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FINANCING INSTRUMENTS FOR SMART CITY PROJECTS

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To my family who has always believed in me. In particular, to my parents who gave me the possibility to achieve all of this.

Thanks for all the letters you wrote to me, they made me stronger in facing all the challenges I had.You know everything about me and you are always proud of what I do, the only way I can pay you back is by doing the same for you.

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INTRODUCTION

The topic of Smart Cities has become increasingly dominant in today's debates. The progress of technology has allowed to visualize scenarios that would not have been possible only a decade ago. Many discussions all over the world have tried to provide a definition of this phenomenon and have attempted to set general guidelines to pursue these types of projects.

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. In fact, in the past years, many projects have been defined as "smart city" ones erroneously; most of these projects aimed at improving only one aspect of city life and, hence, did not have a 360-degree approach to all the areas in which full-scale "smart city" projects are articulated.

The brief introduction above shows how 360-degree integration of 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 trace a sustainable path for smart city development, both in terms of planning and of identifying 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. It will then conclude with a brief snapshot of the major EU and Italian initiative that are tied to the development of smart cities.

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).

On the other hand, Chapter 3 enters more into detail regarding the specific financing instruments that are available for investments in smart cities.
This chapter encompasses EU funds, Public-Private Partnerships, project financing and tailor-made bonds. The final part of the chapter is centered on the evaluation of these alternatives.

Finally, Chapter 4 condenses everything that has been analysed in the previous chapters 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

During the last decade, many debates have led to a significant progress in the definition of this phenomenon. Debates also gave rise to many interpretations of the boundaries of the notion of a smart city, highlighting the necessary steps to transform an urban conglomerate in a fully-fledged smart city.

SMARTNESS OF A CITY

The first step one should follow when shedding light on the concept of smart city is identifying a way to measure the "smartness" of a city, that is, quantifying to what extent a city is smart.

To do this, it is absolutely necessary to distinguish between three different meanings of the level of smartness[1]:

1. The first is based on the number of social and technological domains covered by initiatives promoted by a specific city.
2. The second refers to the planning and visioncapacities of a city, which are crucial for the implementation of the project. Therefore, smartness can also be seen as the quality of architectural and governance choices.
3. The third concerns the improvement of citizens' quality of life. Accordingly, the acceptance and success of the projects strongly depends on the social and economic background in which these ventures are conducted.

[1] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.14-15

From the three points of view listed above, it is easy to understand how complex this topic is: 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.

Their complexity, the number of participants and the uncertain financial returns make these projects hard to realize. To this regard, it is critical to develop a system of indicators that should be accepted and shared by all stakeholders. The guidelines should be set by the Italian Agency working on the Digital Agenda, so as to have a clear path to follow both domestically and at European level.

DEFINITION OF SMART CITY

The numerous definitions of smart city have led to distortions in the understanding of this recently developed concept. In fact, it is not possible to define a single, uncoordinated effort as a smart city project (e.g. single recharge stations for electric cars).

On the contrary, it is well established that the creation of a Smart City stems from the formulation of a vision that is strategic, planned, comprehensive and connected to the ability to assess a territory's potential by a body capable of rethinking the city with a long-term vision and an integrated approach[2].

More in detail, a city can be seen as a smart city whenever investments are allocated to communication and transportation infrastructures with the aim of enhancing quality of life and developing the economy in a sustainable way, thanks to the use of both human and social capital[3].

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

[3] M. De Mitri, "Le Smart City: città intelligenti, digitali ed inclusive", www.marcodemitri.it

It is common to see smart city projects in the domain of urbanization plans which try to optimize and innovate public services and infrastructures[4].

Let's consider some of the most significant definitions of Smart City:

"An urban area functioning and articulated by modern ICT technologies in its various verticals, providing ongoing efficient services to its population."[5]

- *Anavitarte&Tratz-Ryan (2010)*

"A city can be defined Smart when investment in human and social capital and traditional (transport) and modern (ICT) communication infrastructures fuel sustainable economic growth and a high quality of life, with a wise management of natural resources through participatory governance."[6]

- *Caragliu, Del Bo &Nijkamp (2009)*

"A Smart City is more than a digital city because it is able to link physical capital with social one, and to develop better services and infrastructures."[7]

- *Correia&Wunstel (2011)*

[4]Fondazione Ugo Bordoni, *"*Ricerca e Innovazione: Città intelligenti per uno sviluppo sostenibile*", www.fub.it*

[5]Anavitarte and Tratz-Ryan, "Market Insight: Smart Cities in Emerging Markets", *Gartner (2010).*

[6]Caragliu, A; Del Bo, C. & Nijkamp, P (2009). "Smart cities in Europe". Serie Research Memoranda 0048 (VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics).

[7] L. Correia and K. Wunstel, "Architecture and Design for the future internet", *Springer* (2011).

As the definitions written above suggest, there are a few common key attributes that emerge: in fact, ICT and infrastructure and services stand out. 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[8].

Both tangible and intangible aspects were incorporated into a concise definition of a smart city; a smart city is therefore on that[9]:

1. On the basis of a strategic vision in a comprehensive manner, innovatively employs ICT to support the management and delivery of public services to improve living conditions of citizens;
2. Uses information from various sources in real time and leverages both tangible (infrastructures, energy and natural resources) and intangible (human capital, education and knowledge) resources;
3. Is able to adapt to users' needs, promoting its own sustainable development.

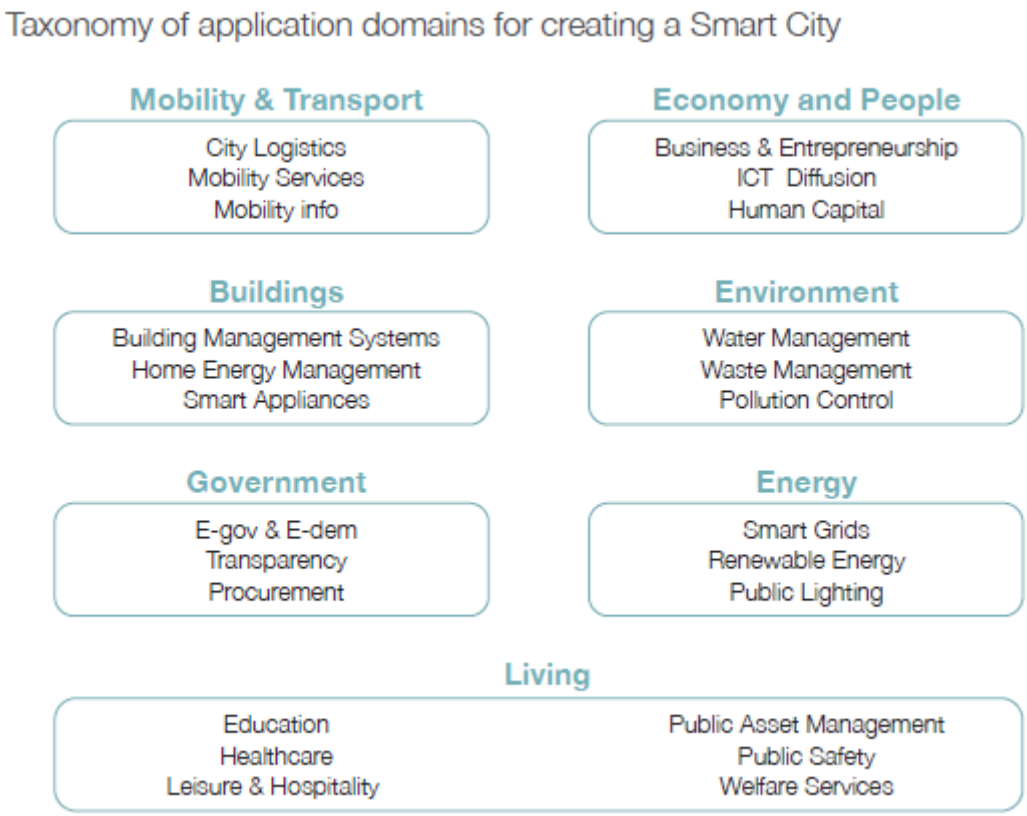
APPLICATION DOMAINS FOR SMART CITY INITIATIVES

All cities are different from one another; however, there are some common elements that somehow bring them together. To have a more precise and schematic view of the topic, a taxonomy of application domains for smart city initiatives is suggested.

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

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

The analysis of literature[10] has revealed that the major taxonomies were created on the basis of tangible aspects, such as infrastructures, energy and environmental issues. Moreover, emphasis is put on housing and building, which, because of urbanization, have strong environmental impacts.



Source: Politecnico di Torino – CDP "Smart City Monographic Report"

To the most prevalent tangible factors we should add the "softer" factors as well, such as education, security, culture, and welfare services. All these initiatives should be finalized to the development and stimulation of human capital within smart cities.

[10]Anavitarte and Tratz-Ryan, "Market Insight: Smart Cities in Emerging Markets", *Gartner (2010);* Caragliu, A; Del Bo, C. &Nijkamp, P (2009). "Smart cities in Europe", Series Research Memoranda 0048 (VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics); T. Nam and T. Pardo, "Understanding Smart Cities: an integrative framework", *Hawaii International Conference on System Science,* (2012)

To summarize we can identify seven areas, or application domain for 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 attract and retain skilled human capital through the development of incubators, research centers for start-ups and adoption of innovative ICT instruments thanks to specific investments.

- Energy. Many of the efforts for the realization of energy efficient solutions are coordinated by supra-national authorities. The goal of these entities is to achieve a higher degree of energy efficiency as well as the development of "cleaner" sources for the future. This is why efforts are concentrated towards the creation of "smart grids", that is, electric networks that integrate the different stimuli coming from the connected users, so to use energy in a more sustainable way. 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.

- 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 thanks to the use of ICT instruments that can easily revolutionize it by

offering a better access to services for citizens (e-Government; e-Democracy). This use of ICT tools could also lead to higher transparency.

- 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. The problem of traffic congestion makes the need of moving people and goods in urban setting a more pressing matter. 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.

Information Management cuts across both of these areas, and develops solutions oriented towards logistics practitioners and citizens, at the same time.

EUROPEAN-LEVEL INITIATIVES

Covenant of mayors, Europe 2020 and the European Digital Agenda

There are several EU-level initiatives that aim at the development of smart city projects under different aspects. The covenant of mayors is an independent initiative by European municipalities, aimed at achieving higher energy efficiency and a better management of energy sources, in order to meet the goal of a 20% reduction of CO_2 emissions by 2020[11]. This project was one of the first initiatives regarding European cities.

The covenant comprehends 4799 participating municipalities (2425 are Italian); 3046 have presented an Action Plan and 709 plans have already been accepted. Participating to the Covenant of Mayors does not "per se" grant direct access to finance, however it allows to use some funds set forth by the European Investment Bank (EIB).

Other goals of this initiative, apart from energy efficiency, are improved living conditions, creation of jobs and increased competitiveness.

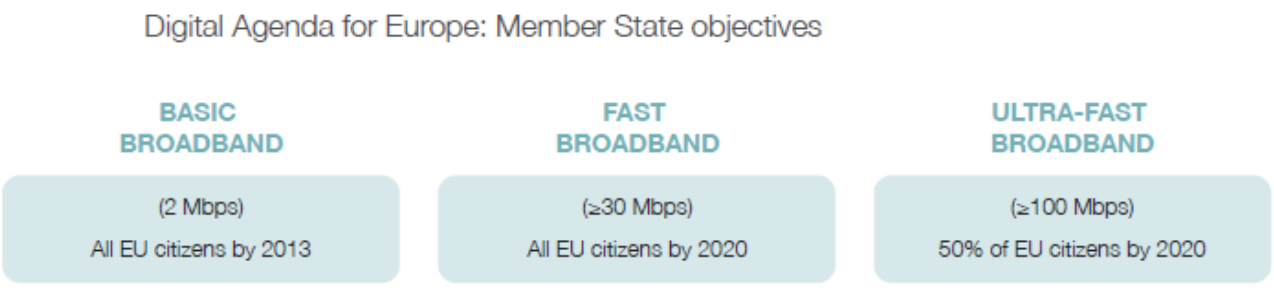
Investments in ICT, particularly on broad band technologies, are widely recognized as necessary for developing the economy in an intelligent and sustainable way. The ultimate goal of Europe 2020 and the European Digital Agenda is the growth of the European digital economy by supporting innovation, job creation and improved services to citizens and enterprises. Advanced communication technologies and their continuous progress is, hence, the main instrument in the hands of the authorities who are in charge of carrying out these initiatives.

The Digital Agenda is based on three main objectives that member states are supposed to meet by 2020; there objectives are[12]:

[11]E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.19

[12]European Commission official web site, "http://ec.europa.eu/digital-agenda/"

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.



Source: European Commission

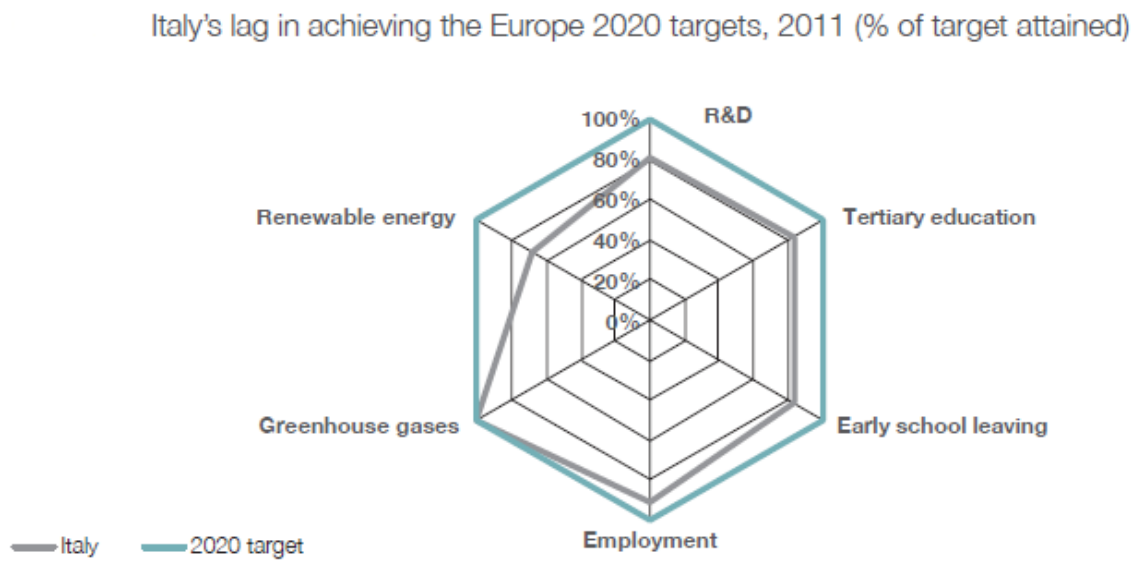
On the other hand, Europe 2020 may be seen as the largest strategic effort for the progress of the European Union. Its objective is to revamp the European economy in the next decade and it is founded on five major building blocks[13]:

- 75% of all EU citizens with an age between 20 and 64 must have a job;
- 3% of GDP should be invested in R&D;
- Achievement of the 20/20/20 thresholds in the area of climate change/energy, i.e. greenhouse gas emissions 20% lower than 1990, 20% of energy from renewables, 20% increase in energy efficiency;
- School drop-outs must be below 10% and at least 40% of young people must complete university;
- At least 20 million fewer people in or at risk of poverty.

It is important that each of these objectives and the guidelines set at continental level are translated into national legislation in order to stimulate their achievement.

[13] European Commission official web site, "http://ec.europa.eu/europe2020/index_it.htm"

Member states are obliged to present an annual report showing their progress towards the objectives set forth by the European Commission; recent reports have shown how Italy is lagging behind on various topics.



Source: CDP Monographic Report on Smart Cities (based on Eurostat data)

SET-Plan

The Strategic Energy Technology Plan (SET-Plan) was approved in 2009 by the EU in order to accelerate the large-scale diffusion of low emission technologies[14]. This initiative highlights how the efficient consumption of energy sits at the core of the EU's intents.The SET-Plan represents a new model of innovation based on a collective approach to planning and execution of R&D efforts.

The plan is grounded on the fact that Smart City projects can emerge as a combination of public strategies and public-private investments[15].

Therefore, the SET-Plan has the goal of making public initiatives more consistent using partnership with private entities. The estimation of the costs of this program for the next

[14]European Commission official website, "http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm"
[15] European Commission, "SET-Plan: towards a low carbon future", (2010)

10 years are listed in the diagram below; however, it is important to note that the EU has not inserted these costs in its budget, this means there is no proposal for funding. However, this list of estimated costs shows the areas in which Europe needs to invest more to support the implementation of its carbon reduction policies, among others there are European Industrial Initiatives and Smart Cities.

Estimate SET-Plan costs, 2011 (€/bln)

Initiative	Estimated cost
European Industrial Initiatives	58
Wind power	*6*
Solar power	*16*
Electricity grids	*2*
Sustainable bioenergy	*9*
CO2 capture, transport and storage technologies	*13*
Sustainable nuclear fission	*7*
Hydrogen fuel cells	*5*
Smart Cities	11
Program total	**69**

Source: European Community, 2009

Smart Cities Stakeholders Platform

This initiative at EU-level aims at creating a platform for the various stakeholders (citizens, PA officers, private entities) of Smart City projects, with the intent of stimulating innovation, new technologies and exchange of ideas.

The platform tries to identify the most appropriate technologies for smart cities and the ways to raise funds to apply those technologies. It is divided into 6 main work groups:

- Energy Efficiency and Buildings;
- Energy Supply and Networks;
- Mobility and Transport;
- Finance Group;
- Smart City Roadmap Group;

- ICT 4 Smart Cities.

The first three groups are sectorial and technical in nature, the next two are broad in nature, cutting across the various application environments, while the last was added recently in reflection of the special focus being placed on ICT[16].

The platform currently contains the profiles of 1306 cities, of which 365 are Italian[17].

ITALIAN INITIATIVES

The Italian Digital Agenda and the Smart City Monitoring Group

The Italian Digital Agenda (IDA) was created in 2012 to enact the guidelines set by its European counterpart. The aim of this domestic initiative is to stimulate investments in ICT, far beyond the current 2% of GDP, and to bring about a sort of "Digital Revolution" not only from an economic stand point but also from a social perspective.

On the other hand, the Smart City Monitoring Group (SCMG), formed from a collaboration between the "AssocazioneItalianaComuniItaliani" and the Forum PA, offers indications for the construction of smart cities to all Italian municipalities[18]. It offers a collection of best practices in terms of:

- Providing external help to cities in structuring projects in creating a network of experience;

[16] E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 22

[17] As of 11 September 2013.

[18] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp. 23

- Mapping, identifying and classifying technological solutions currently deployed in cities, not neglecting programming tools and the main existing regulatory obstacles.

Summing Up

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.

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[19].

As mentioned within this chapter, 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.

[19]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.

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 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

In the previous chapter we have clarified the main characteristics of a Smart City in terms of the various definitions and application domains that these projects have. Moreover, Chapter 1 also introduced the main initiatives to develop and stimulate Smart City projects both at European and Italian levels. Now, this chapter will conduct a general overview of the financial market and will concentrate on the predominant financial instruments used to raise funds, namely Debt and Equity instruments.

Well-functioning financial markets are an essential part of any modern healthy economy. It is through these capital markets that funds are offered by the lenders/savers that have excess funds and purchased by the borrowers/spenders who need those funds. Interactions among these two parties can be "direct" (known as direct finance) or "indirect", that is through financial intermediaries (known as indirect finance).

FINANCIAL INSTRUMENTS

The transfer of available funds takes place through the buying and selling of financial instruments or securities. Literature, generally, defines financial instrument in the following way[20]:

A financial instrument is the written legal obligation of one party to transfer something of value, usually money, to another party at some future date, under certain conditions.

[20] E. Dunne, "Chapter 3: Financial Instruments, Financial Markets, and Financial Institutions", *http://www.oswego.edu/~edunne/340ch3.htm*

We can easily breakdown this definition to analyze the most critical components of this notion:

1. First, it is important to note that a financial instrument is a binding, enforceable contract under the rule of law, protecting potential buyers;
2. An exchange based on financial instruments implies a transfer of value between two parties, where a party can be a bank, insurance company, a government, a firm, or an individual.
3. Finally, such an instrument may have very specific dates and expirations (like a monthly mortgage payment) or it may be based on more uncertain contingencies (like an insurance policy).

Financial instruments, like money, can function as a means of payment or a store of value; however, they are still less reliable than money in terms of liquidity, divisibility, and acceptance. On the other hand, they allow for greater increases in wealth over time, due to market activities and growth,and, hence, they are considered better stores of valuebut with higher levels of risk[21]. Risk transfer is another very important characteristic worth remembering. Certain instruments have the characteristic of enabling buyers to shift risk to the seller, in fact, what is basically happening is that they pay the seller to assume certain risks[22]. Insurance policies are a prime example of this.

Most financial instruments are standardized in that they have the same obligations and contract for buyers. Google stock shares are the same obligation, regardless of buyer. Car loan and mortgage loans contracts use uniform legal language, differing only in specific

[21]E. Dunne, "Chapter 3: Financial Instruments, Financial Markets, and Financial Institutions", *http://www.oswego.edu/~edunne/340ch3.htm*

[22]E. Dunne, "Chapter 3: Financial Instruments, Financial Markets, and Financial Institutions", *http://www.oswego.edu/~edunne/340ch3.htm*

loan amounts and terms. This standardization reduces costs (since the same types of contracts are used over and over again) and makes it easier for buyers and sellers to trade these instruments continuously. In addition to this standardization, financial instruments must provide certain relevant information about the issuer, the characteristics and the risks of the security. The aim here is to level out unfair advantages in order to create an even playing field among different through the use of several information requirements.

FINANCIAL MARKETS

There are many financial instruments, each with its own characteristics; this is why different types of financial markets exist, each deals with a particular type of financial instrument; however, all of them perform crucial functions. They provide a mechanism for buying and selling securitiesquickly and cheaply. The main function of financial markets is to offer liquidity and allow the interaction of demand and supply to determine the price of various instruments[23]. The price of a specific asset class conveys important information about the prospects of the issuer. Finally, we can define financial markets as the mechanism where the instruments that transfer risks are bought and sold.

Financial markets can be easily classified on the basis of their characteristics, their location, and obviously assets traded.

[23]E. Dunne, "Chapter 3: Financial Instruments, Financial Markets, and Financial Institutions", *http://www.oswego.edu/~edunne/340ch3.htm*

Primary vs. Secondary Markets

The financial instruments sold in the primary market are new issues; this means there has been no prior owner. They are sold directly and for the first time to the buyer by the issuer. The securities sold in the secondary market are being resold by previous buyers, who bought them from the issuer or from other buyers[24].

Financial intermediaries operate in both primary and secondary markets. In the primary market, investment banks assist a business in selling a new issue to the public. One of their main tasks is underwriting, meaning that they buy the new issue from the business and sell it to the public. Gains arise from the fees charged for underwriting and other services and from profits obtained by reselling the issue at a higher price.

Even in the secondary market, financial intermediaries are an important part of a well-functioning market. Securities brokers facilitate trade by matching buyers with sellers. For this they charge a commission on each trade.

Securities dealers act as market makers, this "institution" performs both the task of a seller and the task of a buyer. In fact, the books of a dealer list two prices: the bid price and the ask price. The former refers to the price at which the dealer is willing to buy a security while the former indicates the price at which it is willing to sell. The bid price is lower than the ask price (the difference is known as the bid-ask spread), and this is how dealers make their money. Dealers own an inventory of the securities in which they deal. As mentioned above, since dealers stand ready to be the buyer or seller for a security, dealers are said to "make a market" for that security and dealers are often referred to as "market-makers". If a buyer is looking for a seller, the dealer acts as the seller. If a seller is looking for a buyer, the dealer acts as a buyer. This way there is always a buyer and seller, so there is always a market.

[24]E. Kakarot-Handtke, "Primary & Secondary Markets", *Levy Economics Institute of Bard College*, (2012)

Exchanges vs. OTC Markets

Secondary markets can be classified by the location and the methodology of how the trading of securities takes place. The market is said to be an exchange it means that trading occurs in a centralized location[25]. The best known example is the New York Stock Exchange by far.On average 1 billion shares are traded in the NYSE on a daily basis. The NYSE depends on a specialist system, where a firm is charged with maintaining an orderly market for each individual stock traded on the exchange.

The alternative is to trade in what is known as an Over the Counter (OTC) market. In this type of market buyers and sellers are geographically dispersed, and use IT systems (e.g. computers) to make transactions.This major characteristic of OTC markets originated far before the changes brought about by the invention of the computer when securities and money were literally exchanged over countertops by buyers and sellers. Today, IT and electronic systems connect buyers and sellers all over the world[26]. A crucial agent within OTC markets is the dealer literally "makes" the market by acting as the buyer or the seller in different transactions. Bonds are, generally, traded in OTC markets (although some debt security trading does occur on the NYSE), while stocks are traded on exchanges and large OTC markets, like the NASDAQ. Usually, large companies have their shares traded on an exchange market, but overall large OTC markets may have larger transaction volumes.

Furthermore, a third option for buyers and seller is offered byECNs or electronic communication networks where the two parties can find each other directly with no dealer or broker. Examples include Instinet and Archipelago.

[25]E. Dunne, "Chapter 3: Financial Instruments, Financial Markets, and Financial Institutions", *http://www.oswego.edu/~edunne/340ch3.htm*

[26]A. Babus& P. Kondor, "Trading and Information Diffusion in Over-the-counter Markets", *Federal Reserve Bank of Chicago*, (2013)

Debt vs. Equity vs. Derivative Markets

Debt instruments, as in the case of bonds or bank loans, represent a particular form of transaction wherelender (the owner/buyer of the debt instrument) is entitled to receive from the borrower (the seller/issuer of the debt instrument) fixed payments at specified intervals until a final date. The final date is known as the maturity of a debt security where all payments will have been received and principal should be repaid. A common classification of these debt instruments is based on matury:

- Short-term debt securities have a maturity of up to 1 year. This part of the debt market is also known as the money market.
- Intermediate-term debt securities have a maturity of between 1 and 10 years.
- Long-term debt securities have a maturity of 10 years or more.

On the other hand, equity instruments, such as shares of common stock, represent theentitlements on the earnings and assets of a corporation. If, for instance, a shareholder owns 5% of the shares of a company, then it is entitled to 5% of the earnings and assets of that company once creditors are satisfied. Many differences exist between equity and debt secutities:

- the size and timing of the payments are not fixed. Most equity securities imply an entitlement for the owner to receive periodic payments (known as dividends) but these payments are not guaranteed. In fact,shareholders benefit from a firm's profitability only after debtholders receive the money they are supposed to, this is known as residual claim.
- There is no maturity date for equity securities so they are considered long-term securities.

- Stock holders are considered residual claimants also in the event of bankruptcy. This means that creditors are paid before shareholders receive anything. Therefore, this implies more risk in holding shares (this is why cost of equity capital is higher than the cost of debt). A good example is the one referring to the many internet startups that went bankrupt in 2001. The assets were sold but did not even cover all of the debts so stock holders got nothing.

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.

DEBT CAPITAL MARKET

Debt can be considered the main alternative to equity financing and it can serve for both short-term and long-term needs. Debt may be secured or unsecured. The aim of this section is to analyse the characteristic of debt financing from different perspectives and taking under consideration various aspects of this topic.

General Characteristic of Debt Finance

Debt instruments present very different characteristic ifanalysed from the point of view of the lender or from the one of the issuer. For an investor debt could be seen as a low risk instrument because it presents fixed maturity and interest payments (which, hence, do not vary with the revenues or income of the issuer). Moreover, debt holders have priority over

repayment in case of bankruptcy and liquidation: but, on the other hand, they do not have voting rights, except for the case in which interests are not paid[27].

From the view point of the issuer, debt financing is cheaper because the investors require lower returns with respect to shareholders. Moreover it presents many favorable characteristics such as no dilution effect, tax deductibility and the fact that cost is limited to the stipulated interest payment.

However, debt may also have some drawbacks such as the fact that interest payments are fixed and, therefore, the same amount has to be paid both in good and in bad years; the amount of debt a company can use is limited given the increasing risk in having high leverage; long-term debt with fixed interest may prove a burden if the general level of interest rates falls; while, variable interest debt is subject to interest rate rises[28].

Bank Loans and Overdrafts

Almost every firm has been financed through the use of a bank loan or has used bank overdrafts. This type of financing is very common, especially for small and medium enterprises (SMEs).

The former are usually linked to specific projects and assets, this characteristic makes bank loans a good mean to finance a smart city project. Moreover, these loans are secured over assets of the company or entity and repayment is based on a fixed schedule[29]. The sum of these elements makes loans low risk instruments in relation to bank overdraft; this also implies lower interest rates.

[27]Kaplan Financial Knowledge Bank, "Debt Finance", *http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Debt%20Finance.aspx?mode=none*
[28]Kaplan Financial Knowledge Bank, "Debt Finance", *http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Debt%20Finance.aspx?mode=none*
[29]R. Holloway and D. Sullivan, "Overdrafts and Bank Loans", *BHP Information Solutions Ltd*, (2008)

On the other hand, bank overdrafts are way riskier because they are normally unsecured, and this leads to higher interest rates. Companies mainly use them to cope with short term cash flow fluctuations.

Bonds and Loan Notes

Bonds offer an alternative to equity and are widely used for long-term financing. They represent the written certification of the debt of an entity and always present provisions regarding the interest and repayment of the principal.

Bonds can be traded on the stock market much like shares; this is because bonds are usually denominated in blocks of $100 nominal value. Furthermore, this type of debt can be secured or unsecured, the former type implies that the financial asset has claims over one or more assets of the company[30].

On default bond holders can appoint a receiver to administer the assets until the interest is paid. Alternatively the assets can be sold to repay the perpetuity.

Finally, debt may be callable or not, that is, the principal can be repaid before maturity (usually at a premium).

To conclude, it is important to remember that there are many different types of bonds on the basis of issue price and coupons. To this extent we can talk about "Deep Discount Bond" and "Zero Coupon Bonds". The former is issued at a price below its face value and it can be redeemed "at par" or "above par"at maturity. The low issue price compensates investors for the low coupon rate received for the interim cash flows. The latter is a bond that does not pay coupons and, hence, it is issued at a discount. Income from this bond comes in the form of capital gains.

[30]Kaplan Financial Knowledge Bank, "Debt Finance", *http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Debt%20Finance.aspx?mode=none*

Credit Rating

When dealing with debt financing in capital markets it is crucial to underline the importance of credit rating.

Rating is a "risk category" assigned by objective rating agencies to corporate, sovereigns and specific issuances. They represent the relative degree of credit risk which is determined on the basis of leverage or gearing[31].

The analysis to assign a specific rating to a debt instrument issued by an entity is generally based on public information, but agencies also have meeting with managers of the companies to form a view of what is the actual situation of the company.

As the table below shows, ratings go from AAA (most secure bonds) to D (extremely high default risk). Being downgraded implies a higher cost of debt because of the higher perceived risk of default. This is especially true when an instrument is downgraded from actual investment grade (from AAA to BBB+) to sub-investment grade (from BBB to BBB-) or even worst to non-investment grade (lower than BB+). The rating presented above follow the S&P methodology, there are other 2 major rating agencies, namely Moody's and Fitch. The latter follow a similar distinction between ratings.

Bond Rating				
DBRS	Moody's	S&P	Grade	Risk
AAA	AAA	AAA	Investment	Lowest Risk
AA	Aa	AA	Investment	Low Risk
A	A	A	Investment	Low Risk
BBB	Baa	BBB	Investment	Medium Risk
BB, B	Ba, B	BB, B	Junk	High Risk
CCC/CC/C	Caa/Ca/C	CCC/CC/C	Junk	Highest Risk
D	C	D	Junk	In Default

[31] M&A and Investment Banking Class Material, Professor De Vecchi (2013-2014)

Straight Debt: Deal Structure and Main Types of Transactions

It is important to define some key aspects of straight debt deals. It is possible to highlight three major elements that ultimately form debt deals[32], that is:

- Currency Adopted. Major funding currencies are the USD, EUR, STG, CHF; however, there are also other currencies that are called "Arbitrage Funding Currencies" that are widely used, such as AUD, NOK, CAD, NZD. The choice of one currency over another depends upon the investor's diversification desires and the absolute funding costs he/she faces.
- Maturity. When determining the maturity of a bond, acknowledging the investment horizon of the investor is crucial. The decision regarding the maturity of a bond ultimately depends on the issuer's outstanding maturity profile, issuer's funding needs and the depth of investor demand. The choice of the currency affects maturity as well, for instance:
    - STG/USD call for strong investor appetite for long dated securities;
    - EUR/CHF rarely see issuance beyond 12 or 115 years.
- Interest rate. Interest rates may be fixed or floating and the decision to adopt one over the other depends on the future predictions of the movements of the interest rate and on the issuer's asset-side information (linked with stream of inflows). A fixed rate typically offers the deepest investor base probably because of the higher visibility in the future. Floating rates, on the other hand, are more common for shorter-dated maturities.

Deals may come in two main forms:

- Best Effort Basis

[32]M&A and Investment Banking Class Material, Professor De Vecchi (2013-2014)

- Underwritten Bond/Backstop

The former is characterized by the fact that the issuer bears the risk of the execution of final terms. In this case, lead managers receive a flat fee and the role of the Investment bank is to find investors willing to purchase those bonds. Best Effort deals are widely used during bad economic situations because the banks are not sure they will place the whole offer.

Underwritten or "Bought Deals" are completely different from the type of deal described above, in fact, Bought deals are characterized by the fact that Investment banks bear the risk of not placing the whole offer. In this type of deal banks buy the bond at a pre-agreed level (usually at a discount) and then re-sell the bonds to investors. Since the bank faces higher risk fees are higher too and banks also make gains out of the spread on the re-sale of the bonds.

Finally, in backstop deals the bank provides the issuer with a backstop level at which they have certainty on price.

EQUITY CAPITAL MARKETS

In the definition of the equity of a company, equity is often narrowly referred to as being the shares of a company[33]. The concept underlying equity presents a much more vast meaning; in fact, it includes all the risk capital of a company. The notion of risk capital is very broad and includes many elements, such as the reserves, irredeemable preference capital in issue, minority interests less goodwill and, in some cases, debentures[34].

[33]Braam van den Berg, "Understanding Financial Markets and Instruments", *The Academy of Financial Markets,* Chapter 2

[34]Braam van den Berg, "Understanding Financial Markets and Instruments", *The Academy of Financial Markets,* Chapter 2

A share in a company is defined as being a right in the assets, profits and management of the company, equal to the rights of any other similar share, and this right is indivisible[35]. A share is physically represented by a share certificate; this certificate gives its holder, among others, the rightslisted above and the entitlement to express his vote at the annual general meeting of the company where matters concerning the strategy are discussed. The owner of the certificate is said to bear limited liability to the extent of his ownership and can enjoy the benefits of the company (e.g. the profit). The rights of shareholders can be listed in the following way[36]:

- Shareholders may vote at shareholder meetings and general meetings of the company. The company may also be forced by the shareholders to hold a meeting under certain circumstances where they can influence the agenda or voice their opinions.
- Although not explicitly expressed in the Companies Act, shareholders must be kept informed at all times. A prospectus must be distributed when a company wants to raise capital.
- Shareholders have the right to receive dividends but this is a legitimate expectation and not a legal right.
- Shareholders are entitled to expect a high degree of diligence, competence and integrity from the directors of the company.
- Shareholders have the right to be informed by the company regarding any information or developments that might influence its share price.

[35]Braam van den Berg, "Understanding Financial Markets and Instruments", *The Academy of Financial Markets,* Chapter 2
[36]Braam van den Berg, "Understanding Financial Markets and Instruments", *The Academy of Financial Markets,* Chapter 2

The most common types of securities issued and traded on the stock exchange are the following[37]:

- Ordinary shares: which entitle to dividends and give voting power(representing one vote per share)
- N-shares, A-shares and B-shares: These shares are characterized by different voting power if related to ordinary shares. In fact, they are used to obtain additional capital (without affecting the power of major shareholders).
- Preference shares, convertible preference shares, cumulative preference shares, redeemable preference shares and debentures. These are securities that hold preference for dividends or interests but imply no voting power.
- Nil paid right: when a listed company performs a rights issue it is to raise additional capital and it gives existing shareholders a preemptive right to first buy the new shares issued in proportion to the current shareholding. For this right, a letter is issued which is called a nil paid letter (NPL). This letter (representing the right to take up shares) can be sold in the market.

Moving forward from the information reported above, which only introduces the most general concepts that are at the basis of equity financing, the following section will deal more in detail with the role ECM have within investment banks nowadays, the types of equity products available, cash equity financing alternatives and the monetization strategies adopted.

[37]Braam van den Berg, "Understanding Financial Markets and Instruments", *The Academy of Financial Markets,* Chapter 2

ECM role in an Investment Bank

Equity Capital Market places itself between investors and issuers, and their main objective is to act as a connection among these two parties to facilitate dialogue and activity between corporate and institutional clients[38].

A crucial aspect of this endeavor is the collection and analysis of extensive information on investor behavior and preferences in combination with all the research deriving from the flow of capital information coming from the trading side.

ECM Product Range

Within the ECM business it is possible to find 4 products: initial public offerings (IPOs), follow-on offerings, equity-linked securities and derivative transactions[39].

IPOs are the sale of a private company to institutional and retail investors. They represent the first time shares of a specific company are traded on the market. Therefore, valuation methodology (Comps, Compaqs and DCF) and research credibility are key in the preparation process since there is no existing reference price. The marketing phase of an IPO is very complete and comprehends pre-marketing and roadshow.

On the other hand, follow-on offerings represent the sale of shares of an already listed company on a recognized stock exchange. Since the company is already listed pricing and marketing strategy are much simpler, however, for the latter this is not always the case.

Deals concerning equity-linked securities are more 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).

[38]M&A and Investment Banking Class Material, "*ECM, DCM and Rights Issue",* Professor De Vecchi (2013-2014)

[39]M&A and Investment Banking Class Material, "*ECM, DCM and Rights Issue",* Professor De Vecchi (2013-2014)

Finally, derivative transactions are 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.

Cash Equity Financing Alternatives

Equity capital can be raised using various techniques. Literature proposes three main ways to offer a capital increase to investors[40]: rights issue, fully marketed capital increase and accelerated capital increase.

The first consists in offering company shares at fixed price (or at a discount to market share price) with pre-emptive rights for existing shareholders. The main advantage of a rights issue is the fact that it avoids ownership dilution for existing shareholders. However, it is a complicated and lengthy process which leads to longer exposure to the market.

A fully marketed capital increase is based on offering shares via an open-priced bookbuilding, where no pre-emptive rights exist. Marketing efforts are very important and culminate in the roadshow. This is a type of structure which maximizes size and demand by investors, but may lead to dilution for existing shareholders. The higher level of demand due to the enhanced size of the transaction generates maximum price tension.

Finally, an accelerated bookbuilding consists in an issue of company shares through an undocumented and rapidly bookbuilt offer without any marketing efforts. This transaction is the simplest of the three proposed and it may be performed in approximately 24 hours. Since the speed of this methodology is so high, management is hardly distracted from its daily activities of running the business. The nature of this technique makes it difficult to

[40]M&A and Investment Banking Class Material, "*ECM, DCM and Rights Issue",* Professor De Vecchi (2013-2014)

attract retail investors and, moreover, it implies that the vendor carries price risk during bookbuilding.

Monetisation Strategies

Monetisation strategies may be similar in some aspects to the deals described above. There are five main monetization strategies[41]: Accelerated bookbuilding, block trade, fully marketed offer, optional and mandatory exchangeables. The difference between these methodologies and the ones described in the "Cash Equity Financing Alternatives" section is that the latter are specifically used to expand equity capital in a company, while the former imply a transfer of ownership.

- Accelerated Bookbuilding(ABB): it is an open-priced mechanism with the price set at or close to market level. It aims at achieving a broad distribution and a significant size. ABB is characterized by low market exposure and it is capable of maintaining momentum in the transaction. In this type of deals, risk is on the vendor.
- 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). From the vendor's perspective there is certainty of execution and, hence, no market risk. However, there is no upside potential, in terms of price, for the vendor which should also pay higher fees to the bank which faces much more risk.
- Fully Marketed Offer: this type of transaction is based on bookbuilding and stresses the importance of marketing and roadshow efforts. It manages to achieve

[41]M&A and Investment Banking Class Material, *"ECM, DCM and Rights Issue",* Professor De Vecchi (2013-2014)

the broadest distribution, maximum size and demand. The combination of these elements makes it possible to have upwards price pressure.

- Optional Exchangeable: This is a particular type of method, based on the use debt instruments with an embedded call over underlying shares. This form of debt is characterized by low coupon (because of the equity component), and the positive signal it send to the markets. However, there is no certainty regarding the disposal of the underlying shares.
- Mandatory Exchangeable: similar to the one dealt with in the previous point apart for the fact that disposal of underlying shares is guaranteed by the mandatory exchange. Still sends a positive signal to the market, but coupons are higher.

Summing Up

The chapter above has conducted 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

As mentioned above, 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 sto 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.

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.

There 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.

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CHAPTER 3: FINANCING INSTRUMENTS FOR "SMART CITY" PROJECTS

As mentioned in the previous chapters, the development of smart cities is intertwined with the concepts of continuous innovation and investment. The level of investments needed for large smart city projects cannot be exclusively sustained by public financing, therefore, the need to access private funds is a key topic worth analyzing.

It is possible to identify several financing instruments that could be used to raise funds for smart city initiatives. The aim of this chapter is the classification of these instruments on the basis of three broad categories.

The first category is represented by EU instruments and funds, which can offer great help in these situations; however, it is also important to attract private finance through the establishment of public-private partnerships. Finally, public administration should develop a business-friendly environment capable of drawing and supporting private initiatives in terms of economic returns and socio-environmental impact.

Chapter 2 discussed the general characteristics of the main financing instruments in the market. Thanks to this overview it is now possible to enter into more detail by considering the most appropriate ways to finance projects.

Therefore, the following chapter will take into examination the various instruments for smart city project financing.

EU INSTRUMENTS

The instruments deriving from the European Union can be of different typologies. In fact, smart city projects can access funds not exclusively destined to urbanization projects but also those destined to sustain SMEs and human capital, which, as stated in chapter 1, are

an integral part of full-scale smart city projects. It is, therefore, possible to divide the various instruments available into three broad groups according to their intrinsic features:

- Directly-managed programs (Horizon 2020, COSME, Life +);
- Structural Funds;
- European Investment Bank (EIB) Instruments.

Directly-Managed Programs: Horizon 2020, COSME and Life +

As the title of this section suggests, there are three principal forms of directly-managed programs that are connected to the financing needs of smart city projects.

The first, Horizon 2020, is the EU's new Framework Program for Research and Technological Development for the years 2014-2020[42]. The objective of this initiative is to create a European harmonized effort towards research by mobilizing private investments considered to be absolutely necessary to stimulate competitiveness in certain key sectors[43]. Harmonization of policies within each Member State is still a central topic of debate; in fact, fragmentation in R&D policies in the 27 Member States lead to very heterogeneous outcomes.

Horizon 2020 is based on a multidisciplinary approach which combines, in a unique program, efforts regarding research, development and innovation. This triangular approach goes beyond what the previous Framework Program did. The latter focused only on specific R&D fields, with innovation driven by the Competitiveness and Innovation Framework Program (CIP) and the European Institute of Innovation and Technology (EIT).

[42] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.55

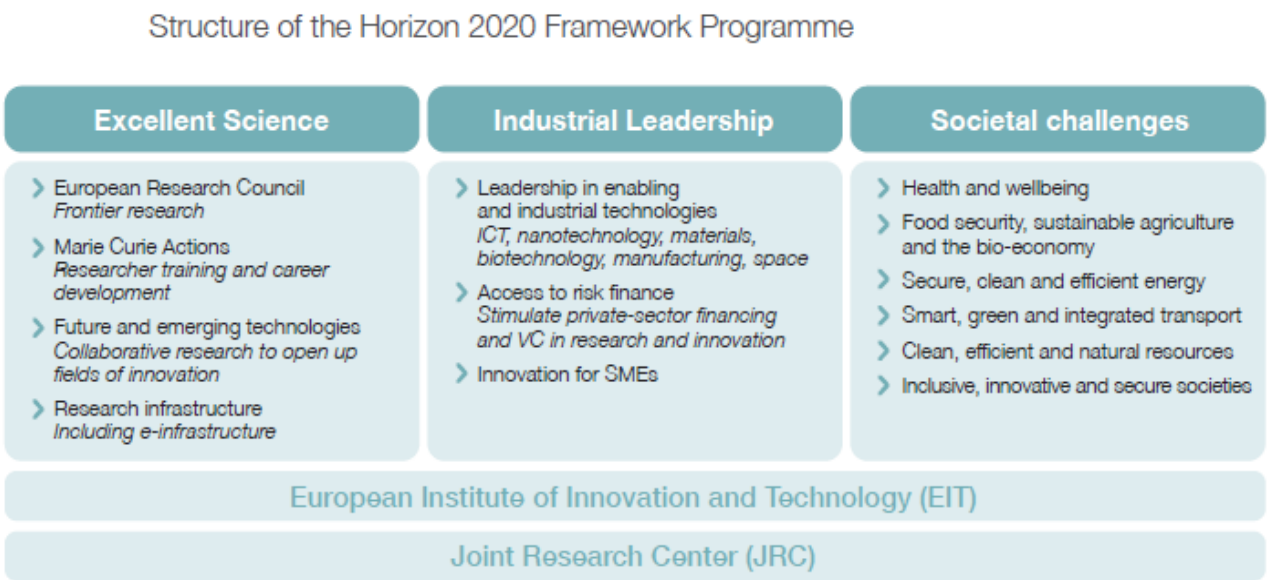
[43] A. Del Bello, "Horizon 2020: le tre priorità e le novità rispetto al VIIPQ", Università di Ferrara (2012)

The final aim of Horizon 2020 is to fill in the gap between the EU and the US or Korea and Japan, in terms of the capability of translating research into industrial innovation.

The program has a budget of approximately €78-80 billion, that will be used to fund 100% of all R&D expenses and 70% of other activities which are closer to the market roll-out.

The structure of the program is based on 3 pillars[44]:

- Excellence Science, which mainly focuses on basic research (seen as the foundation of technological development);
- Industrial Leadership, focused on the development of technologies such as those in the fields of ICT, nanotechnology, etc., which require private sector investments and the work of innovative SMEs to create jobs and growth;
- Societal Challenge, which is based on the assumption that Europe 2020 targets can only be achieved thanks to a multidisciplinary approach.



Source: Politecnico di Torino – Report Monografico CDP "Smart City"

[44] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.55

The program presents several elements that are worth considering:

- The strong cross-contamination among the areas;
- The existence of financial tools, developed together with the EIB, to facilitate access to credit and stimulate innovation;
- The focus on SMEs, consistent with the idea of a smart city which aims at involving the local industrial community in the research and development programs;
- All the pillars are designed to foster the expansion of pre-commercial procurement and public procurement of innovative solutions.

The planned effort in the period 2014-2020 will also tap on another initiative named COSME (Programme for the Competitiveness of Enterprises and SMEs). The program's budget is around €2.5 billion and it is aimed at sustaining entrepreneurs and SMEs in consolidating or starting up their business[45].

The program provides for facilitating the access to finance for SMEs through the use of tailored instruments, specifically created according to the business's life-cycle stage. It also encourages the creation of a network of enterprises (Enterprise Europe Network) both within and across national boundaries. Furthermore, its ultimate goal is to create a business-friendly environment which is capable of stimulating sustainable competition among European enterprises and lead the internationalization of smaller firms.

This initiative plans to contribute to an annual increase of €1.1 billion in Europe's GDP[46].

The last directly-managed program that has to be dealt with is "Life +". It is a financial instrument specifically designed to intervene in environmental matters. The budget for

[45] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.56

[46] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.56

this program during the period 2014-2020 is €3.2 billion and is should be used for grants or public procurement contracts. The beneficiaries can be public and/or public bodies, entities or institutions. Co-financing is 50% of the eligible costs, at its maximum.

The program is divided in 3 major topics:

- LIFE+ nature and biodiversity, whose aim is the implementation of Union policies and creating monitoring and evaluation tools;
- LIFE+ environmental policy and governance, which is based on the development of innovative methods, technologies and tools for environmental policy as well as increasing the involvement of stakeholders;
- LIFE + information and communication, which aims at disseminating awareness regarding environmental issues.

Structural Funds

Structural funds are indirectly-managed instruments provided by the EU. These funds are part of the EU budget, but their expenditure procedures involve different actors[47]:

- The European Commission, which negotiates and approves the development programs proposed by the Member States, approves funding and participates in monitoring the programs;
- The Regions, which manage the programs and implement them by selecting projects.

Therefore, the funds are actually managed by the Regions, but can be employed by local governments in urban areas[48].

[47]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 57

Structural Funds include the European Regional Development Fund (ERDF) and the European Social Fund. The former is supposed to act in order to level out imbalances between different EU regions. It deals with many topics, such as:

- Research, development and innovation;
- Access and quality of ICT;
- Low-carbon emissions;
- Support for SMEs;
- TLC, transport and energy infrastructure;
- Sustainable urban development.

The last topic listed above plays a central role in development of smart cities because, according to the new directives of the ERDF, cities are supposed to invest at least 5% of ERDF resources, approximately €16 billion, in integrated urban development actions through an instrument known as the Integrated Territorial Investment Instrument.

On the other hand, the European Social Fund (ESF) is focused on sustaining European policies regarding employment and social integration[49]. The fund has four objectives:

1. Fostering employment and supporting labour mobility;
2. Promoting social inclusion and the war on poverty;
3. Investing in education, skills and life-long learning;
4. Improving institutional capabilities and enhancing government efficiency.

All EU regions can use these funds but the way in which resources are allocated is based on the following criteria:

[48]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 57

[49]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 57

- Less-developed regions, per capita GDP less than 75% EU-27 average (in Italy: Calabria Sicily, Campania and Puglia);
- Transition regions, per capita GDP between 75% and 90% of EU average;
- More-developed regions, per capita GDP greater than 90% of EU average.

The programs are jointly developed by the EU, central governments and the regions and they follow the principle for which EU funds cannot replace national or regional funds, but rather must add to them.

EIB Instruments

EIB stands for European Investment Bank, which is a financial institution owned by the 27 Member States. Its mission is to finance projects, mainly within EU boundaries, and to pursue six major objectives[50]:

- Cohesion and convergence;
- Support for SMEs;
- Environmental sustainability;
- Implementation of the "Innovation 2010" initiative;
- Development of trans-European transport and energy networks;
- Sustainable, competitive and secure energy supplies.

The activities performed by the EIB can be very diverse. For instance, it can make loans and equity investments, provide technical assistance and guarantees. In many cases it operates in conjunction with the European Union (EU), and it provides financial instruments that are capable of leveraging private-sector investments for projects with a high socio-economic impact, which in some cases may not be particularly attractive to

[50] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.58

investors given the high level of risk involved and the long payback periods. Among others, the instruments that are more adequate for smart city projects are:

- ELENA (European Local Energy Assistance). This initiative began in 2009 and it is customized to projects concerning energy efficiency, renewables and other objectives of "Europe 2020". Initially the budget was approximately €49 million and it was used to cover 90% of technical assistance costs incurred for the preparation, implementation and financing of energy projects. The goal was to avoid a lack of know-how by the local authorities which were not accustomed to working on large-scale projects.
- JESSICA (Joint European Support for Sustainable Investment in City Areas). JESSICA is a financial instrument born from the joint efforts of the EIB and the EU and to promote the use of Structural Funds for urban projects[51], hence, stimulating investments for €2.2 billion, with an average leverage ratio of 60. The goal is to finance economically sustainable projects, which will, in turn, be able to finance other future projects thanks to the returns they generate. This is the main idea to attract private and public investors in integrated urban development plans.

  Urban Development Funds (UDF) can be deployed in a many ways:

  - Loans to private-sector entities or special-purpose vehicles (SPVs);
  - Investments in SPVs;
  - Loans to local authorities.

  The criteria followed for eligibility are identical to the ones governing the utilization of Structural Funds. This instrument has been widely used in many

[51]P. Hirst et al., "JESSICA for Smart and Sustainable Cities, *Horizontal Study European Investment Bank*, 2012

European Cities such as Manchester, Amsterdam, Barcelona and Malmo, showing how it is particularly suited to tackle smart city issues[52].

Examples of financing in 18 smart city projects studied by Alcatel-Lucent

SMART CITY PROJECT	GREENFIELD/BROWNFIELD	INVESTMENT	FINANCING SOURCE
Amsterdam	Brownfield	200 m Euros	• Partly European fund for regional development
Birmingham	Brownfield	20 b BP	
Cape Town	Brownfield	355 m Rands	• City of Cape Town, national and provincial government
Chattanooga	Brownfield	$111.5 m US	• Grant from Department of Energy for smart grid • Internet funded separately
Dakota County	Brownfield		
Dublin	Brownfield		• European regional development fund for GREENOV
Gdansk	Brownfield		
Jubail	Greenfield	650 m Euros	• Loans from the Saudi Industrial Development Fund • Government assisted housing loans from Real Estate Development Fund
Malaga	Brownfield	31 m Euros	• Partly European fund for regional development • Ministry of Science and Innovation center for the development of industrial technology
Masdar	Greenfield		
PlanIT Valley	Greenfield	10 b Euros	
Shenyang	Brownfield	250 m RMB	• Local government
Songdo	Greenfield	$35 b US	• Loans from Korean banks
Suwon	Brownfield	$27 m US/year	• Local government
Trondheim	Brownfield		• EU-funded ECO-city project
Wuxi	Brownfield		

Source: Alcatel-Lucent Market Analysis

- JEREMIE (Joint European Resources for Micro to Medium Enterprises). This initiative came into being thanks to the joint work of the European Commission, EIB and the European Investment Fund (EIF). It promotes the use of financial engineering techniques to improve SMEs' access to financing through Structural Funds[53]. JEREMIE has multiple objectives such as the creation and expansion of

[52] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.59

[53] E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 60

enterprises, facilitating access to investment capital by enterprises to modernize their activities and production technologies. It is very important to note that the Structural Funds channeled through JEREMIE are allocated to Holding Funds, which, in turn, select financial intermediaries that offer SMEs the guarantees, loans, securitizations, equity capital, investments in technology transfer funds and in business angel matching funds that they need. Therefore, this initiative is actually tailored more for financial intermediaries, which operate in smart city scenarios, rather than to the SMEs. A very important requirement is that the selected investment should generate sufficient returns to repay investors and finance future re-investments, in order to generate a sort of multiplicative effect.

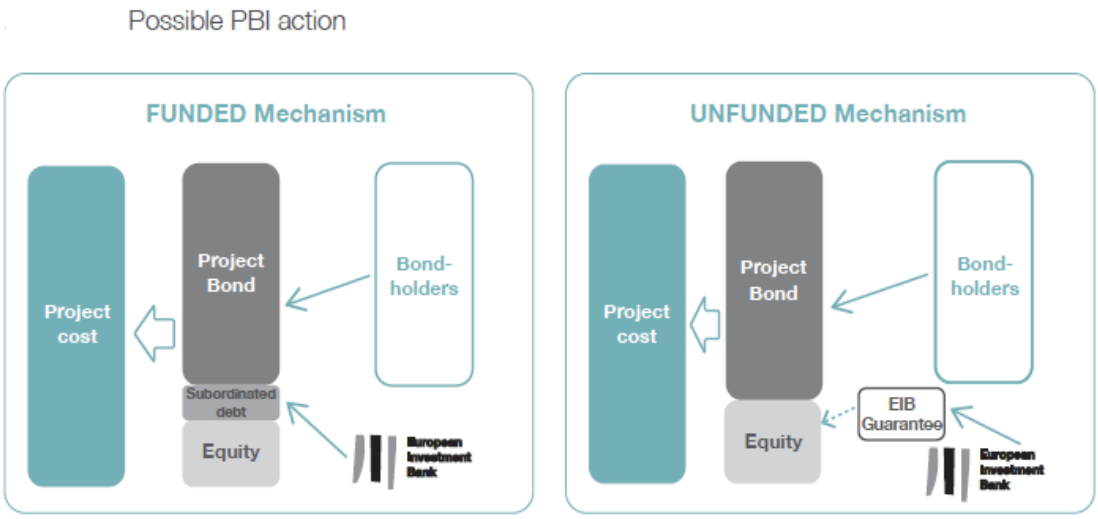
- Europe 2020 Project Bonds Initiative (PBI) is one of the latest instruments created by the EIB in conjunction with the European Commission in 2010. It is specifically designed to attract funds from capital markets in order to invest in infrastructure projects[54]. The aim is to find financing for strategic fields were private-sector investments are low and, hence, there is a need to stimulate investments in order to close the infrastructure gap. This initiative is deemed necessary to develop transnational transport, energy and telecommunication projects.

  In order to enhance the attractiveness of the securities issued by the project companies to raise funds for specific infrastructure projects, the PBI seeks to boost their creditworthiness using a credit enhancing mechanism, in one of two forms[55]:

[54] "Financing PPPs with Project Bonds: Issues for public procuring authorities", European PPP Expertise Centre, (2012)

[55] E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 60

- Funded: the support involves the financing, up to specified limits, of the subordinated debt of the SPV;
- Unfunded: the support involves the issue of a letter of credit to the project, which guarantees EIB intervention if the project's cash flows are insufficient to service the senior debt. Support for a specific project may not exceed €200 million or 20% of total senior debt. The initial test phase for the instrument will involve €230 million (€200 million for TEN-T, €10 million for TEN-E and €20 million for broadband projects) to stimulate the market and raise €4 billion in funds[56].



Source: European Investment Bank, 2012

- The Risk Sharing Finance Facility (RSFF). This joint initiative by the EIB and the EC was launched in 2007 to finance a risk sharing system. This mechanism is supposed to improve the access to credit for R&D projects undertaken by medium size enterprises, public institutions, SPVs and foundations. It sustains basic R&D as well applied research. The eligible sectors are green technologies for mobility,

[56]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 61

energy efficiency, pharmaceuticals, biomedical engineering, transport and TLC. The main goals of RSFF are:

- To enhance creditworthiness of promoters (to make it more attractive in the eyes of other investors);
- To incentives investments by banks and make them participate in risk management.

In total, expected capital will be around €2 billion, and it will be invested in highly risky projects with a total debt of approximately €10 billion. To borrow from these funds, enterprises to not need to be rated, but they must demonstrate to be able to repay at least 50% of their debt in 5-7 years. The options available for financing are:

- Senior corporate or project debt, with a term of up to 10 years, with a variety of repayment options;
- Mezzanine debt**,** in the form of a subordinated loan or guarantee, with a term of up to 6 years and repayment at maturity.

PUBLIC – PRIVATE PARTNERSHIPS (PPP)

PPP Definition and Characteristics

Public-Private partnerships can be defined as all those cooperation agreements where two or more agents, that have a public or private background, decide to combine theircompetencies in order to work on projects that have relevant public interest. In general, PPPs present the following characteristics[57]:

- Long-term arrangements between public entities and one or more private companies;
- A certain amount of risk is transferred to the private sector;
- Based on specific project outputs, rather than inputs;
- Use of private financing (often under the form of project finance)
- Payments received by the private-sector party may come from the users of the service, the public-entity or both. To this extent, we can define 3 major types of investments[58]:
    - "Hot" investments, which have the intrinsic capacity of generating income;
    - "Lukewarm" investments, which require government support;
    - "Cold" investments, where the private-sector player receives a flat fee or a "shadow rate" paid by the public entity.

The development of this type of financing alternative calls for the need of a strong and participative public-sector entity. In fact, it is absolutely necessary that the public-sector party acts as the principal and takes on the role of the project manager. This effort

[57]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 61
[58]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 62

requires the acquisition of a series of capabilities that crucial for the project's success, such as ex-ante efficiency and cost-effectiveness evaluations as well as the capability of negotiating with the other parties involved in the project, being them public or private.

PPP Tests

Before starting a PPP it is necessary to present a feasibility study (FS) and/or a preliminary design, whose purpose is to translate the idea in an actual investment proposal[59]. These documents analyses the general context and assess the economic and financial feasibility of the project; therefore, a crucial part of these studies is the cost-benefit analysis. The final decision on using a PPP as the form of financing rather than more traditional methods depends on a series of analyses which are part of what is as the "PPP test"[60].

A PPP test includes:

- Financial Feasibility Analysis (FFA), which concern economic and financial soundness of the project as well as attractiveness on the market;
- Grant Appropriateness Assessment (GAA), used to determine the optimal level of public resources deployed to achieve economic and financial soundness of the project;
- Project Risk Management (PRM), which involves the project's entire life-cycle;
- Public Sector Comparator (PSC), which quantifies the project's value for money (VfM) by comparing the PPP approach to the direct management of the project by the public-sector entity.

[59]"Financing PPPs with Project Bonds: Issues for public procuring authorities", European PPP Expertise Centre, (2012)

[60]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 63

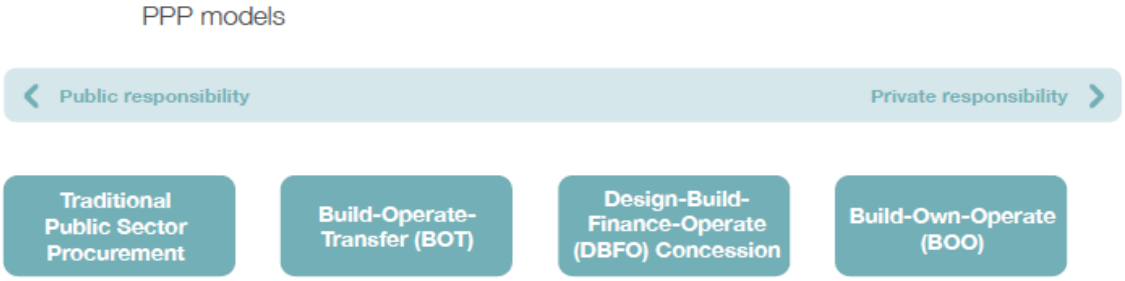
Contract Types and Procedures

Under a PPP agreement it is possible to create "ad hoc" contracts on the basis of the project's characteristics, the services that need to be rendered and on the players participating. In general, within a contract several element coexist, such as:

- Design (D)
- Finance (F)
- Build or renovate (B)
- Operations and Maintenance (O&M) or Operate ("O")

Combining the elements listed above it is possible to create various models. The most common are:

- Traditional procurement, public-sector contracts the private sector to design and build the work for a specified price;
- Build-Operate-Transfer (BOT), this typology involves the concession agreement among the public and private sector-parties covering the design, build and operate phases (also known as "turn-key contract"). The advantage is represented by uniting various tasks under a single entity.
- Design-Build-Finance-Operate (DBFO), compared to the previous methodology the private-sector party also faces the risk of finding funds for the project;
- Build-Own-Operate (BOO), in this form of contract the private sector retains ownership of the work. Generally, it is used whenever the useful life of the work coincides with the term of concession.



Under EU law, there are 4 main types of award procedures – open, restricted, negotiated and competitive dialogue[61]. On the other hand, Italian legislation allows PPP to take the form of concession of works, concession of services, finance leasing, availability contracts and sponsorships. Moreover there also are institutionalized forms of PPP that comprehend mixed companies (created thanks to public and private capital), mixed companies created in accordance with the Italian Civil Code and Urban Development Companies.

Risk Management

Risk allocation is a key success factor for PPP. It is crucial important to allocate risk to the party that can best manage it. In general, it is possible to identify 5 major categories of risk, namely:

- Construction;
- Operation and Maintenance;
- Demand;
- Financial; and,
- Context (socio-economic and political risk)

[61]"Financing PPPs with Project Bonds: Issues for public procuring authorities", European PPP Expertise Centre, (2012)

The first two categories are usually faced by the private party which, in most cases builds and operates the work/project. In a similar fashion, the bank is the most suited participant to deal with financial risk and the public entity with context risk. Demand risk is a very complex form of risk and it is usually shared by all the parties involved in the project.

Adequate risk allocation is founded on the capability of the public entity to perform ex-ante analysis, in terms of the economic, social and financial situation. However, ex-post monitoring and evaluation is as important since it allows to measure performance within the project[62].

The UK has introduced the use of standardized contracts for particularly innovative projects, this is a very important move because it allows to significantly reduce the number of failures.

Governments can stimulate private sector participation in PPPs by granting government guarantees in order to satisfy financial, risk and policy issues. The use of government guarantees is a double edged sword, since it may also influence the Value-for-Money of the project or, in the worse cases it could lead to moral hazard.

The next section will dig deeper in the most appropriate financial instruments for Smart City projects. With a special focus on Project Financing as the main structure adopted for the establishment of PPPs. Highlighting all the characteristics that make it such a widely used element for these innovation-driven projects.

ESCO, Urban Development Companies, Finance Lease and Sponsorship Agreements

Energy Service Companies (ESCO) are the entities in charge of promoting energy efficiency and bear part of the risk that is faced within the project. In fact, the services offered by these companies are totally or partially paid in relation to the effective results

[62]"Public-Private Partnerships-Reference Guide", *World Bank Institute*, (2012)

obtained in terms of energy savings. The ESCO is in charge of performing an energetic audit, that is a sort of preliminary analysis of the factors that may impact its operations; then it also designs, executes, operates and monitors the project directly. The contractual form that governs the relationship with ESCOs is known as Energy Performance Contracting (EPC), which clearly states that the ESCO is remunerated on the basis of the energy savings it manages to obtain. Yet, EPCs can come in two different forms:

- Guaranteed savings EPC, where the initial investment is sustained by the client and the ESCO guarantees that a certain amount of savings will flow to the client;
- Shared Savings EPC, where the ESCO sustains the investment and the savings generates are shared.

However, a large problem with ESCOs arises when we deal with the limited capitalization of these companies, which are unable to provide adequate collateral security to banks which are supposed to lend them money. This implies a significant slow-down in the banks' propensity to invest in these instruments and, hence, an even-larger drop in energy efficiency projects.

An Urban Development Company (UDC) is a specific-purpose mixed corporation promoted by a public entity to design and execute urban development projects in cooperation with a t least one private partner[63]. The creation of a UDC is based on a feasibility study which leads to the choice of the private partner that will help the PA complete the project. The access to private funds make projects come to life in much shorter time span that would normally be the case.

[63]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 68

A finance lease is a slightly more complex three-way relationship where a financial partner bears the investment in the construction company and then is subsequently repaid by the PA through periodic installments. The PA usually performs an ex-ante cost-benefit analysis and monitors the situation ex-post.

Finally, sponsorship agreements are a very used tool. They consist in an agreement with a private entity which may decide to contribute through cash or with any other contribution in-kind to whatever project, being it innovative or restoration-based.

Thesetypes of initiatives are regulated by law and must comply with the following four conditions[64]:

- pursue public interest;
- be free from conflicts of interest;
- the public entities must achieve savings compared with the established appropriations; and
- the financing of initiatives, services or other activities must not be part of the ordinary expenditure program if a portion of the revenues are used for employee incentives.

PROJECT FINANCING (PF)

Project Finance: Definition and Key Characteristics

Project finance can be seen as a multidisciplinary approach for the funding of specific investments that present high degrees of complexity and for which high level of bank

[64] Article 43 of Law 449/1997

participation is required[65]. It is an extremely structured way of financing that is closely linked to the economic and financial balance of the specific project it refers to rather than to the balance within the enterprise where the project is carried out. This is the reason why theservicing of debt and the remuneration of capital are based on the cash-flows and profits generated by the project. The latter forms of income must be generated with relative certainty and risks are to be allocated in an efficient way in order to extract as much value as possible from the initiative.

The evaluation of the economic and financial sustainability of a project is based on its actual quality, in terms of the capability of generating cash-flows given a certain level of risk, and it does not depend on the creditworthiness of individual shareholders.

PF is not a technique, nor a simple financing instrument, but rather it is to be seen as an approach for managing and financing complex project that have high capital requirements and are characterized by a division of risks among all participants.

As mentioned above, the project is analysed on the basis of the cash-flows generated. These cash-flows are the primary mean used to service the debt.

Efficient performance of operations is, hence, very important because it allows to generate cash-flows.

One of the principal characteristics of PF is the fact that a Special Purpose Vehicle (SPV) is created in an "ad hoc" fashion, in order to establish an independent entity, completely separated from the participating enterprises/entities. This distinction allows sponsors to consider costs/debts incurred from the project as off-balance sheet items[66] and stimulates the use of financial leverage. In fact, it is common to find debt as the major source of finance (70%-80% of the capital required). This whole structure is characterized by lower

[65] Comitato Internazionale Programmazione Economica-Unità Tecnica Finanza di Progetto, "Project Finance: Elementi Introduttivi", (2000-2001)

[66] E. Reviglio et al., "SMART CITY: Development projects and financial instruments", Monographic *ReportCassaDepositi e Prestiti,* (2013) pp. 71

cost because of the use of debt over equity, collateralization of assets and a pre-agreed process of debt repayment.

Debt can be serviced in 3 different ways[67]:

1. Non-Recourse: on the basis of the cash-flows generated by the project;
2. Limited Recourse: the compensation to shareholders is limited in terms of timing, amount and quality;
3. Full Recourse: shareholders bear all the risk but this implies a deviation from the assumptions of PF.

PF was first developed in the United States within energy and extraction projects. It subsequently spread in Europe and in Italy, where it also became used for infrastructure projects.

Evaluation of Project Sustainability

The sustainability of a Smart City project, or any other project, that adopts PF essentially lies on the allocation of risks to the different participants. The contractual arrangements among the different parties involved and the allocation of risks form what is known as the Security Package. The identification and composition of the most suited security package for a given project are incredibly complex tasks. The success of the whole initiative depends on it. The Security Package is also crucial for banks because it is supposed to guarantee that they will receive back the money they have invested beforehand in the SPV.

To assess financial sustainability and, therefore, bankability of a project there are several relevant indicators that we can use:

[67] Comitato Internazionale Programmazione Economica-Unità Tecnica Finanza di Progetto, "Project Finance: Elementi Introduttivi", (2000-2001)

- Debt Service Coverage Ratio (DSCR), which measures the ability of cash-flows to service the debt of a given period of time (t).

- Loan Life Cover Ratio (LLCR): used to evaluate the payment of debt service over the residual term of the loan.

$$LLCR = \sum_{t=s}^{s+m} \left(\frac{CF_t}{(1+i)^t} + R\right) \Big/ D_t$$

- Project Cover Ratio (PCR): an index that refers to debt servicing over the whole period of concession.

The first indicator is instantaneous, this means that it offer a measurement at a specific point in time, say the current year for instance; while the last two indicators are dynamic because they keep into consideration the impact of cash-flows over a certain period, that is, until term of the loan for LLCR and over the period of concession for PCR[68].

According to sector-specific and project risk, DSCR e LLCR are benchmarked at different levels. Obviously, the higher the benchmark-level of the indicator the riskier the project. Therefore, we can say that DSCR is used to describe the relationship between debt and equity (D/E), indicating the project ability to repay the debt incurred each year.

[68] Comitato Internazionale Programmazione Economica-Unità Tecnica Finanza di Progetto, "Project Finance: Elementi Introduttivi", (2000-2001)

Other very useful tools to assess the profitability of a project are Net Present Value (NPV) and the Internal Rate of Return (IRR).

PF in Italy

PF is characterized by the fact that PA grants a concession in favour of the SPV, which in turn consigns construction contracts to other companies. Basically, SPV obtain equity capital from sponsors and debt capital from bank loans or through the issue of bonds.

Raising funds for SPV can be a very interesting business for investment banks which could look for sponsors/investors and, at the same time, help the SPV raise money through the issue of bonds.

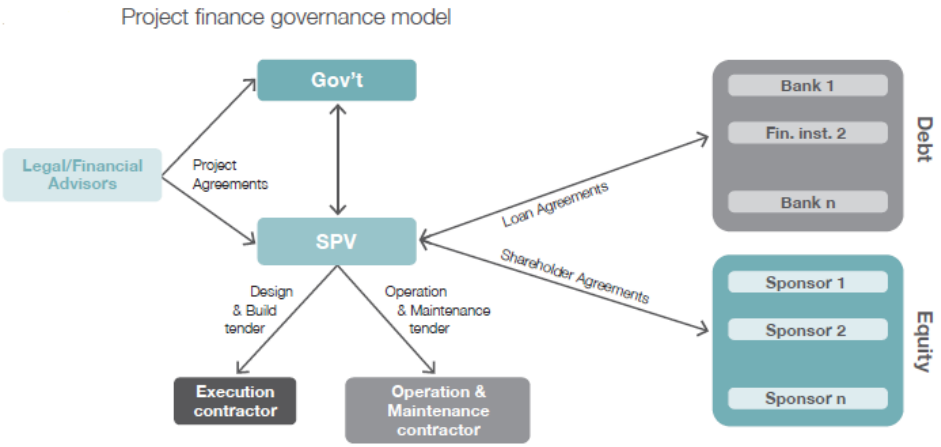
Shareholder Agreements and Loan Agreements respectively regulate the relationship among the SPV and the sponsors and between the SPV and debt-holders.

PF 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.

PF has always been used prevalently in the realization of tangible infrastructure because of the possibility to collateralize the tangible assets that were being created, and the ease in identifying the potential cash-flows of these projects. Even though Smart City projects are characterized by higher levels of intangible benefits and innovation, PF could still

represent an extremely efficient financial tool; in fact, the maturity stage of certain types of technologies makes it easier to predict the cash-flows generated by operations.



Source: Politecnico di Torino – CDP Monographic Report "Smart Cities"

It should be nevertheless emphasized that PF can be expensive, with high transaction costs associated with governing the various contractual relationships and reducing the risk associated with information asymmetries[69]. Studies suggest that PF is becoming more popular for large-scale projects and, hence, it would be a good idea, for Smart City Projects, to create a SPV in charge of performing smart city projects in various cities for example. This would allow attracting more investors and increase overall bankability of all these initiatives.

NEW TRENDS: GREEN BONDS AND SOCIAL IMPACT BONDS

Ethical Finance

It is possible to notice the emergence of interesting trends in the markets nowadays. Many newspapers talk about the uprising of what is defined as Ethical Finance (EF).

[69]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", *Monographic Report CassaDepositi e Prestiti,* (2013) pp. 74

EF is a phenomenon that is quickly spreading throughout the globe and it focuses on a more sustainable and socially responsible approach to investments[70].

Even though EF is spreading rapidly it is still a niche within the financial world; in fact, a study highlights that 23% of the interviewed investors state they know about socially responsible investment instruments, but unfortunately the rest (77%) has only heard about them[71].

Among the major financial instruments of this new sustainability wave we can find Green Bonds (GB) and Social Impact Bonds (SIB).

Green Bonds

Green bonds still represent a not widely used investment class, but they are continuously growing, taking advantage of the current saturation of the traditional bond market.

From the beginning of 2013 more than 8 billion Euros have been invested in this instrument, with very diverse issuers (e.g. supranational banks, local governments, corporates).

Green bonds are similar to plain vanilla Eurobonds and are issued by entities (corporates or local authorities) which have very high investment grade rating and that are already known to the traditional debt capital market. The principal characteristic of these bonds is that they are issued for a specific environmental or social purpose and they offer feeds on the progresses these environmental/social investments have. A very good example is offered by the "Vaccin Bond" which was issued by the International Finance Facility for Immunisation for a total amount of €4.5 billion. According to Novethic (a French Research Company) these instruments are increasingly adopted by local authorities. The

[70] M. Monti, "I Green Bond pronti a sbarcare in Italia dopo il Boom in USA – Focus su ambiente e progetti sociali", *Il Sole 24 Ore*, 18/12/2013

[71] Doxa Metrics, "Gli Italiani e L'investimento sostenibile e responsabile"; Vigeo, "Green, social and ethical funds in Europe", Il Sole 24 Ore, Approfondimento "Sviluppo Sostenibile", 05/11/2013, Pag. 11

first local authority to adopt this instrument to raise funds for infrastructure improvements was Nord-Pas-de-Calais which raised € 50 million with green bonds in 2008. It is easy to imagine this instrument used to collect money for Smart City projects since a municipality could issue the bond and justify it thanks to the improvements in living standards of citizens and waste management for example.

A really suited example comes from the US, where the state of Massachusetts raised $100 million to improve the quality of water, energy efficiencyand waste management. The aim of this initiative was to tap on to private sector funds and lower the tax level for citizens.

Many energy companies use this instrument as well; Edf raised €1.4 billion (coupon at 2.25%) to invest in Edf Energies Nouvelles[72].

Social Impact Bonds

SIBs represent the ultimate frontier of responsible investing. They are configured as contractual agreements among several players which aim at raising private capital to promote social innovation projects.

These bonds are quite different from traditional bonds; in fact, they can be considered a "pay for result" vehicle which does not guarantee the remuneration of capital for holders[73]. What happens is that the payment of coupons and principal is subordinated to the accomplishment of specific results. SIBs are, hence, an example of output-oriented contract, meaning that it is oriented towards the fulfillment of certain social/environmental objectives.

[72] M. Monti, "I Green Bond pronti a sbarcare in Italia dopo il Boom in USA – Focus su ambiente e progetti sociali", *Il Sole 24 Ore*, 18/12/2013

[73] L. Incorvati, "La Finanza Etica deve farsi conoscere di più", *Il Sole 24 Ore*, 05/11/2013

The accomplishment of the predetermined objectives is certified by another independent entity and these results should allow savings capable of:

- Repaying the initial investment;
- Offering remuneration to investors (both coupons and principal);
- Ensuring savings for the PA.

To make sure that payments are actually given out at the right time it is fundamental to have a robust and objective way to measure results and an identifiable population to measure the actual impact of the social actions put into place[74].

Investors are by far the party that faces the highest level of risk. This is why SIBs are used for projects with a very high social impact, in fact investors (foundations, charities and philanthropic entities) don't only require economic return but also an accurately measureable social impact.

In general, projects that use SIBs have a horizon of 5 years (considering initial set-up and final measurement periods as well) and returns that vary in the range 7%-13% p.a.[75]

OTHER PRIVATE SECTOR FINANCIAL INSTRUMENTS

Mini-Bonds

Mini-bonds are a particular form of debt instrument that grant access to capital markets for non-publicly listed companies; therefore it is implicitly directed towards SMEs[76]. This instrument can be used for short term and medium-long term uses.

[74]E. Reviglio et al., "SMART CITY: Development projects and financial instruments", *Monographic Report CassaDepositi e Prestiti,* (2013) pp. 70

[75]E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.71

[76] R. Culicchi, L. Moro, "Mini-Bonds – Profili Legali", 02/12/2013; E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.75

Smart cities are deeply intertwined with local industrial development and mini-bonds can surely provide a mean to stimulate innovation stemming from small local companies and facilitate the access to capital for SMEs.

The issue of mini-bonds can be performed in various ways:

- Issue with the help of a sponsor (banks or authorized financial intermediaries) , unless the issuing company can be defines as a large enterprise.
- Not publicly listed company, whose latest financial statement has been approved by an accounting and auditing company.
- Issue of bonds for professional investor which should not have any connection with the issuing company.

Venture Philanthropy

Venture Philanthropy (VP) is somehow very similar to activities performed within the area of Venture Capital (VC). Basically, VP is the application of VC practices to non-profit projects that have social impact[77]; the major participants are usually patrons, foundations, Private Equity companies and academic institutions.

VP has more stringent requirements, with respect to ordinary philanthropy, when it comes to the selection of projects to sustain. This is because VP is strongly based on VC principles and, as such, it applies a complete investment plan to all the projects it deals with. The support offered by investors does not only come in the form of financial resources but it actually may be in the form of knowledge and expertise that are crucial for the success of the initiative[78]. This leads to true value-added in the investment. The investment plan also considers an adequate exit strategy for the VP/VC investors.

[77] A. Grossman et al., "Venture Philanthropy: Its Evolution and its Future", Harvard Business Review, (2013)
[78] L. Buckland, L. Hehenberger and M. Hay, "The Growth of European Venture Philanthropy", *Stanford Social Innovation Review*, 2013

The criteria to give the green light in investing in a specific project combine financial returns with social factors with a more holistic business visual[79].

Crowdfunding

Crowdfunding (CF) is a collective financing process where many investors can contribute different sums of money to projects/initiatives that they want to sustain[80]. It may seem similar to fundraising but it can actually be distinguished on the basis of active participation, transparency (in fact, the process mainly takes place online) and the rewards received in exchange of sustaining the project[81]. The real break-through of this type of financing methodology is the capacity to leverage upon the wisdom of the population as a whole, and try to create a community of people which want to see a change in the status quo.

There are four main ways to raise money through CF:

- Reward-based, which is the most common methodology adopted. It is based on the fact that contributors are rewarded for sustaining the initiative. The reward may be tangible or intangible.
- Equity-based, where the target sum of money is divided into equal parts which are offered as shares of ownership.
- Lending-based, that consists in loans received for philanthropic or sponsorship reasons (from private to private P2P or from private to businesses P2B). The

[79] E. Reviglio et al., "SMART CITY: progetti di sviluppo e strumenti di finanziamento", *Report Monografico Cassa Depositi e Prestiti,* (2013) pp.75

[80] Consob, "Equity Crowdfunding-Cosa devi assolutament sapere prima di investire in una start-up innovativa tramite portali online".

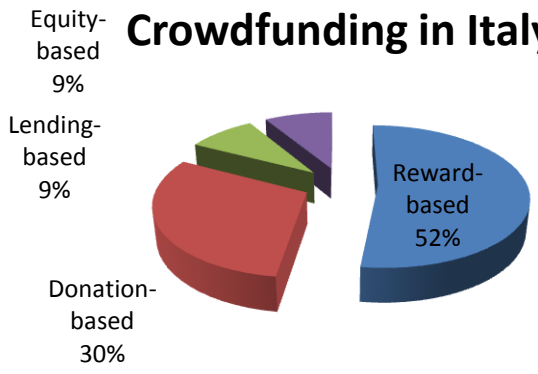
[81] D. Castrataro and I. Pais, "Il Crowdfunding in Italia", *Il Sole 24 Ore*, April 2013

interest rate on these loans is supposed to be lower than the one on traditional loans.

- Donation-based, donation for philanthropic purposes.

To make sure that CF is successful it is necessary to define a preliminary strategy, a communication campaign, objectives, targets and timing.

The promoter of the project defines the characteristics of the CF deal, the platform that will be used to raise funds, as well as target money, and payback scheme for investors. It is possible to say that the platform acts as an intermediary that collects the funds and distributes them to the proponent.



Source: D. Castrataro and I. Pais, "Il Crowdfunding in Italia", *Il Sole 24 Ore*, April 2013

EVALUATION OF ALTERNATIVES& CASE STUDIES

This chapter has illustrated 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 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.

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 (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.

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.

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.

Therefore, 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 Study: Genova Smart City

Smart city projects in Genova (Italy) were mostly financed with the use of European instruments and funds[82].

There are 3 major initiatives that were developed that were in this whole smart city effort:

1. TRANSFORM, which is an urban sustainability project based on quantitative and qualitative analyses in order to arrive to a full-scale strategic plan to develop a more citizen-friendy environment. The whole effort for this initiative was regarded as being around €5.5 million. However, the actual amount received by the Comune di Genova was €674,000.
2. CELSIUS is a project designed to control energy performance and efficiency. The total level of investment required was €14 million and the EU actually invested €2.5 million.
3. R2CITIES, which particularly refers to energy efficiency within buildings. The amount received by the EU was approximately €2.5 million (out of €9million requested) and the aim was to create strategies to restructure and build new generation residential areas.

Apart from these major projects, another €1.7 million was received by the authorities in Genova to start smaller initiatives in various fields of action.

As the list above suggests, EU funds acted as the main source of finance for smart city projects; however, there are also other tools that were adopted in order to boost the development of more sustainable cities. In fact, as a result of the Seventh Framework Programme (7FP) many public-private partnerships were created to work on projects regarding the efficiency of buildings, production plants and urban mobility systems.

[82] Official website Genova Smart City: http://www.genovasmartcity.it/finanziamenti.aspx

Moreover, the Italian city authorities also raised funds and acquired knowledge on the subject thanks to:

- ESCOs (Energy Service Companies);
- Project Financing;
- Loans for the European Investment Bank;
- ELENA fund.

Case Study: Tianjin Eco-City

The Tianjin Eco-City project first began in 2008 and is currently a work in progress. The city is approximately 150 Km from Beijing. This project came into life thanks to the efforts of two governments which joined forces: the Chinese government and the Singapore authorities[83].

The aim of both these institutions was to create a 100% eco-friendly city to show that projects this large are actually feasible and also to strongly show the willingness to deal with the Chinese pollution problem.

Energy within the Tianjin Eco-City will be entirely produced by solar and wind technologies, and special equipment will be adopted for water and air purification.

In terms of the financing structure, the Chinese government is covering most of the costs while the authorities coming from Singapore are bringing in-kind contribution in the form of know-how.

The expected delivery date is 2020 and the city will be ready to accommodate 350,000 residents.

Case Studies: Barcelona, Amsterdam, Malmo and Manchester

[83] http://actualidad.rt.com/actualidad/view/102509-china-ciudad-ecologia-sostenible-sustentable

For reasons of commercial confidentiality it is hard to find information regarding the financing of specific projects. However, it was possible to discover that city-wide initiatives,where more agents take part, are, generally, funded by contributions from each party. Most of the times, these contributions are in the form of time and expertise. Developers tend to raise money through corporate and project finance, but private companies also try to get help from the EU, national and local governments.

It may also be that certain pilot projects are financed by a sponsor, who may have specific interests in doing so, for example: testing new technologies.

In Barcelona, most of the initiatives to transform the city in a more sustainable urban conglomerate are financed by the European Union. In good years the Spanish government has the availability to allocate funds and perform loans for these projects but the current situation in Europe makes it hard to assign large quantities of capital for smart city projects.

The situation in Amsterdam is much more positive, in fact, there are various European funding streams in place in order to support many smart city projects. Moreover, the ERDF plays a central role in giving assistance for funding these sustainability initiatives. The City Authority also contributes through its own financing. Larger projects are funded thanks to investments coming from partner organizations which decide to establish public-private partnerships. On the other hand,smaller companies contribute in smaller projects. Investment from industry is needed for projects to materialise[84].

The shares owned in Nuon by the Municipality of Amsterdam were sold few years ago to create two revolving funds, each containing €60 million:

- Amsterdam Innovation Fund, which is in charge of stimulating and financing innovation; and

[84] P. Hirst et al., "JESSICA for Smart and Sustainable Cities, *Horizontal Study European Investment Bank*, 2012

- Amsterdam Sustainability Fund.

A positive aspect of Amsterdam is that it is always ready to try new and smarter ways to fund projects. In the future, there is the desire to stimulate private-sector participation in order to provide support for public-sector efforts. The aim is to move away from a grant funding approach towards repayable investments. The only problem in attracting private sector players is that these projects take a lot of time to start generating revenues, in fact, even though the initiatives put in place by the Amsterdam authorities are quite well structures they still need many years to become fully profitable.

In Malmö, EU and National grants represent the main way to finance smart city initiativesbut investment from developers and utility companies also represent a valid alternative, or better a support. Unfortunately, long payback periods are common for most of the projects undertaken. The capability to create and utilize innovations lies on the access to external funding. The City Authority plays the double role of beingthe land or property developer, and, at the same time it invests its own funds in energy efficient systems and smart automation and control systems[85].

In Manchester, there is a similar problem regarding revenue generation. The creation of cashflows is a key factor to generate ROI and the projects that are capable of doing so are not many. This is why the private sector relies heavily on the public sector to bridge the gap in funding. Initiatives that aim at reducing carbon emissions or are retrofit projects in residential areas are the ones most likely to generate. Projects are typically funded by a combination of public and private sector finance, but, in general we can say that public sector participation is more active whenever projects imply significant social impacts. However,smart energy projects may have very long payback periods of around 5 years, while smart grid projects may have payback periods of 20 to 25 years. Since payback

[85]P. Hirst et al., "JESSICA for Smart and Sustainable Cities, *Horizontal Study European Investment Bank*, 2012

periods are so long, obtaining financing for these projects is very difficult. Authorities are very much focused on finding ways to mix public financing with other sources,the aim of moving away from grant-based funding to repayable investments is present here as well.

Another critical point raised is the fact that even though there are many piloted projects these may not reach the threshold necessary to make investing in them profitable as it would be the case for large projects. The high level of initial investment due to trial and test of new technologies makes bearing the costs for each small project quite difficult. Large scale projects, on the other hand, have the capability to be less affected by these costs thanks to scale.

In the United Kingdom as well as in other parts of Europe it has been seen that it is quite difficult to access financing for project development.

CHAPTER 4: CONCLUDING REMARKS

Hopefully, the previous chapters have shed some light on the complexities of this argument. Smart City development is a very complex issue because of the many parties involved (Public Administration, Sponsors, European Entities, Banks and private-sector investors) and of the various application domains of these projects. This complexity can also be observed when it comes to financing these initiatives. Public-sector budgets cannot easily sustain the up-front investments necessary to develop a smart city, especially in many European countries. Therefore, this leads the discussion to identifying the most adequate investment methodology for Smart Cities.

The aim of this thesis is to perform a solid overview of what are financing instruments in general and enter into more detail for those instruments that seem more suitable to be used in this specific case and, finally, arrive to the point of identifying the best instruments or the best mix of instruments that can be adopted in an effective way.

First of all let's recall the main instruments we have seen so far.

EU-level initiatives come in various forms and have different aims. The tools proposed by the European institutions are to be considered as an accelerator for the development of smart cities and for the improvement in living conditions for citizens. There are different types of initiatives that try to set objectives for large projects and also allow access to finance in different ways. More in detail, we can talk about:

- Covenant of Mayors: an independent initiative by municipalities to work on topics regarding energy management and efficiency.
- Europe 2020: strongly focused on revamping the economy in general.
- European Digital Agenda: pushes for the growth of the European digital economy by supporting investments in innovation and ICT.

- SET Plan: promotes large scale diffusion of low-emission technologies.
- Smart City Stakeholder Platform: unites all stakeholders (citizens, PA officers, private entities) and tries to identify best technologies and practices for smart city projects.

In the first chapter, Italian initiatives were dealt as well, namely;

- Italian Digital Agenda: started in 2012 and aims at enacting the guidelines set by its European counterpart.
- Smart City Monitoring Group: formed by the "AssociazioneItalianaComuniItaliani" and Forum PA, that aims at putting together a collection of best practices to construct smart cities.

The second chapter of this thesis aimed at describing the major ways to obtain funds from capital markets or from other institutions.

We saw how organizations can raise funds in primary and secondary markets or trade their securities on exchange or Over-the-counter markets.

Capital markets are formed by three main types of instruments:

- Debt;
- Equity; and,
- Derivatives

Debt instruments are widely used tools that entitle the debt-holder to receive fixed payments at regular intervals and, also, getting the principal repaid at maturity. A very important notion when talking about debt instrument is credit rating that divides companies in investment grade or sub-investment grade on the basis of default risk.

In general, we have seen several debt-instrument such as:

- Bank loans;
- Overdrafts;
- Bonds, which may come with different coupon, maturity and price.

Debt instruments represent a cheap way to obtain funds but may not be easy to obtain when projects do not have certainty in cash-flows. This is the case of Smart City projects that will have strong social impact but cash-flows are not easily estimated and payback periods are very long. Moreover, SMEs, which usually generate breakthrough technologies, may not have access to this type of finance because of their small scale.

Banks and financial intermediaries play a fundamental role when it comes to raising funds through debt, in fact, investment banks can coordinate several types of bond deals by assisting the issuer for technical and issue-placement needs. The chapter illustrated two principal deals:

- Best Effort deals, where the investment bank receives a flat fee and offers placing services. The risk is entirely on the issuer in the case in which the issue is not placed entirely;
- Underwritten deals, where the investment bank faces the risk of not placing the entire offer because it has guaranteed that it will cover this risk for the issuer. In exchange for bearing higher risks the bank receives higher fees.

The second main instrument is equity which represents the claim on the company's assets or profits; basically, they are shares of ownership.

Equity instruments are characterized by no fixed payments at regular intervals; this is because they depend upon the organization's profits. Company shares are regarded as long-term instruments which hold residual claim on the company's assets. In fact,

shareholders are paid after bond-holders in the case of pay-outs and in the case bankruptcy and liquidation.

Equity funds can be raised in different ways:

- IPOs: the first time shares of a company are listed on a market. The company is said to become publicly listed;
- SEOs or Follow-on Offerings: when an already listed firm decides to raise additional capital by issuing other stocks;
- Equity-Linked Securities; and
- Derivative Transactions.

To this extent we can also list the major type of monetization strategies adopted:

- Accelerated Book Building;
- Block Trade;
- Fully-Marketed Offer;
- Optional Exchangeable;
- Mandatory Exchangeable.

The third chapter has presented more “Smart-City – specific” financing methodologies. It has assessed the characteristics of various broad categories of instruments, namely:

- EU Instruments and Funds;
- Public-Private Partnerships;
- Project Financing;
- New trends;
- Other forms of private-sector financing.

The first category is very broad and encompasses many different types of instruments. In fact, the chapter described several EU-level tools that could be adopted to make Smart City projects become reality:

- Directly Managed Programs (Horizon 2020, COSME, Life +)
- Structural Funds; and
- EIB instruments: the European Investment Bank offers loans and equity investments but also creates specific tools to boost private-sector investment when needed. Moreover, it coordinates various initiatives to promote principles that are at the basis of smart city development, such as:
    - ELENA;
    - JESSICA;
    - JEREMIE;
    - Project Bonds Initiative, which can be used through funded or unfunded mechanism; and may also be used to finance PPPs.
    - Risk sharing Finance Facility.

PPPs are one of the most widely used mechanisms to develop and finance large urban renovation projects like smart city ones. They represent a partnership where different entities combine expertise and risk management capabilities to perform these very complex and risky projects. The main characteristic of this tool is the capacity to allocate risks in an efficient way to the party that can best handle it. For instance, a bank could handle the financial risk of the project, the private party could handle construction, operation and maintenance risks while the PA can handle socio-economic risks as well as risk associated with the political and cultural background of the location.

PF, instead, is a multidisciplinary approach based on the analysis ex-ante and ex-post of the sustainability of a project on the basis economic and financial conditions. This approach lies on the fact that projects should be capable of generating cash-flows or savings that would make it possible for the project to sustain itself.

Cash flows generated by the project (through a SPV that sponsors finance in order to get the Smart City running) are the main way to service debt incurred for up-front investment as well as debt incurred for actual operation and maintenance. Unfortunately, it is hard for smart city projects to generate positive cash-flows immediately. The use of a SPV is, however, advantageous for the parties involved that can record cost incurred as off-balance sheet items, and moreover, this strong separation between the sponsoring entities and the SPV stimulates the use of financial leverage (debt 70-80% of SPV).

New trend have seen the emergence of particular asset classes that are specifically tailored for raising funds for environmental and social purposes.

- Green bonds, which require high credit rating and have been successfully adopted by various public authorities as well as corporates.
- Social Impact Bonds, characterized by the fact that repayment depends upon fulfilling certain social and environmental objectives.

Other forms of private-sector financing entail:

- Mini-bonds;
- Venture Philanthropy; and
- Crowd-funding

All of the last instruments listed could not easily finance a project as large and complex as a smart city one. They 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

- Transfer of risk to private party;

- Based on specific project outputs (rather than inputs);
- Use of private financing;
- 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

Cons

- Transaction costs
- Negotiation with other parties
- Need for ex-ante analysis skills

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

- Well-structured, multidisciplinary approach;
- Based on economic and financial sustainability of a project through cash-flow generation;
- Risk is divided among parties;
- Based on efficient operations (to generate revenues and, hence, cash-flows);
- Creation of Special-Purpose-Vehicles;
- Stimulates financial leverage;
- Based on Security Package;

Cons

- Does not depend on creditworthiness of single shareholders (may be a pro);
- Expensive;
- Transaction costs;
- Contractual Relations;
- Only effective for very large projects, with large financing needs
- Risks are not allocated as for PPPs.

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.

The Role of an Investment Bank

An investment bank can play a fundamental role in facilitating and coordinating the intricate financing process in Smart City projects. We have discussed how the entities involved in these initiatives can raise both equity and debt capital, however, it is obvious that there is the need for expert advise on how to structure fund raising activities and on the financial analysis of the context. To this extent, an investment bank can offer very valuable services.

In the case of equity capital raising it can help a SPV find sponsors willing to invest in the project. Moreover, it could fully regulate the whole process by coordinating the efforts of the all the advisors that take part in the procedure. An IPO could also represent a solution for an organization involved in urban renovation, since it would allow it to gain scale and access to finance. An IPO deal can take two major forms:

- Best Effort Deals: where the IB performs placing services and the risk is entirely faced by the issuer. The IB receives a flat fee for these services; or
- Firm Commitment Underwriting: where the issuer sells the entire issue to the underwriting syndicate that then needs to find investors willing to purchase those

shares. The risks faced by the syndicate are much higher in this case, therefore, fees received are also higher and the banks also get the spread on re-selling the shares.

In general, the Investment banks act as global coordinators or bookrunners of the syndicate and they offer coordination in terms of Due-Diligence and Prospectus, Valuation, communication and roadshow.

Similar coordination and advisory services can be offered in the case of debt capital raising. In fact, apart for activities of placing the bonds and structuring the deal, an investment bank can also offer research services to assess macroeconomic conditions in the market or to analyze the situation for fixed income instruments or securities.

The Full Potential of Smart City Projects

A study by Confindustria[86] highlights how energy efficiency and smart city projects can make a difference in the Italian economy and within the global economy. In fact, the study shows that thanks to an accurate work in constructing and maintaining energy efficient cities, buildings, and industrial sites the Italian economy could increase its GDP by 0.5%. This large increase, in times of crisis, does not affect public budgets thanks to the development of appropriate incentive schemes to promote this new phenomenon.

The first step to do is the stabilization of fiscal bonuses related to works within buildings and transport systems, where wastes are actually very high[87].

[86] M. Beccarello et al., "Smart Energy Project", Gruppo Smart Energy and Comitato Tecnico Energia, (2013)

[87] F. Rendina, "L'Efficienza vale 0,5 punti del PIL", *Il Sole 24 Ore*, 2/10/2013

The study pushes for the development of smart cities merging rationalization of existing resources and the combination of energy and ICT technologies. The aim is to create smart buildings and mobility, and reorganize industrial plants in technological and functional cluster, that can interact in a sort of urban network.

This new investments and reorganizations could generate, according to the study by Confindustria, a return of 4€ for every 1€ invested. These huge returns are possible thanks to the large scope of the projects and improvements implemented within the scenario analysed within the study. Smart cities have so many application domains that an investment can generate large returns thanks to all the businesses that are affected by the improvements. In fact, these investments would reduce energy expenses, making enterprises more competitive. In the period 2014-2020 the enactment of the proposals suggested within the study could generate, according to projections, an increase in industrial production in Italy of €64 billion per year versus base case. Moreover, it would also imply an increase 500.000 jobs. All of this contributes to an increase in GDP growth of 0.5%. The reduction in energy expenses would be around €5.7 billion per year (10% of the current level of spending), and a reduction in CO_2emissions for an amount of €270 million per year[88].

As already mentioned above, public budgets would not face excessive strain, in fact, the total investment would be of € 10.5 billion to be divided in 7 years (€1.5 billion per year). This would generate a collective gain of €42.2 billion; this means a net benefit of €31 billion. So, 1€ of public spending would generate a collective return of 4€ in terms of energy savings and environmental externalities avoided.

[88]M. Beccarello et al., "Smart Energy Project", Gruppo Smart Energy and Comitato Tecnico Energia, (2013)

The study is based on a very conservative approach to investment in smart city projects[89], in fact, in periods of lower financial strain for governments, a braver investment strategy could seriously generate a GDP annual growth of 3% (vs 0.5% seen above). This could give Italy a chance to lead the European states out of the crisis.

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