Science and Business Media LLC.

Walters, L. C. 2011. Land and Property Tax: A Policy Guide. Nairobi, Kenya: UN_Habitat and the Global Land Tool Network.

Walters, I. C. 2012a. "Are Property-Related Taxes Effective Value Capture Instruments?" In Value Capture and Land Policies, edited by G. K. Ingram and Y.-H. Hong, 187-214. Cambridge, MA: Lincoln Institute of Land Policy.

Walters, L. 2012b. "Land Value Capture in Policy and Practice." Paper presented at the World Bank Conference on Land and Poverty, Washington, DC.

Webster, C. J. 1998. "Public Choice, Pigouvian and Coasian Planning Theory." Urban Studies 35 (1): 3–75. DOI: 10.1080/004209898.

World Bank. 1992. Environmental Accounting for Sustainable Development. The World Bank.