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FINANCING INSTRUMENTS FOR SMART CITY PROJECTS

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INTRODUCTION

The topic of Smart Cities has become increasingly dominant in today's debates. The needs to rethink urban spaces, rationalize resources and increase efficiency at all levels of metropolitan life are the key determinants that started this whole movement.

The development of Smart Cities represents the ultimate innovation frontier because of the implications these projects have: Smart City projects bring together a variety of different aspects of urban life and highlight how it is only possible to make a change when there is a clear vision and an integrated plan to follow. This topic is a 360-degree approach to various aspects of urban life and continuous innovation represent the main characteristics of a Smart City.

The target of continuous innovation requires a level of investment that cannot be sustained only through government budget. Indeed, public expenditure is desirable in these very large projects that aim at improving social wellbeing but tapping private-sector funds could alleviate the strain on public budgets that are already suffering at the moment.

The aim of the thesis is to shed light on the concept of smart cities and illustrate traditional and non-conventional financing instruments that could be used by developers and local governments to invest in these projects. In the light of these considerations, this dissertation attempts to identify the most adequate funding sources for the associated projects.

More in detail, chapter 1 will deal with identifying a concrete definition of smart city and the various branches in which smart city projects are articulated. Chapter 2 aims at illustrating the main financing alternatives that are available in the whole business environment, namely Equity Capital Markets (ECM) and Debt Capital Markets (DCM).Chapter 3 enters more into detail regarding the specific financing instruments that are available for investments in smart cities (EU funds, Public-Private Partnerships, project financing and tailor-made bonds). Finally, Chapter 4 condenses everything that has been said and portrays the final considerations regarding the best financing instrument or the most adequate mix of instruments to fund smart city projects.

CHAPTER 1: DEFINITION OF A SMART CITY

Smartness of a City

The topic of Smart Cities is a much debated one because it is difficult to draw the boundaries of this very recent phenomenon. The first step we should make is identifying the "smartness" of a city which can be observed on three different levels:

- Number of social and technological domains of the initiative put in place by the specific city;
- Quality of architectural and governance choices, which has a deep impact on the planning and vision of a smart city;
- Improvement of the quality of life for citizens.

As we can infer from the list above, this concept has many faces and this adds up to its inherent complexity. Therefore, complexity can be found in identifying the relevant fields of action, aligning them with the overarching socio-economic background of the territory and, finally, analyzing the effective execution capacity of the projects.

Definition of Smart City

A single, uncoordinated effort (e.g. a single recharge station for electric cars) cannot be defined as a smart city project. Real Smart city initiatives stem from a vision that applies to the city as a whole and to various initiatives at the same time. Nowadays this emerging phenomenon implies making large investments in ICT systems to improve living standards and through urbanization plans, for example.

Literature offers many definitions for this topic but, in general, one can identify certain key terms that are repeated across most definitions, namely:

- ICT

- Infrastructure
- Service

Therefore, it seems that a smart city is first and foremost a digital city, however we should also consider a number of "softer" aspects such as governance among the stakeholders of the city, the city's human capital and internal social relationships[1].

Application Domains for Smart City Initiatives

Smart city projects have different areas, or application domains. The definition of these application domains is strongly based on tangible elements such as infrastructure, energy and environment, but more intangible aspects are used as well. There are 7 main areas for the application of smart city projects:

- Building. This area mainly refers to increases in efficiency within buildings and houses in terms of energy consumption, home automation and smart appliances.

- Economy & People. This domain refers to the "softer" factors and to public administration's ability to create a better environment for the development of companies and for the empowering of people. The aim is to boost innovation and talent.

- Energy. The goal is to achieve a higher degree of energy efficiency as well as the development of "cleaner" sources for the future. Other sub-domains are renewable energy sources and public lighting.

- Environment. Protecting the environment mainly consists in a better use of natural resources and a careful control of waste management. To this extent water management and pollution control become vitally important.

[1]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 15-16

- Government. Bureaucracy sets many obstacles to the development of innovations and economy for a country. It is possible to make the burden of bureaucracy much lighter and transparent thanks to the use of ICT instruments.

- Living. Improving living conditions in urban environment implies upgrading the services that are already present in cities. This domain encompasses many different areas of interest, such as healthcare system, welfare services, security, cultural heritage, tourism, culture and leisure activities.

- Mobility & Transport. Improving transportation services is key to improve a set of services offered by the public sector to city dwellers. This domain can be divided in two parts:

    1. City Logistics, aimed at improving "last mile" logistics in terms of traffic, pollution and energy consumption;

    2. Mobility Systems, which tries to develop more sustainable ways of moving.

European-Level Initiatives

The European Union is putting a lot of effort in creating a better environment for its citizens. To this extent, the EU proposes several important initiatives that play a central role in continuously promoting development and innovation. The Covenant of Mayors (COM) is an independent initiative by municipalities that aims at promoting energy management and efficiency. The COM does not give direct access to finance but allows the use of funds from the EIB.

Europe 2020 and the European Digital Agenda (EDA) are two other initiatives. The former is focused on revamping the economy in general while the latter pushes for the growth of a "digital" economy. In fact, the EDA supports innovation and ICT investments and is based on three objectives:

1. Basic Broadband (2Mbps) available to all EU citizens by 2013;
2. Fast Broadband (>30Mbps) available to all EU citizens by 2020; and
3. Ultra-Fast Broadband (>100Mbps) available to at least 50% of EU citizens by 2020.

The SET Plan was approved in 2009 and promotes large-scale diffusion of low emission technologies. This EU initiative leads to another important solution known as the "Smart city Stakeholder Platform", which literally puts together all the stakeholders of these projects (citizens, PA officers, private entities) and treis to identify the best technologies and practices for smart city projects.

Italian Initiatives

Italian initiatives are obviously much smaller but trace the path set by the European institutions. In fact, the Italian Digital Agenda was created in 2012 and enacts the guidelines given by the European counterpart. The Smart City Monitoring Group is another domestic initiative, which was born from the combination of the "AssociazioneItalianaComuniItaliani" and the Forum PA, to collect best practices to construct and manage smart cities.

CHAPTER 2: FINANCING ALTERNATIVES

Financial Instruments and Markets

The chapter will conduct a general overview of the ways to raise money from capital markets for companies and other entities that need it for various reasons. Debt and equity instruments are predominant in this field and offer a variety of solutions.

These instruments are traded in several types of markets; in fact we can distinguish between:

- Primary and secondary markets: Primary markets are the ones were shares are offered to investors for the first time while secondary markets are characterized by the fact that buyers purchase securities from previous buyers.

- Exchange and OTC markets: the former identifies a typology of market where trading takes place in a centralized geographic location, while the former is represented by a dispersed network of buyers and sellers which use ICT systems to perform transactions

Characteristics of Debt, Equity and Derivatives

Debt instruments, as in the case of bonds or bank loans, represent a particular form of transaction where lender is entitled to receive from the fixed payments (defined as coupons) at specified intervals until a final date. Moreover, at the final date the debtholder will receive the principal. Debt is classified on the basis of maturity into short term maturities (up to 1 year), intermediate term securities (from 1 to 10 years) and long term debt (with a maturity of over 10 years)

Equity instruments, such as shares of common stock, represent theright to the earnings and assets of a corporation.

Many differences exist between equity and debt securities, in fact, shareholders receive payments with no specified size nor timing, this is because it depends on the profits of the organization; maturity does not exist and stockholders are considered residual claimants in case of bankruptcy or liquidation.

Finally, there are derivatives markets have experienced tremendous growth in the last two decades. Derivatives are financial instruments whose value depends upon the value of an underlying asset. Buyers and sellers use these instruments to transfer risks; in fact, these markets are utilized very much when there are fluctuating asset prices.

The most common forms of debt capital are bank loans and overdrafts which allow SMEs to access capital. However, bonds are also a very wide-spread instrument. The issue of bonds critically depends on credit ratings which are performed by independent rating agencies and divide securities issued by different corporations and entities in investment grade and non-investment grade securities. This division is based on assessing the risk of default of the issuer; therefore, to this extent leverage is an essential measure.

Debt and Equity Deals

Deals regarding bond issue of bonds may take two main forms: Best Effort and Underwritten. In the former the bank that offers support in this process performs placing services and the risk of not matching demand and supply are borne by the issuer. In an underwritten deal the bank guarantees that it will place the securities or else it will have to buy them itself and put them on its books.

On the other hand, the ECM business offers 4 main products:

- Initial Public Offerings (IPO): the sale of a private company to institutional and retail investors for the first time.
- Follow-on Offerings: the sale of shares of an already listed company on a recognized stock exchange
- Equity-linked securities:deals that are complex in nature. In fact, the sale of these securities is contingent and linked to a fixed income or preferred securities. These are highly tailored and structured solutions (e.g. used for refinancing and disposal).
- Derivative transactions: used to hedge or dispose of stakes discreetly and in some cases may lead to material tax advantages. These types of transactions are only possible for listed companies.

Monetisation Strategies

There are several types of monetization strategies adopted to raise finance within the realm of equity deals. More in detail:

- Accelerated Book Building: it is an open-priced mechanism with the price set at or close to market level;
- Block Trade:the vendor sells shares to the bank at a fixed price (usually at a discount), then the bank re-sales the shares to investors (may gain something on the spread between prices);

- Fully Marketed Offers: this type of transaction is based on bookbuilding and stresses the importance of marketing and roadshow efforts.
- Optional Exchangeable:This is a particular type of method, based on the use debt instruments with an embedded call over underlying shares. The equity component reduces the coupon to be paid. There is no certainty regarding the disposal of the underlying shares.
- Mandatory Exchangeable: similar to optional exchangeable but the disposal of shares is guaranteed at maturity.

The following chapter will introduce concepts and financing alternatives that are more in line with what is going on for Smart City Projects. The instruments that will be dealt with in Chapter 3 have different sources and nature, and as such may be extremely different from one another and may not follow the general rules highlighted in Chapter 2.

CHAPTER 3: FINANCING INSTRUMENTS FOR "SMART CITY" PROJECTS

This chapter illustrates the characteristics of the most adequate instruments to finance smart city projects. There are 3 broad categories of instruments that can be seen as the main typologies that could actually be used:

1. EU Instruments & Funds
2. Public-Private Partnerships (PPP)
3. Project Finance (PF)

EU Instruments & Funds

EU instruments are well structured and are aimed at sustaining innovation, SMEs and human capital. Some programs, such as Horizon 2020, COSME and Life +, sustain research and technology development by using financial tools to support SMEs and entrepreneurs. More specifically, Life + is an initiative created to deal with environmental issues.

Structured funds represent one of the most used instrument and they are managed by both the EU Commission and regional authorities. The most relevant points of intervention of these funds are social and regional development.

Another very important tool within the category of EU instruments is the European Investment Bank (EIB). The EIB is connected to the European Union and can provide capital in the form of loans or equity investments for promising projects. The most important aspect that the EIB deals with is the establishment of specific tools to attract private investments. The largest initiatives are:

- ELENA (European Local Energy Assistance)
- JESSICA (Joint European Support for Sustainable Investment in City Areas)
- JEREMIE (Joint European Resources for Micro to Medium Enterprises)
- PBI (Project Bonds Initiative)

The last is used whenever private investments are low in a specific sector. Project Bonds represent a good instrument because they boost creditworthiness in two main ways: funded and unfunded mechanism.

Public-Private Partnerships (PPP)

Moving on the next category, PPPs are a cooperative arrangement where 2 or more agents decide to combine their competencies.

PPPs are very common when it comes to performing urban development works and the public administration does not have resources and knowledge it could specifically use.

In general, it can be considered an exceptionally good instrument because it is based on the allocation of risk to the most suited party that can handle it. Within smart city projects we have seen there are many different type of risks (construction, financial, socio-economic) and having the possibility to allocate them to the most adequate party is definitely a positive aspect.

Project Financing

Project Financing (PF) also represents an adequate measure to finance smart city projects. PF is a multidisciplinary approach particularly used to face projects with a high degree of complexity and where strong bank participation is required.

The servicing of the debt and the remuneration of capital are based on the cashflow generated by the project. This implies a great focus on evaluation of economic and financial sustainability before starting the project.

Since cashflows are the main way to repay debt, it is very important for operations to be in place.

PF is founded on the use of a Special Purpose Vehicle (SPV) which is an entity completely independent and separated from the sponsors. This division allows the sponsors to treat costs for the projects as "off-balance sheet" items and stimulates the use of financial leverage. In fact, it is no wonder that the majority of the projects that use PF are financed by debt up to 70%-80% of the total project cost.

New Trends: Green Bonds and Social Impact Bonds

For what regards new trends, even though their purpose seems very much in line with what is the spirit of smart city projects, they may be not sufficient to raise enormous amounts of money that are absolutely necessary to put in place a fully-fledged smart city projects.

Green Bonds, for instance, are a good instrument that has been used successfully by many municipalities; however, they require a very high credit rating to be issued. This could seriously be a problem for many European countries which are not very much in shape at the moment.

A similar discussion could be extended to Social Impact Bonds (SIB) where payments are not only in the form of cash but also in terms of social results obtained.

The payments actually depend on fulfilling certain social and environmental objectives.

Other forms of Private-Sector Financing

On the other hand, mini-bonds are particularly good to help SMEs get access to capital markets and give them the possibility of raising the necessary funds to develop breakthrough innovation. They could be used to finance a SME that is working on a component of a Smart City project, rather than for the project as a whole. This is because these types of projects are too large and complex to be financed only by mini-bonds.

Finally Venture Philanthropy and Crowdfunding seem very interesting tools but may not have the scale to be really useful for large project that require millions or billions of euros or dollars.

Conclusion

From the summary above it seems that the most adequate financing instruments are Public-Private Partnerships and Project Financing. These two tools are particularly good because they allow the interaction among different parties that have different skill sets and can face various types of risk. Risk allocation to the most relevant party is a critical factor as well as ex-ante sustainability analyses and the capacity to use financial leverage in a safe way.

However, EU instruments can still play a very important role since they usually act as the "kickstarter" for many projects by attracting private capital. The most relevant tools in this category are the tailored initiatives by the European Investment Bank and Project Bonds.

Case Studies:

The thesis presents several real-life examples that show how difficult it is to finance smart city projects, namely: Genova, Tianjin, Barcelona, Amsterdam, Malmo and Manchester.

The Genova Smart City Project was funded thanks to EU instruments and funds. In total it has received slightly less than €7.5 million divided among various initiatives with different objectives (e.g. urban sustainability, energy efficiency, and efficiency within buildings. Other tools were adopted as well, such as PPPs, ESCOs, loans from the EIB and Project Financing.

Tianjing Eco-City project started in 2008 and is expected to end in 2020. The aim is to create a 100% eco-friendly environment which can be energy independent and totally "green". The project is the result of the efforts of the Chinese Government, which financed it, and authorities coming from Singapore. The city is 150Km away from Beijing and it will welcome 350.000 residents.

Unfortunately, commercial confidentiality makes it difficult to find information regarding the financing structure of most projects. However, we can analyse the cases of 4 other cities, Barcelona, Amsterdam, Malmo and Manchester. In Barcelona, the projects are financed mainly through EU interventions but in good years the Spanish government was particularly active as well, but the crisis reduced the resources available for these projects. The situation in Amsterdam is much better; in fact, there are several funding streams such as: ERDF, City Authorities, PPPs and 2 revolving funds (Amsterdam Innovation Fund and Amsterdam Sustainability Fund). Smart City in Malmo was financed mainly with EU and national grants given the difficulty in attracting private sector investors due to long payback periods and revenue generation problems. The latter is also a problem in Manchester were financing is a combination of private and public sources.

CHAPTER 4: CONCLUDING REMARKS

Not all the instruments mentioned are appropriate to finance a project as large and complex as a smart city one. Some of them can be used to raise funds for SMEs that develop technologies and innovations for these projects or to raise funds for smaller parts of Smart City initiatives.

Among all the alternatives suggested within this dissertation there are two that stand out for their actual applicability to smart city projects, namely:

- PPPs; and
- Project Financing.

Both of these alternatives are particularly good to deal with highly risky and complex urban renovation projects. Both of them imply the division of risk among participants and the combination of public and private funds/resources. In some cases, these instruments are even intertwined; in fact, project financing is one of the main structures adopted to establish PPPs. PPPs are very well-fitted instruments for these projects because it is based on strong participation by public entities that must act as the project manager. This, however, may also entail some problems since the PA does not have the resources and skills necessary to perform an optimal work. PPPs are founded on feasibility studies that comprehend cost-benefit analyses and Project Risk management (risk is formed of 5 components: construction, operation and maintenance, demand, financial and context risks). The best part of the PPP cooperation is that the PA does not have to pay the initial investment; in fact, what happens is that the financial partner bears the cost of the up-front investment and then is repaid through installments by the public entity. Below there is a list of pros&cons for the use of PPPs for smart city development:

PROS	CONS
Transfer of risk to private party	Transaction costs
Based on specific project outputs (rather than inputs);	Negotiation with other parties
Use of private financing	Need for ex-ante analysis skills
Possibility to create "ad hoc" contracts (BOT, DBFO, BOO)	
Risk Allocation (to the party that can bear it better)	
Use of ESCOs and Urban Development Companies	
Finance lease and Sponsorship Agreements	

Project financing, on the other hand, is mainly adopted for tangible infrastructure projects but its core characteristics make it a very adequate instrument also for Smart City Projects that are based on high intangibility and innovative jump. The core principle of PF is that the project should be capable of repaying itself through the generation of cash-flows and profits. The creation of revenues

is, hence, fundamental to service debt and remunerate capital. PF is essentially based on economic and financial sustainability of a specific project. Moreover, it presents several advantages for the PA:

- The private sector is responsible for designing the service, so the public-sector entity does not need to give detailed technical descriptions of the service, since it might not have the knowledge to do so;
- Public works can be executed without increasing public debt;
- Private sector bears design, construction and operation risks;
- Timing and quality standards are much better for citizens because of the impact of the private sector agents.

So, summing all that has been said on PF we can identify the key pros&cons that our analysis aimed at finding:

PROS	CONS
Well-structured, multidisciplinary approach	Does not depend on creditworthiness of single shareholders (may be a pro);
Based on economic and financial sustainability of a project through cash-flow generation	Expensive
Risk is divided among parties	Transaction costs
Based on efficient operations (to generate revenues and, hence, cash-flows)	Contractual Relations
Creation of Special-Purpose-Vehicles	Risks are not allocated as for PPPs
Stimulates financial leverage	Only effective for very large projects, with large financing needs
Based on Security Package	

Therefore, PPPs and PF offer the best frameworks to finance and manage Smart city projects. These instruments prove capable of uniting the skills of different participants and manage to allocate risks in a way that simplifies the whole process.However, PPPs and PF could also need the help of EU initiatives that represent the first mean to raise funds and attract private-sector investing as well. EU funds and instruments can be, therefore, seen as an accelerator of business in this case.

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