

Financing methods applied to urban infrastructures. An application to Milan metro system.

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Abstract

The paper discusses the topic of the so-called “innovative” financing methods, applied to urban infrastructures. A range of methods is, or is supposed to be, available to policy makers to partially or fully finance transport infrastructures. In general, these methods are claimed to be the solution to financing problems, but in reality they have been seldom applied and the experience on the actual effects is then limited. Methods range from traditional public procurement to land value capture, passing by the taxes of scope and project financing.

The paper is structured as follows. After an introduction, a review of the available traditional and innovative methods is provided in section 2 and 3, both from the theoretical and applicative point of view. Some literature examples are given in section 4, stressing the main outcomes of some applications around the world. The following section is dedicated to a cross-methods comment. Section 6 is proposing an exercise application to Milan new metro line 4 financing. Some “innovative” funding methods are commented, focusing on the application of a simple land value capture scheme, including an exercise calculation of the possible revenue. Conclusions draw a general comment on the topic, its limits and the motivations of the success among policy makers.

Keywords: land value capture; infrastructure, urban transport; rent skimming; project financing.

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1. Introduction

The paper discusses the topic of the so-called “innovative” financing methods, applied to urban infrastructures. A range of methods is, or is supposed to be, available to policy makers to partially or fully finance transport infrastructures. In general, these methods are claimed to be the solution to financing problems, but in reality they have been seldom applied and the experience on the actual effects is then limited.

The paper revises the traditional and innovative financing methods in the following sections 2 and 3. Later, section 4 proposes some significant case studies among those where the land value capture is applied to transport infrastructure financing. Section 5 is dedicated to a comparison of positive and negative aspects of all these approaches. Final section 6 is proposing an exercise application to Milan new metro line 4 financing, calculating the order of magnitude of possible land value capture in an European city.

2. Traditional infrastructure financing methods

Socio-economic feasibility should be at the roots of public expenditure into infrastructure. The issue of financing, especially if the public intervention is needed, comes after. In very general terms, we may stress that

- Social welfare increasing schemes, that can be totally paid by the private sector, must not be financed with public sources;
- Social welfare increasing schemes, but financially unsustainable, should be paid by the public sector only for the share maximising the social surplus (applying the concept of Marginal Opportunity Cost of Public Funds. See Snow and Warren, 1996). All the rest of investments should be covered by revenues (i.e. project financing or concessions, etc.).

This part of the paper is briefly describing the main financing methods considered as “traditional”, given the broad range of applications and examples available in literature.

Public funding

With public funding we intend the funding of infrastructural investments with lump sum transfers from the state, for which no remuneration or reimbursement is requested. This money comes usually from general

taxation, when potential revenues are insufficient to finance the investment (often neither investments nor the running costs) that is however socially positive. This is the most common case in urban transit systems.

Available resources can be directly used by the state or can be transferred from higher administrative levels to lower ones for a specific scheme (earmarked transfers) or for general purposes and decided by the beneficiary (non-earmarked transfers). A fourth case is the financing with loans contracted by the administration to spread the cost over time. Finally, we can consider as public investment an investment paid with an equity increase to a public company, for which any remuneration is impossible.

Usually, public administrations use a range of funding sources to finance single schemes, such as loans by banks (i.e. investors not participating to risk), European funds, etc. Loans in favour of a public administration are usually borrowed at a lower interest rate compared to those applied to private investors, thanks to the *sovereign guarantee*. In other words, in general, capitals could be raised at a lower cost by public administrations than by private investors.

Public-private financing

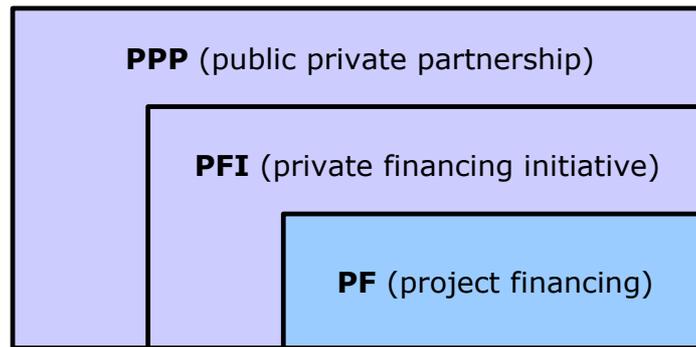
The so called “public – private financing” is in fact a broad range of tools that involve, in the same project, both private and public contributions.

Public – private partnership (or *PPP*) is the most general form of partnership that substitutes the traditional public procurement. This kind of approach is not limited to financial aspects (i.e. co-financing of projects), but involves also the sharing of management and technical capabilities and is regulated by a long term contract for the delivery of goods and services. The revenues of the private partner, for example in the case of urban transport, are usually constituted by fares (both real and, more and more frequently, shadow tolls), subsidies or other revenues such as advertising or exploitation of ancillary services (for example the management of commercial spaces into stations).

Two are the true drivers to PPP:

- The higher efficiency and effectiveness of a private partner (if correctly regulated) in providing services instead of public procurement
- Financial constraints of public sector, such as the European Stability Pact, or simple shortage of funds.

Figure 1. Relationships among PPP, PFI and PF



The *Private Finance Initiative* (or *PFI*) is a form of collaboration between public and private that involves mainly financial aspects.

The advantages of PFI with respect to traditional public procurement and financing are:

- Increase of efficiency and effectiveness thanks to a more realistic risk allocation (see below),
- Better respect of costs and timing, if correctly contracted;
- Increase of debt exposition of local administrations, above budget constraints. It means that, let's say, a municipality can build and operate a metro system even without any financial and technical capability.

To the other side, some elements make the PFI critical towards public investment.

- PPP/PFI schemes are, by definition, more expensive than public funding (Blanc-Brude et al., 2006), essentially due to two elements. The investment is usually optimised to decrease the life cycle cost but not the initial investment cost and there is a *cost of risk* that is not *explicitly* included into public financing¹.
- The role of regulator must be very strong. Otherwise the private ownership of facilities make the public sector very weak as a pure service purchaser.
- A PFI on an infrastructure is usually lasting decades, especially for less profitable projects. The ownership of the facilities goes back to the public at the end of the contract, possibly under the payment of a takeover compensation.

¹ This does not mean that the cost of risk is zero for public investments: rather it is simply hidden instead of explicitly contracted. We may say that a hidden cost is less desirable than an explicit cost in case of public choices. However, in some cases the extra cost of risk is counterbalanced by a better efficiency and a better design with respect to inefficient public investments. See for example Gervasoni e Del Giudice (2002) that report a study on 150 PF schemes.

- Together with the project, the public partner must carefully contract all the issues concerning subsidies, level of services, standards, quality, fares, etc. This operation is very difficult due to the length of contracts and to information asymmetries.

The most known form of PPP/PFI in transport sector is the *Project Financing* (or *PF*). PF is a PFI, i.e. a partnership activity involving private capitals and capabilities, related to a specific project and for which a company ad-hoc is constituted. The risk capital of the company is invested by both partners and the project is supposed to remunerate it. The intrinsic financial feasibility of the project and the risks associated are at the basis of the partnership, instead of the characteristics of the private partner. Often a public lump sum transfer is present anyway, covering part of the investment with no remuneration. This happens very frequently in urban transport sector.

Similarly to PFIs, also PF are theoretically more expensive. However, if correctly managed they can actually be less expensive in comparison with the enormous cost overruns that often occur in large projects, both private and public (Flyvbjerg et al., 2003). For example, Alario et al. (2003) quantifies, for a sample of road projects funded by EIB, an extra cost due to risks explicitation of +24%, but this is of the same magnitude order of cost overruns for traditional investment, as reported in literature.

The positive facts associated to PF are similar to PFI ones. However, it must be underlined that it is more and more frequent often the use of PF schemes as a way to hide conventional public investments, impossible due to budget constraints. This fact, especially if not known to the public opinion, should be avoided because source of higher costs (both for risk management and cost of capital). In other words, if a scheme does not present any correlation between performance, fares and demand, there is no risk and the PF simply becomes a spreading in the time of a cost or an hidden loan.

In the so-called PF we can have a range of different mechanisms, varying according to the case and to the will of the contractors. Differences are given by the presence or not of the design phase, by the property of assets, etc. The following table summarises the existing typologies.

Table 1. Types of Project Financing

<i>Contract type</i>	<i>Roles and competencies of the private partner</i>
BOT – <i>Build Operate and Transfer</i>	The private partner builds, operates and gives back the assets to the State at the end of the concession.
DBOT – <i>Design Build Operate and Transfer</i>	The private partner designs, builds, operates and gives back the assets to the State at the end of the concession

BOO – <i>Build Own Operate</i>	The private partner builds and owns the facility. It is not given back to the State.
BTO – <i>Build Transfer and Operate</i>	The private partner builds the infrastructure, whose ownership is of the State, but goes on in managing it.
BOST – <i>Build Operate Subsidize and Transfer</i>	The private partner builds, operates and gives back the assets to the State at the. It receives subsidies during operations.
DBFO – <i>Design Build Finance and Operate</i>	The private partner designs, builds, finances totally and operates the infrastructure.
ROL – <i>Rehabilitate Operate and Leaseback</i>	The private partner restructures and manages n infrastructure. The ownership is regulated by a financial leasing contract.

Source: IRER, 2007.

A basic issue for the credibility of public – private partnership schemes is that of risk allocation. Theory suggests to preferentially allocate any single risks to the partner that is more suitable to manage it and consequently minimise it or obtain the best efficiency. A possible classification, proposed by Phang (2007) for an urban rail system, tends to leave to the private partner the financial risks and those associated to building and operations, i.e. the phases that the private partner can actively manage. All the exogenous risks are left to the public or shared. The commercial risk is not explicitly quoted because not very significant in urban transit systems subject to subsidies and regulated fares, i.e. is a regulatory risk. Instead, the risk associated to forecasting is shared.

The issue of regulatory risks requires a further comment. It is realistic that a private operator can charge himself industrial and, sometimes, commercial risks. Conversely, he does not desire to risk on the topics related to public decisions (for example expropriations, uncertainties, regulatory changes, etc.). The only cases in which a private operator will charge itself for those risks is when:

- There is an appropriate payoff;
- He can manage them in some other way;
- It is possible to renegotiate ex-post the contractual conditions.

In all cases, these strategies generate an extra-cost for the project that would not exist if these risks are left to the public. The last option, in particular, is very common and depends directly on the pre-contractual power of the private operator (in terms of political power or informative rents, or both) to reject potential risks back to the public partner (Phang, 2007). These obvious opportunistic behaviours should be avoided because generating considerable extra-costs or inefficiencies or unregulated profits.

Fiscal Charges

A further source of public transport funding concerns the fiscal charges on property investment. When a property project is built, it can produce some negative repercussions on the surrounding area. This can arise some environment, social, economic and financial impacts (for example the necessity to improve infrastructure networks, increased costs of social services, etc.). In these cases it is possible to create a partnership between public and private subjects (public sector and the property developers) to compensate those impacts.

This practice can assume different forms. In situations related to conventional buildings, this compensation consists in the payment of construction costs for basic social services. If the negative impacts are significant, especially for the transport system, public sector can demand to developers to contribute to the funding of offsetting works (for example a new transport infrastructure, a new social services or the improvement of the existing network). There are at least three main types of agreement between public sector and property developers and they depend on moment of their applications:

- Proffers;
- Impact fees;
- Benefit assessment.

Proffers are a packet of actions that property developer has to take on to obtain the construction's permit. They are fundamental to begin the building and public sector cannot grant the concession without them. The dimension of such actions is in relations with the measurement of the impacts that the project establish with the contest. In the transport sector, the actions can concern the building of new road or roundabout or some traffic lights as pre-condition for a new development. In case of larger negative impacts, actions required might be wider.

The second type of fiscal charge is named **impact fees**. These measures were pioneered in United State in 1960. They are fees, paid from land owners, to cover the costs of services and infrastructures in proportion to the project. Impact fees are financial contributions imposed by communities on developers or builders to pay for capital improvements within the community which are necessary to serve the new development. These fees are used to cover the social costs to the new project and are considered a reimbursement, from property developer, to compensate the negative impacts of the project. In case of transport, the fees can be used to pay

for new roads, extending water and sewer lines, and schools, among other things. In most cases impact fees are used in new development. Impact fees have become the most important method in infrastructure financing and an essential part of local governments to fund infrastructure or public services. There are two main types of impact fees:

- Linkage fees. They are used in order to provide for expanded services that are caused from the new development. They can also be used towards residential developers as well for social needs that rise from new development.
- Mitigation fees. This fees concern environment impacts due to new property development, and they are used to refund the negative impact on community.

Impact fees can be also damaging for local economies, because some property developers can move their projects to cities where there are not such fees. A second problem raise if the imperfections of the estate market have the consequence of transferring the fees to the house buyers instead of skimming developers' profits.

The third tool is that of *Benefit Assessment*. These are a tax that local administrators charge on property developers for the benefits introduced by public sector to a new project. The fees concern the benefits of new infrastructure and they are proportional to the services offered. Benefit Assessment tool is attractive for several reasons. It shifts the burden of infrastructure finance from the general public to properties directly receiving the benefit, while avoiding the short-term time horizon of purely private infrastructure provision. BA is often used to cover the costs of a new public transport lines in an area, through the fees on beneficiary (Newport Partners LLD, Davidsonville MD, 2007).

The mechanisms of funding above described are not a form of co-funding between public and private sector to build new infrastructure works. They are rather a financial tools used to compensate for negative impacts or for new services that can arise due to the building of a new development. Those tools are not linked to the land or building value and they don't consider the results of their improvement on building prices. The table shows a comparative features of these principal fiscal charges.

Table 2. Comparative features of fiscal charges

	PROFFERS	IMPACT FEES	BENEFIT ASSESSMENTS
<i>Subject towards the tool is addressed</i>	Property developer	Property developer	Property owner
<i>What</i>	Necessary before construction's permit	Reimbursements to compensate social costs of the project.	Quantification of the benefits of new project
<i>When</i>	Ex-ante	Ex-ante / In itinere	Ex-post
<i>Why</i>	To obtain the construction's permit	To fund actions of public interest linked new project	To capture the benefit of new infrastructure

3. “Innovative” infrastructure financing methods

The present section tries a review of the most significant “innovative” approaches found in literature for the financing of urban infrastructures.

Dedicated taxes

Dedicated taxes are particular fees applied to some activities or people to achieve one specific purpose or finance one specific project². The essential argument is based on the principle that the willingness to pay of the users is larger if they perceive that the tax is used to finance a shared project. They show some positive effects:

- The tax is linked at one specific development and this can arise community’s responsibility towards that project and the policy related to it;
- The tax is needed to assure a minimum but constant funding to the project;
- The tax can help economical and temporal stability to the project.

Dedicated taxes have also some criticism, despite the good successes and the wide application range. The main risk is about the possibility that public administrations use too extensively these taxes instead of the general taxation. Then, it can increase the difficulty of adapting budgets to changing economic and social conditions because part of budget is fixed and assigned for some years to a determinate project. Moreover, if the use of this tool doesn’t stop with the object’s achievement, there is the risk that its social acceptability

² For example, Doherty (2004) reports some USA cases of limited surcharges on sales prices, usually approved by local referendums, to finance transit lines. In California and Europe some dedicated taxes in form of fuel surcharge exist to finance multimodal schemes.

can decrease. For example, in the case of transport infrastructure, the taxes on fuel could be removed when the project is concluded.

Land value capture

There is a strong relationship between land value and accessibility, except the cases in which the negative effects such as noise or pollution prevail. This relationship is clearly visible when a new transport infrastructure is built: the increased accessibility of the surrounding area, generates nearly everywhere an increase in the value of the land or of the buildings. This effect is well known in literature (see, for example, the review by Smith e Gihring, 2006; So et al., 1997; Ryan, 1999; Martinez e Viegas, 2007 and the section “A review of land value increases due to transport investments”, at page 12).

The increase of land value is the combination of two distinct effects. On one side the area enjoys a better accessibility in the sense of lower access time. This decrease in generalised cost is capitalised and generates an increase in the utility of the area and of its market value. The second element is related to the effect of rent or of relative scarcity of land with these characteristics. In other words, land parcels with high accessibility are scarce and then more valuable. This rent, without skimming mechanisms, is transferred to building prices and finally on the prices of goods and services produced in that area. This has the consequence of a differential advantage for certain individuals, namely the owners of those areas, in disfavour of all the other owners (Doherty, 2004) and all the other citizens. Moreover, this monetary advantage is given to them at no cost, since transport infrastructures (especially urban ones) are usually paid totally or partially by public budget.

Given these premises, some tax mechanisms capable of capturing and redistributing these differential advantages would, at the same time, solve a problem of equity and raise funds necessary to the transport system. The idea is to tax the owners of the benefitted areas in order to (partially or totally) skim their land value increase and to invest this value into the infrastructure building or operation. If this skimming is not applied, all the improvements in the accessibility (i.e. the lower access time) tends to become in the medium term pure land rent for the privileged owners (Doherty, 2004). At the same time, users will be forced to pay more the buildings and the services offered there or go away in order to “escape” from the land rent (Ponti et al. 2008, under publication).

Despite the apparent simplicity, these principles are nearly unapplied all over the world even if some

literature on the topic is present and will be discussed here. In general, three mechanisms are classified in literature (Doherty, 2004):

- *Betterment Tax*: tax similar to the impact fees, covering the transport investments that raise the land value at no cost for the developer/owner. Usually it is applied *una tantum* on new redevelopments.
- *Tax Increment Finance*: consists in various mechanisms. It is a tax applied to properties near to high accessibility spots (typically the stations or the metro stops) in order to promote a higher efficiency and force higher densities on the most accessible areas if residual capacity exist.
- *Joint development mechanisms*: is a form of cooperation and cost sharing between public operator and private owner/developer. For example, the developer builds a station or pays for the services.

All these mechanisms are not free from practical, distributive or distortive problems. For example, the lump sum taxation of all land owners benefited from a new infrastructure can be unpractical (they could not be able to pay for it), unfair (why one should pay for a useless infrastructure that is supposed to give benefits in the far future). More details on such problems will be given in the following paragraph “Land value capture on existing properties”, page 20.

Co-financing trough building indexes increase

Some infrastructure could be funded through a cooperation between the public agency and the private developers. In this case local authority or government, in order to finance and maximize the profitability of its investment in public transport, encourages property development (residential and/or commercial) close to stations. Public sector can increase the value of land by giving the possibility to change in destination's use or increasing the building volume index. The private developer will benefit from larger profits, better accessibility and more customers. In change, developer will contribute sharing the transport infrastructure construction costs. This tool is defined “Joint Development Mechanism”. The business and commercial opportunities that arise from land value increase can be further capitalised by the public sector also by lending sites within the transport infrastructure (underground commercial activities, advertising, etc.).

The main disadvantage could be the discretionary components of the process and the potential scarce transparency. Also, this can drive to an excessive edification.

Valorisation of public estate

The availability of public areas could be an opportunity to funding new investment. Transport investments should bear in mind the opportunity of these areas, especially if their extension is considerable, by increasing their accessibility and value. The increased value can be used to finance the construction costs of necessary transport infrastructure. These process will establish some benefit not only for the infrastructure (to cover the costs), but also in the area around the project.

For example, in Milan, the location of the so-called “Passante” rail line, in the 80s, was driven also trough the necessity to link some industrial areas blighted. These areas, most of them of public property, increased their value because of new transport infrastructure and some important functions and activities were localized there (universities, a directional centre, research centres).

Another example is the Oeresund Bridge between Copenhagen and Malmoe in Sweden. The main residential (and also tertiary) developments of the whole area were concentrated in Malmoe, especially because guaranteeing high accessibility levels trough new station (Beria, 2008).

4. Case studies from literature

A review of land value increases due to transport investments

Literature on land prices increases is mainly non-European, with a particular focus on USA cases. The figures found are quite different and are presented here without commenting the methodology used for estimation, that can in many cases explain part of the differences. For the explanation we address the reader to the sources.

Martinez e Viegas (2007) review a small sample of European cities finding house prices increase of +7% - +18%³ for the introduction of a new mass transit system. More information is given for rail and *light rail* systems in USA and European cities, ranging from 20 to 50% increase.

GVA Grimley (2004) includes a sample of USA cities and finds out values of +4% - +25% on property or rent prices. They use a figure of +10% for the Scottish case they need to focus on. Referring in part to the same cities, Cambridge Systematics (1998) reviews property prices increases of +2% - +18% for houses and +4% - +19% for offices.

³ Helsinki metro: da +7,5 a +15%; London e Manchester: effetto positivo non quantificato; Vienna S-BAhn: +18,7%.

The review by Smith e Gihring (2006) catalogues empirical studies for USA and classifies increases of +5% - +25%, with some more extreme cases (+32% in St. Louis and + 45% in Santa Clara).

Hong Kong Mass Transit Railway Company

One of the most cited and successful cases of transport infrastructure financing with land value increases is that of the Hong Kong Mass Transit Railway Company (MTR).

The firm, today largely owned by Hong Kong government (77%), was established in 1975. Its mission was to build and manage a urban rail system for the territory of the former colony. Since year 2000 it became a joint stock company and it is now in charge also of other public rail lines. Today MTR serves the city with nine traditional metros, plus a light rail system, plus a fleet of feeder buses.

The peculiarity of the MTR is the joint management of transit lines and land developments around stations. In Hong Kong, in fact, the land is owned by the public sector, that grants concessions for the estate development lasting for decades to private operators (Martinez and Viegas, 2007). For MTR the main source for financing and running the transport lines is, except fares, the exploitation of these areas, whose value is largely dependent on the transit accessibility (Hong, 1996). There is no direct public financing in form of lump sum transfer or subsidy and the whole system is based on land concessions of 50-70 years (Franceschini, 2008).

Given the strict relationship between land value and accessibility, the firm's strategy is to concentrate the high density estate investments in the areas around its stations, providing concentrated demand to its own metro lines. On the other side, the market value of the estates (tertiary and commercial) is heavily dependent on the accessibility and on the mass of demand. The effect has been the huge development of high density districts around stations and a "transit oriented" city form. Everything is done at no direct cost for the administration.

The financial results have been very interesting. MTR has four main revenues sources, plus one: fares, commercial exploitation of stations, renting its buildings, development of properties to be sold. At the same time, the company enjoys a large financial capability and can provide loans to the developers of its areas. According to sources (Hong, 1996), between 1970 and 1991, the HK government has been capable of capturing trough this mechanism the 39% of the overall land value increase. More than half (69%) was a direct result of the valorisation made by MTR, the rest as property taxes. In total, this mechanism financed

on average the 79% of the totality of infrastructural expenditure in HK. This is the best case known in terms of percentage of infrastructural investment covered by non-tax revenues.

The balance sheets of the MTR show large profits, mainly from real estate development (8,3 billions of HK\$ in 2007), fares (4,6 billions) and rents (1,3 billions) (MTR, 2007).

This successful model could be reproduced only when peculiar conditions are true: the public property of land that can be given out in form of concession, high densities, an appropriate normative system. The first condition is usually not present in Europe, but could be applied in specific contexts and in a more limited but significant way. For example, in case of areas owned by national railways or local authorities, their public exploitation with this mechanism can guarantee at least part of the investment costs.

The case of Business Improvement Districts

Business Improvement Districts (BIDs) were pioneered in The United State, USA, Canada and Australia. They consist in a particular tax, applied mainly on business property localised in a specific area subject to improvement investments. The tax is justified by the increase of the value of the land and, finally, of the property. The basic idea of this financial tool is that public improvement expenditure induce growth in an urban area and that the property taxes of the manifested urban growth are used to recover the development costs (Medda, 2008). In this way, commercial activities become an active actor in the evaluation of costs and benefits of the project, pointing out their *trade-off* and avoiding *free riding* phenomenon. In the UK, business properties can participated in the process to approval the tax and their vote have different weight (Enoch et al., 2005).

A special application of that is Special Assessment District in Los Angeles, linked to the transport investment. In this case a tax, based on land value increment, is used especially to cover the infrastructure costs of a new rail line. Usually the localization of this tax is around the stations (400-800 meters), where the benefits of the accessibility are major (Doherty, 2004). Doherty also suggests some experience in Australia, like the ACT *Change of Use Charge* (o “CUC”) and other taxes less important.

Die Sozialgerechte Bodennutzung: Munich City case

In Europe, the most important case of land rent taxation is “*Sozialgerechte Boden Nutzung*” (SoBoN), in Munich. In 1989 city of Munich decided to appoint the 40% of new buildings for housing programs. The policies to fund these projects must be compulsory and quick (Munich City; Martinez e Viegas, 2007).

In 1994 the present system of taxation was introduced. It aimed to capture the land value increment created to the change of destination’s use in that area. That increment was calculated as the difference between land value before and after the destination. Following of that, each owner had to pay all the infrastructural costs needed for the area up to the level of 2/3 of the land value increment calculated (Martinez e Viegas, 2007, Hass-Klau, 2006), keeping the rest for him.

This system made a success and the tool, when the objective was obtained, was renewed in 1997. Today is it is the normal procedure to have construction ‘s permit. In that period were built 2700 units of new housing (the total on the market was 10400 units), plus some places for free time and handmade activities. In ten years (1994-2004) 100 hectares of private land became public land and it was possible to obtain 172.9 million euro (Martinez e Viegas, 2007).

The acceptability of this tool was positive because of wide use of participative processes between public and private actors.

Other case studies

In literature there are actually few case studies about land value capture mechanisms.

Batt (2001) reports the case of the construction of a new highway in Albany (USA). This infrastructure raised the value of land in the proximity of it (within 2 miles of distance) and the difference of value is calculated in 3734 million dollars. This increment is due to new highway but also to the change of destination’s use. If that value was captured the amount obtained could have consisted in ten times the construction costs of the highway (128 million dollars).

Doherty (2004) shows some case studies in USA and Australia, where the construction of a new transport infrastructure induce new development. In these cases taxation consisted in a *una tantum* tax on land value increment.

In UK there aren't cases applied to transport infrastructures and the mechanism used in France (*versement de transport*) to finance transport improvements cannot be considered as a tool of land value capture (Doherty 2004).

5. A comparative comment on available methods

Different mechanisms of funding can present some different type of applications, with specific benefits and disadvantages. There is no a better tools than others, because each of them is in relation with a particular context. Every mechanism has some limits and his application should tend to minimise them. The following table suggests a possible comparative evaluation.

	<i>advantages</i>	<i>disadvantages</i>
Public funding	<ul style="list-style-type: none"> ▪ Less capital costs ▪ Total public control on public goods 	<ul style="list-style-type: none"> ▪ Existence of a marginal opportunity cost of public funds ▪ Public budget constraints ▪ Scarce efficiency of public sector
Project Financing	<ul style="list-style-type: none"> ▪ Useful in case of budget constraints ▪ Allows a better project management ▪ If the project is efficiently designed, lower total costs 	<ul style="list-style-type: none"> ▪ The wrong allocation of risks drive to wrong outcomes and cost overruns ▪ Capture problems of public bodies ▪ Higher management costs and for risk repayment
Fiscal charges	<ul style="list-style-type: none"> ▪ Good acceptability ▪ Automatic tool and related to the direct costs 	<ul style="list-style-type: none"> ▪ Automatism is risky ▪ Risk of discretionary decisions
Dedicated taxes	<ul style="list-style-type: none"> ▪ Transparency ▪ Responsabilising ▪ Rigid demand goods, if taxed, guarantee a constant flow of money 	<ul style="list-style-type: none"> ▪ Risk to became an ordinary tool ▪ Difficult to adapt ▪ Cross subsidisation
Land Rent Capture	<ul style="list-style-type: none"> ▪ Very effective and neutral to collect resources (Batt, 2001) ▪ Fair (progressive taxation) ▪ Discourages the speculation ▪ Well related to private benefits ▪ Improves the quality of the debate on infrastructure works ▪ Applicable also to existing buildings 	<ul style="list-style-type: none"> ▪ Scarce political acceptance ▪ Technically complex ▪ High transaction costs
Co-financing trough building indexes increase	<ul style="list-style-type: none"> ▪ Reduction of private benefits ▪ Effectiveness in raising resources ▪ Neutral ▪ Good social acceptability 	<ul style="list-style-type: none"> ▪ Discretionary ▪ Does not cover infrastructure running costs ▪ Applicable to new developments only
Valorisation of public estate	<ul style="list-style-type: none"> ▪ Optimisation of transport - land use relationship ▪ Valorisation of underdeveloped assets ▪ Public control ▪ Does not increase fiscal pressure 	<ul style="list-style-type: none"> ▪ Risk for transparency ▪ Risk of insufficient consideration of transport issues in favour of land value ones.

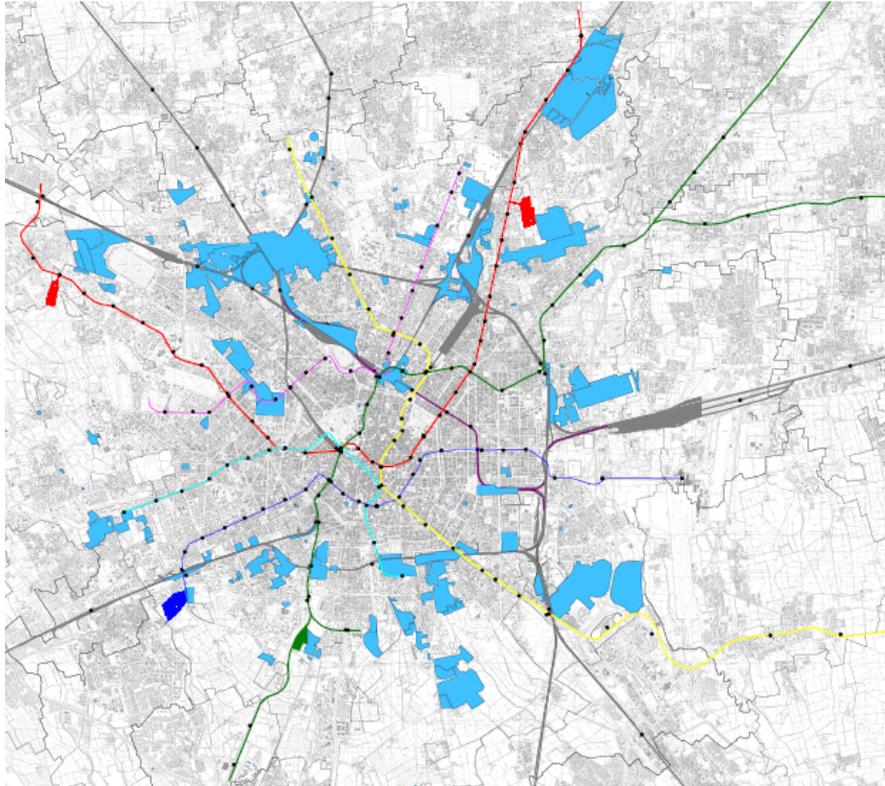
6. A land capture scheme proposal for Milan metro line 4

The previous review offers us a picture of the theories and of the experiences of innovative funding practices in urban infrastructures in Europe and in the world. The large amount of descriptive and theoretical literature available on land value capture, in particular, shows that the interest for the topic is large. This fact is reinforced also by some common-sense considerations: infrastructures, especially the urban transport ones, can increase significantly the value of properties and buildings, at least at the same level of land use planning practices (zoning, imposition of constraints, etc.). Such value is totally generated by public choices and by public expenditure, but is enjoyed mainly by the owners of the areas and the developers of the estates. Even without any budget problem, this fact constitutes at least a problem of equity among taxpayers and citizens (few beneficiaries get an enormous benefit, paid by general taxes). Moreover in case of budget constraints, the choice of one investment closes up the possibility of another one to be built.

This part of the paper tries an application of the before described innovative financing schemes, with particular interest to the land value capture, to the city of Milan, in Northern Italy. Differently from other cases in literature that usually refer to new developments, in Milan there is a predominance of already built areas even concerning the new planned metro lines. In fact, the numerous new lines or extensions included in the *Piano di sviluppo della rete metropolitana milanese* (Development plan of Milan metro system. AMA, 2008) will serve mainly the existing city, where some brownfields areas exist and will be redeveloped⁴.

⁴ The only exception is the forecasted Line 8, crossing the southern border of the town, now almost empty.

Figure 2. Planned lines, scenario 2015. In blue colours, the redevelopment areas.



Source: AMA (2008)

The expected effects on the city are enormous, according to the plan. In particular, aside to accessibility improvement, a large population increase is expected. The assumption, even if not demonstrated and not particularly realistic, is an increase of 20% more inhabitants until 2025. Those new citizens should concentrate mainly on new stations and in new redevelopments, generating 500.000 new daily trips in 2025 (AMA, 2008).

Starting from these premises, it is possible to present various financing schemes:

- i. traditional public funding;
- ii. project financing plus shadow toll (similarly to the line 5, under construction);
- iii. sale or securitisation of public areas;
- iv. co-participation of private developers of new areas to the investment and running costs by means of earmarked taxes, value capture and increase of building permits;
- v. implementation of a land value capture on existing buildings.

The five approaches are not reciprocally alternatives. The PF, given the scarce financial feasibility of urban metros, is a sort of delayed public investment, since it needs the use of shadow tolls paid by the municipality. The other three sources try to capture the increased land value generated on public areas (iii),

new developments (iv) and existing city (v), assuming that in the long term the real estate market will remain on the same price levels than now. The financing via dedicated taxes is excluded because difficult in the Italian context (gasoline taxes and income taxes are national and already high) and because road pricing is already existing in Milan.

The next paragraphs present a preliminary roadmap for the application of these principles in Milan, with a proposal for the land value capture and some calculations.

Funding by sale of public areas

There are some projects in Milan to extend subway network and part of them concern several wide areas, also of public property. It is possible to introduce a land value capture mechanism that can work in two ways (Batt, 2001):

- if infrastructure investment are capitalized in land values in the vicinity of stations or gates by improved accessibility, those values can be recaptured as “rents” in support of the services provided;
- the higher rents on land values in the proximity of the services serve further as an incentive to development density.

The application of this mechanism is articulated as follow:

- census of public areas potentially involved;
- planning of infrastructure route to “touch” that areas;
- socio-economic evaluation of the new path;
- estimation of generated land value, as difference between the land value with and without the transport project;
- definition of the capture mechanism.

Related to the last point, land value generated can be captured by the municipality through the selling of such land, by directly develop and rent the areas or by leasing of the areas at some public or private company to manage and develop them.

The tool is interesting also because an integrated planning of transport infrastructure decisions and property development could make more attractive the involved areas. For example, the position of the buildings inside the areas could be optimized to increase the density close to the most accessible points. Also, it is possible to control cases of saturation of the existing network avoiding to settle the most attractive functions there.

Financing through new developments

New areas to be developed in Milan imply a significant increase in the number of inhabitants. Large quantities of new trips generated need in many cases the construction of new mass transit lines, usually subways. The developers of such areas are, at the same time, significantly benefited of such necessary investments in terms of increased land value.

Land value capture mechanism in Milan could then be implemented with *lump sum* tax on construction works plus an annual tax on operation costs, both applied to new property developers. In fact it can be stressed that new developments are generating the need for new infrastructures, otherwise sufficient. This mechanism is classified under the group of *proffers*. It can be made more incentive promoting by using forms similar to the Munich experience quoted above: the more the land value is incremented, the larger is the proffer.

For new developments, it is important that there are not building constraints about volumes and localisations of buildings, except environmental and artistic constraints. These could make free the developer to optimise the dimension of investment and its location. For example, they could be able to organise their project along infrastructure route or around stations, where the accessibility is highest, to have maximum land value increment without being forced to finance a new metro line.

Land value capture on existing properties

The building of large infrastructures influence substantially also on values of existing buildings, including small and spread properties. The amount of such increase varies according to building type (residential, commercial, offices, etc.), distance to stations, demand type and other intrinsic characteristics.

The land value capture on existing buildings presents some practical and political problems:

- **Acceptability:** the tax imposed to citizens-owners is significant and depends on political decisions that they do not dominate or do not agree. For example, an owner could not desire a new metro line even if the value of his house is increased. In some cases the new line is not an advantage at all for the owner (because not willing to use the line, or because old or poor and unable to pay the tax without selling the house).
- The market price is difficult to estimate and to control by public decision maker.

- Practical difficulties for tax collection. One must know exactly the variation of market prices and be able to tax it fairly. In particular, in Italy there is not any database of all transactions and the related price paid.

It is important to underline that a new infrastructure gives two types of advantages: the direct benefit on travel time, that must not be paid back to the local authority, and the benefit of improved accessibility in terms of market price. This benefit is however only potential until the owner decides to sell the house and actually receive the benefit in term of increased value.

Given these constraints, we formulate a proposal of land value capture for the Italian context. The proposal tries to minimise the cited problems according to realistic conditions.

- a) Increase of the *legal value* of the interested buildings, in the range of distance where significant variation of *market values* occur. The legal value in Italy is always by far lower than market value, but it is known by municipalities.
- b) Imposition of a tax equal to the 100% of the increased legal value, but at the moment of selling (or renting) the property, not at the moment of infrastructure building.
- c) The yearly taxes on properties are based on legal value. The increased legal value determines more yearly taxes that may partially cover the operation costs.

The use of legal values instead of market values reduces the complexity of the system, increases the political acceptability of the policy (the tax is for sure a small part of the true benefit) and makes more certain the financial flows (it is independent from market fluctuations). Conversely, it skims only part of the generated benefit, as we will show below. It is important to underline that the tax is imposed when the property is sold, or rent, or inherited: the moment when the owner actually capitalise the benefit in monetary terms and not before. The tax does not damage those that do not need the infrastructure or do not have the money to pay for it. Moreover, it is perceived as a lower benefit and not as a cost, as it would happen if taxed at the moment of construction.

The problems associated to this scheme are mainly financial. Firstly, present costs must be covered with future revenues and the future revenues are uncertain because dependent on estate market (number of transactions). The extent of the effect of these two facts depends on who will collect the tax. If it is the

administrative body directly, the risks are lower but the function of fund raising falls. Alternatively, the amount can be anticipated by a company or by a fund, that will collect tax flows in the future.

A tentative estimation of land value capture

The paragraph presents a calculation of the possible revenues in case of a soft application of the principles expressed above. The calculations are based on realistic assumptions, in absence of more detailed data.

In particular, we assume that the property value increase generated by a new metro line in Milan compact city is 15% of the market values. This figure should be verified, but seems realistic due to the good accessibility of the city also in absence of the new line and to the maturity of the market. This figure seems also coherent with the figures already revised in section 4.

The total number of transactions in Milan in 2007 is available (Agenzia del Territorio, 2008). We exclude the industrial sites. Since only part of the land is interested to the new infrastructure, we consider an area of influence of stations of 500m, a proxy coherent with available studies. The already quoted infrastructural plan (AMA, 2008) quantifies the total land coverage of new infrastructures planned for 2015 (M4, M5, M6 first part, other extensions) in 8,4%. We assume that the new M4 alone represents the 2/5 of new lines and then will cover approx. the 3,4% of total Milan area. The same figure is considered as a proxy for total transactions: the new line will benefit 3,4% of all houses and offices sold in Milan in one year.

Table 3. Estimation of transactions interested by the new M4

	<i>Total transactions Milano 2007</i>	<i>Estimation annual transactions involved with M4 path</i>
houses	21842	734
offices	1361	46
commercial	2444	82

Source: elaborations on Agenzia del Territorio, 2008 and AMA, 2008

For the estimation of the land value capture revenues, we use the average legal value and apply the hypothesised 15% of increase. We underline that the 15% of the market price would be considerably higher (see below), but this benefit is left to owners, also for practical reasons. We then assume that the tax will collect the 100% of such increase. Multiplying this figure by the total number of transactions, we obtain the figures in table.

Table 4. Total land value capture calculation, per year (hypothesis)

	<i>Average legal value (hypothesis)</i>	<i>Value increase due to M4: 15%</i>	<i>Value capture share</i>	<i>Total value captured</i>
houses	60.000	9.000	100%	6.605.021
offices	60.000	9.000	100%	441.566
commercial	10.000	1.500	100%	123.178
TOTAL				7.139.765

This figure refers to 2007, assuming to capture the 15% of the legal value increase, applied to 3,4% of all houses purchases in Milan. We do not know historical data or projections. We therefore assume a realistic profile for the future years⁵ and discount the financial flow generated at 8% per year (quite high: include the cost of managing the process, cost of the risk, remuneration for the anticipated capitals, etc.). The figure we obtain for 30 years is **55.3 millions of Euros**⁶.

Of course the figure derives from simplified assumptions, that could be easily improved if detailed data on transactions were available. We however consider this as an order of magnitude. However this figure is surely lower than the increase of value that will be experienced in the market. The assumptions above determine an average land value capture of 9.000 Euros, compared to an increase of market value of approximately 21.000 Euros⁷. Moreover, it is the lower boundary of resources available in case of application because it is calculated on the basis of legal value and not market value and because successions and rents are not included in the estimation.

With these absolutely conservative hypotheses, the value captured of 55 Millions of Euros covers a share of approx. 3,6% of M4 total costs. More realistically, including rentals and successions and basing the value capture on market prices instead, a share of 7 to 10% could be reached. To this, further resources could be obtained by new developments, not calculated but discussed above.

7. Conclusions

Often city governments have difficulties to find efficient ways of financing urban transport.

At the moment, very few examples in “innovative” financial methods consider the recovery of the benefits accrued by the increased accessibility. This paper has commented the range of available financing tools and

⁵ Year 0 to 4: no purchase are taxed because the new line did not influence the market yet. Year 5 to 7: 10% more purchases compared to 2007, due to the dynamism introduced in the market by the new line. Year 8 to 14: same purchases than 2007. Year 15 to 30: decrease of purchases number of 2% per year.

⁶ Using 6% discount rate would give approx. 75 millions.

⁷ 15% of the average price of a 65 sqm flat for main cities in Italy.

provided some case studies to illustrate the so-called “innovative” ones. In general, we would suggest that the formal partnership with transparent and wider participation in the decision and with the explicitation of risks involved, should be preferred to informal partnership often in use.

The cases and the theory show that one of the most interesting approach is that of land value capture, both in terms of fairness and potential money raising capability. The main potential benefit of land value capture approach is its capability stimulate, through an appropriate structure of incentives, the efficient use of available land, especially the most accessible one. Also, it promotes the risk-sharing to the features of the project among promoters and administrators. However it is perhaps unwise to seek for a standardised model of this tool that can be easily replicated across cities and across countries, where many specificities exist.

The last part of the paper tried an application of this financial tool in Milan, reflecting the local political, economical and institutional environment. We suggested one possible method for application, based on data analyses and on the specific context, aimed at minimising conflicts and being realistically applicable. The result is that the lower bound of co-financing is below 4%, but it is possible to think to a more extreme taxation level. However, we argue that the highest share is around 10%, at least given the high construction costs found in Italy.

This fact should be considered by decision makers when stressing that the valorisation of public and private land around new stations is sufficient to finance significant shares of the infrastructure cost. This claim explains easily the success of such policies among politicians, but at the same time explains also the scarcity of meaningful applications around the world. However, a clever application could help the financing, together with other innovative methods, granting fairness and social acceptability.

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