



Business Models for Smart Cities

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1. Introduction

The 'smart city' concept has been gaining popularity over the last few years for several reasons. First, the world population living in urban areas is experiencing a relentless growth. Second, information and communication technologies (ITC) are booming as sensors and radio frequency identification (RFID) are getting cheaper. Third, the irruption of the smartphone had facilitated transferring and receiving real-time information to and from almost everyone and everywhere. And fourth, cities provide a large amount of services that consume a lot of natural resources and energy thereby having a great impact on the economy, the environment, and the quality of life.

There is not a clear definition of a smart city. Albino et al. (2015) comment on the existing confusion about what a smart city is, especially since several similar terms are often used interchangeably. One of the most acknowledged definitions is that "a city is smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance" (Caragliu et al. 2011). The idea of smart city is also associated to setting a 'control room' for the city that provides ICT architecture with the necessary tools to automatically interact with infrastructure in order to optimize services. However, some authors such as Graham (2002) have criticised the strong focus that the concept of smart cities has had on information technologies, which may impact the digital divide in a negative sense, creating larger inequalities and social division.

Five key areas are acknowledged in the development of a smart city: i) the need for leadership and organisational change, ii) the availability of a city plan, iii) the existence of a robust legal framework, iv) the presence of a technological model, and v) the need for business models that ensure the effectiveness of the measures adopted. The types of activities of a smart city are related to any kind of services that a city may provide such as: environmental services (water, sewage, waste management, recycling), urban mobility services (public transportation, parking, freight delivery, etc.), retail information activities, quality of life (park and leisure activities, management of cultural infrastructure), energy use (lighting, heating), participation of the population in the government of the city (public referendums), etc.

After some years of implementing the smart city concept, it is clear that the main issue for the success of this approach is not so much related to technological aspects as it is to **finding ways for successful business models**. The objective of this paper is to discuss

the main challenges of putting into effect models that may contribute to speed up smart city solutions.

2. Why are business models so important for smart cities?

There are many business opportunities that may arise from the use of ICT in the provision of services in a city. Implementing an on-street intelligent urban lighting system able to adapt energy consumption to the number of people present in a certain place, or to the intensity of the natural light, may contribute to save energy. An intelligent watering system aimed at optimising consumption in public parks and gardens -depending on weather conditions or the specific needs of a certain type of plant- contributes to improve the overall environmental performance of the city. An intelligent parking system that provides information about the availability of on-street parking and sets a dynamic pricing approach aimed at guaranteeing the availability of parking space at any time, thereby helping drivers to adapt their mobility plans and behaviour, will contribute to improve the quality of life of the population. Setting sensors in waste containers providing information about how full they are may help optimize pick-up routes. The implementation of electric car-sharing systems associated to mobile apps facilitates a green mobility alternative to many users. These are just some examples of the potential that the right use of ICT may have in the improvement of quality of life within a city.

Along with above-mentioned businesses, the new data economy can provide a crucial value just by simply accumulating and storing information that may be useful to other interests. These opportunities have to do with the possibility of using Big Data and the Internet of Things (IoT) to better achieve some of the goals of certain companies, or promote innovative opportunities based on the crowd-sourced economy.

The literature regarding business models for smart cities is scarce and has been mostly focused on the field of mobile apps. Walravens and Ballon (2013) conducted an analysis of the business models applicable for mobile city services, as a way of approaching platform business models in a public context. They examined four different aspects; i) the way in which the value network is constructed, ii) the functional architecture, iii) the financial model, and iv) the value proposition parameters.

In addition to that, they set two core principles of public business models: the governance of the value network, and the public value generated in the network. On the basis of this analysis, they built a public business model grid that allows classifying different mobile app services offered in cities in terms of the government involvement —limited vs. strong— and the public value created —direct vs. indirect—. *Direct value* refers to the citizen having a more immediate relationship with the government while *indirect public value* refers to what adds public value to the public sphere.

Though the contribution from the literature provides very interesting feedback; the research in this field is still fairly limited and very much focused on mobile services that usually do not require high investment costs.

Given the fact that one of the main limitations for the success of smart city services is the availability of effective and sustainable business models, this discussion paper intends to open a debate about the critical issues that governments, technology firms and business providers need to address in the future.

3. Key points for the success of business models to promote smart cities

In the author's view, there are three crucial aspects that contribute to the success of business models in the implementation of measures aimed at making cities smarter (see Figure 1):

- 1) Being able to create value for the community by finding new opportunities.
- 2) Being able to capture this value by ensuring the collection of necessary funding resources.
- 3) Being able to raise resources to finance the necessary expenses and invest in deploying the systems.

The first point is about making sure that the measures implemented are able to create value for the society. This added value may be quantified as either monetary savings or utility gains for any of the members of the community: citizens, users, private companies, public companies, the government, etc.

The added value may materialise in the reduction of costs and subsequent increase in competitiveness of the industry, or the possibility for citizens to enjoy better services at a lower cost. Creating value is, at the end of the day, **the most important reason for making cities smarter**, and it requires finding opportunities where the use of innovations may, at a reasonable cost, substantially improve the quality of life of the society.

A second aspect that is essential for the success of business models in smart cities is the capacity of operators to capture the value produced. If the added value may be turned into a future flow of money, investors will be willing to provide the necessary resources upfront to implement new systems.

Value can be captured through four different ways, which are not exclusive: a) future budget savings for the government, b) future production costs savings for private or municipal-owned companies, c) the willingness of citizens or private companies to pay for a

benefit that is acknowledged by them, and d) taxing approaches aimed at monetising positive externalities.

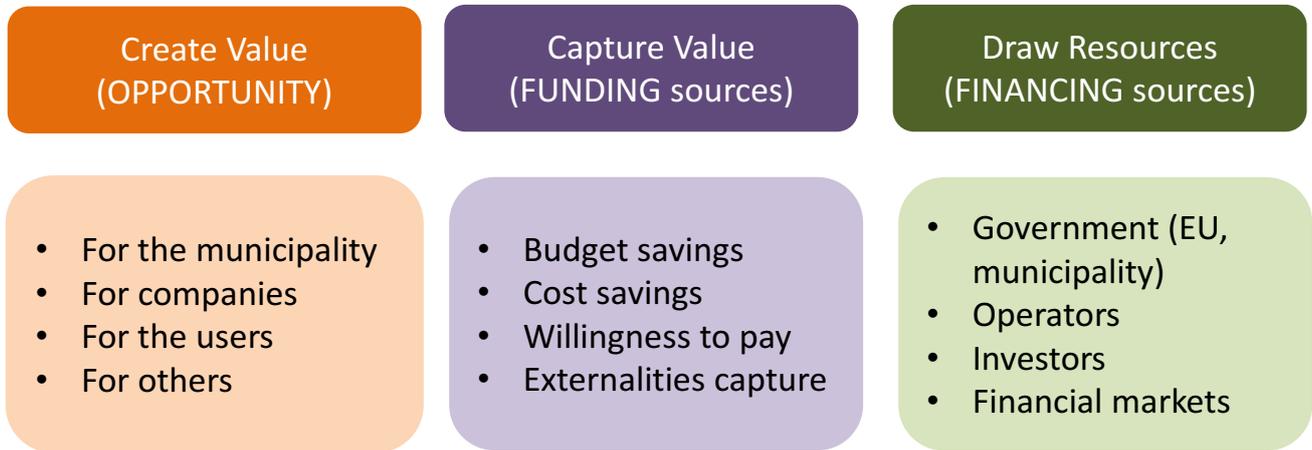


Figure 1 - Key pillars for the success of business models in smart cities

Even though all smart city services are ultimately aimed at benefiting citizens, there are some aspects that may directly affect the people while others touch them just in an indirect way. Installing sensors to provide on-line information about parking availability is directly perceived as a benefit by many drivers. Other benefits, however, are not necessarily perceived by citizens, such as for instance, using intelligent watering systems to save water consumption in the management of public parks and gardens. In the first case, citizens directly perceive the benefit while, in the second case, they do not do it at all, even though they may take advantage of lower municipal taxes in the future because of water consumption savings.

Capturing value directly from users is almost impossible when they do not perceive the benefits. However in some cases the value is perceived by either private or municipal-owned companies as future savings. These companies are supposed to pay for future savings as long as they offset the payments they make. For the success of this model, it is crucial that municipal corporations have the right incentive and vision to implement new technology to invest now in order to save larger costs in the future.

In the cases where citizens easily perceive the benefit, capturing value implies being able to charge a fee to them. Insofar as the utility enjoyed by citizens is greater than the charge they pay to cover the necessary capital cost, the business model will end up working.

The problem may come when citizens are not willing to pay thereby making value capture an issue. This may happen for two reasons. A first one is that citizens may be too much accustomed to receive certain services free of charge, without understanding that no investment is for free because in the end somebody —users, taxpayers, etc.— will end up

paying for it. A second reason is that the society does not accept additional charges as it is not able to understand the benefits that may come from the application of additional measures. This negative attitude may happen for instance with some environmental improvements that are difficult to individualise or are unevenly perceived across society.

The third key point is how to raise the necessary resources to undertake the initial investment. Figure 2 shows the connection between the three pillars mentioned to promote the successful implementation of business models in smart cities.

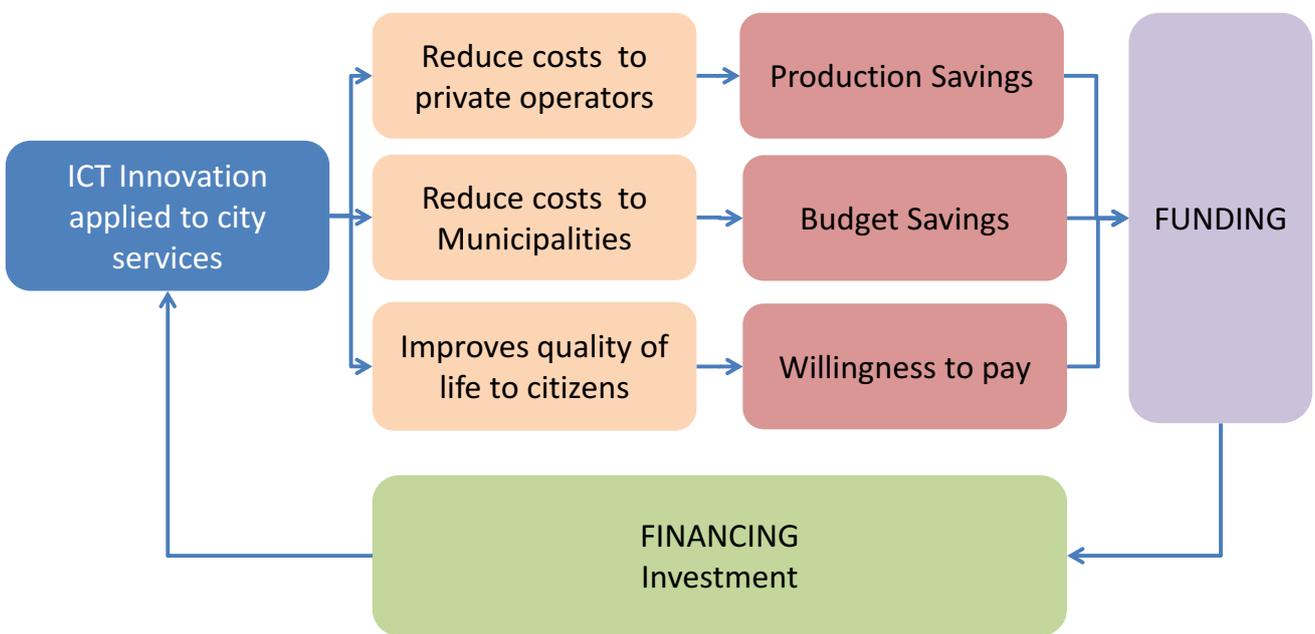


Figure 2 – How to capture value in a smart city project

Financing may come either from the city budget or from the private sector. Budget financing is usually very much constrained, so it should be used only for developments whose social benefit, though evident, is difficult to capture mainly because it falls on citizens who can barely perceive it.

If the value created can be turned into cash flows over a reasonable period of time, raising financing from private investors should not be such a big issue. This just requires that the expected business profitability coming for the cash flows was attractive to investors, both equity holders and lenders, according to the risk that they are bearing. A good legal and institutional framework will contribute to mitigate risks and consequently reduce the financial cost of financing smart city projects.

4. What should be the role of the private and the public sector?

At the time of devising business models applicable to smart city projects is important to define what should be the role of the government and the private sector for the success of the measures implemented. The economic literature has studied in detail the role of the private sector and the reasons for the intervention of the government in the provision of certain services. Overall, it is admitted that the private sector is usually faster and more efficient in implementing innovations aimed at saving costs when these may contribute to increase its profit or competitive position in the market. The private sector, in its turn, has a greater incentive to be more agile and dynamic in providing new solutions. All these strengths should not be underestimated at the time of defining the right business model.

However, government intervention is still necessary in some cases for the right functioning of certain services that are provided in the city. Some reasons justifying municipal intervention are listed below.

A first reason is avoiding that a company may take advantage of a certain monopolistic power to set prices above reasonable standards. A second reason is the need to coordinate some services provided by different private companies, especially those integrated in a network, to benefit everyone. Finally, a third reason is to take advantage of overcapacity in the networks already deployed by an incumbent.

One of the means of ensuring greater competition by preventing the problems coming from market failures is unbundling different parts of a service that has traditionally been provided in a bundled way. The goal of this measure is to separate the part that has natural monopoly characteristics, and as a consequence has to be regulated by the government, from the part that may be opened to free market competition. For instance, setting parking sensors in a certain street should be deployed and managed by a single company to take advantage of economies of scale. However the use of these sensors for commercialising several services may be open to free market competition.

There are different levels of government intervention in the provision of public services in the city; the direct provision by a city-owned company, the procurement of the service through a contractual approach such as PPPs, the restriction of the access to the market to a certain number of companies, or the regulation of the maximum prices that may be charged.

One of the **crucial roles for the City Council** in promoting smart city solutions is to define the **right role of the public and the private sector**. Figure 3 shows different approaches to manage this. For services where market failures have a low impact and, as a consequence of this, setting a fair competition among different private operators is possible, the best solution is to leave absolute freedom to compete in the market. This will be

possible insofar as the private sector is able to capture the value added to the beneficiaries of the new ICT developments.

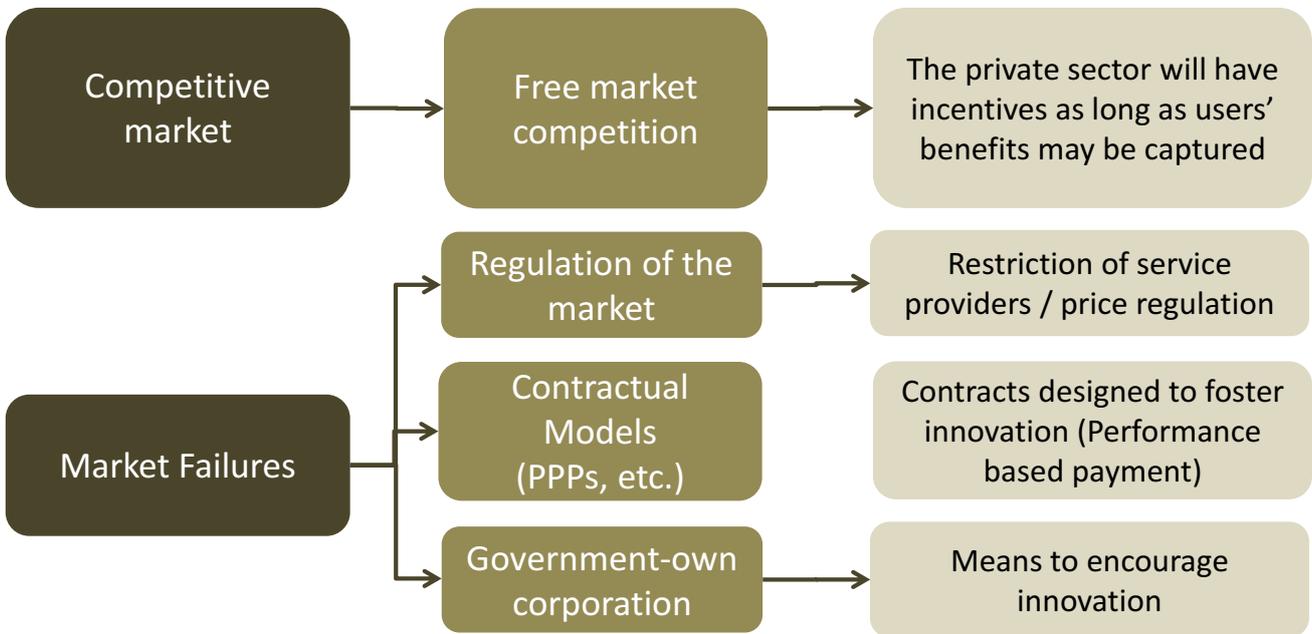


Figure 3 – How to capture value in a smart city project

When market failures have a larger impact, it is necessary to define the way of preventing the problems stemming from liberalisation while preserving the incentive of the private sector to be as efficient as possible. There are several solutions that may be implemented to manage market failures. One of them is regulating the market by limiting the number of companies that may provide the service, or regulating the prices that these companies charge to their customers through price caps. Other possibility is setting a long-term agreement with a private company selected through a competitive tender to deploy a new smart city solution for a period of time. One of the potential problems of this approach however is the lack of flexibility stemming from the regulation through contracts, especially when it comes to technology services that may experience great changes over time. Drafting good PPP contracts incentivising innovation for smart city services is a reasonable means of minimising this problem.

In the cases where city services are managed by city-owned corporations, it is essential that their owners set the right incentives to the city services' managers to adopt measures aimed at promoting innovation. This will require instrumenting channels to hear the ideas from the private sector that may contribute to make the management of the systems much more efficient.

5. Final discussion and future challenges

The definition of new business models is nowadays the main challenge for the successful implementation of smart city solutions. While technology issues are overcome rapidly, setting the right incentives for the well-functioning of business models still remains a point unresolved. Dealing with this issue requires the willingness of all the stakeholders involved to open a discussion aimed at finding out solutions for different cases, taking into account the rapid change of technology and the evolution of social needs. In this context, STA is taking the lead at EU level by promoting new business models for transportation infrastructures innovation across modes and the Smart City.

As it has already been mentioned in this paper, the success of business models for smart cities lie in three pillars: the creation of value, which is the most important one; the capture of value, which is the most difficult one; and the attraction of investors, that basically depends on the availability of a clear technological model supported by the right legal and institutional framework.

Regardless the model adopted, leaving the private sector to promote ideas that may positively help improve the quality of life of the community should always be welcomed. However City Councils should not forget that in some cases the initiative of the private sector requires certain control and coordination to ensure that the measures adopted benefit everyone.

Future challenges to tackle for promoting smart city business models are the possibility of unbundling different layers of a service to promote a greater liberalisation in some of them, the definition of flexible PPP models that may be used for smart city services, and the ways of incentivising technological innovation by city-owned services.

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