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Mobile Services in the Smart City: Framing the Potential Roles of City Governments

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Abstract

This paper presents a theoretical framework for the analysis of business models that involve public actors, and city governments in particular, in the value network. It starts from an established business model framework and expands it to include an additional set of parameters required to successfully perform a qualitative analysis of the business models of new (digital) services offered by cities. It then applies this framework to four divergent cases from the mobile services sector in which city governments are involved as part of their efforts in becoming "smarter cities".

Keywords: business models, smart city, mobile services.

1 Introduction

Cities today face increasing challenges when it comes to providing advanced (digital) services to their constituency. The explosive growth in popularity of mobile internet, mobile applications and smartphones, the increased connectivity of devices and the internet of things as well as the drop in costs of sensors and RFID technology are trends that present new questions to city governments. These difficulties mainly pertain to the business models of these new services, combined with the fast moving pace of the internet and ICT industry and slow reaction time of city administrations to changes in these sectors. In this quickly evolving context, city governments need to rethink the ways in which they interact with large companies in offering services to their citizens as well as how they communicate with those citizens.

These questions link up to the ever-evolving concept of Smart Cities. We will see that although this notion remains vague, it has a great deal of potential in framing some particular challenges cities face today and provides new ways of thinking about potential future issues. As ICTs generally form a large part of the operationalization of the Smart City concept, we will take a closer look at how mobile technologies can be an important tool in reaching "Smart City goals" policy makers set out, as long as careful and systematic thought goes into the development of the business models for these new "smart" services.

This paper decidedly starts from the perspective of the city and begins by framing the Smart City concept while highlighting current trends related to mobile services. It takes mobile city services as a case to explore new ways of thinking about business models in a public context and proposes a new theoretical framework to tackle pressing questions in this sector.

2 Smart Cities

The idea of linking innovation and ICT-development, together with social and societal development, to a geographical area is far from new. Komninos (2009) provides an overview and describes the evolution of systems of innovation, linked to geographical locations, in Europe. Komninos starts from early 1980s literature describing industrial districts, a concept which was popularized by Porter (1990) under the header of "Industry Clusters". This trend could be identified in traditional industries, but also proved effective in technology and technology-related sectors, gathering in so-called "Technology Districts". These districts brought together various players such as the basic research companies, venture capitalists, law firms, consultants and local companies, similarly to the pattern of Silicon Valley. In a somewhat more 'planned' approach, innovation linked to location could be found in science and technology parks, which in some cases could be interlinked in certain regions, forming so-called "Technopoles" or multi-park areas. The innovation dynamics within these all these types of clusters or districts are mainly centered around the diverse skills in various fields, the close cooperation networks in place there and the presence of "catalysts" that can spark cooperation between the skills and units within the cluster (Komninos, 2009).

From the mid-nineties a shift from district literature can be identified, moving to the concept of "Learning Regions", referring to how organizations can learn and generate new knowledge, followed by a third generation of systems, from the year 2000 onwards, for organizing innovation on a geographical level that can be identified under the "Intelligent Cities and Regions" moniker (Komninos, 2009). This mainly refers to the addition of online or virtual collaboration to the mix; something that became increasingly easy as internet technologies evolved and became more accessible, both to end users and enterprises. Progressively it became clear that ICTs could be an essential part of improving workflows and increasing efficiency and efficacy on a local scale, but also facilitating interactions on a global one. This was not only the case in sectors that are directly related to ICT or telecommunications, but also in various other sectors and industry branches beyond it e.g.

health, culture, media, mobility, energy, government, policy etc. It should be clear that the Smart City concept is a direct descendent of the conceptualization of this link between innovation, ICT and geographical areas.

Even though the term is relatively young, the operationalization of what a Smart City is, can vary dramatically depending on the approach. Several attempts have been made at formulating a definition of the Smart City, taking different perspectives. In an effort to be holistic, several areas a city should focus on in making itself "smarter" have been identified, such as competitiveness, social and human capital, participation, transport and ICT, natural resources and quality of life (Giffinger et al., 2007; Caragliu et al., 2009). This view is supported by the somewhat technologically deterministic idea of a "control room" for the city, providing an architecture and ICT-based overview of all activity in the city as well as the tools to (automatically) interact with infrastructures or adjust parameters to predefined optima (IBM, 2009).

These architectural or infrastructural viewpoints are contrasted by a more experimental, bottom-up view on the Smart City. In this perspective, innovation comes from the people "using" the city or is at least co-created with citizens, a process that can be stimulated by government. Examples of this can be found in the growing trend of open data initiatives and "hackathons", stimulating developers to create applications based on cities' databases, or the use of social media to organize local and ad hoc or more structural events and even protests. In such a perspective, what defines the Smart City is not the infrastructures or architectures it offers, but the ways in which its citizens interact with these systems as well as each other.

The Smart City concept has also been criticized, a.o. for its self-congratulatory tendency, as well as its focus on I(C)T and the potential consequences towards reinforcing a digital divide (Hollands, 2008; Graham, 2002). If insufficient attention is paid to this topic, the strong focus on information technologies in the Smart Cities discourse can dramatically impact the digital divide in the negative sense, creating even larger inequalities and social divisions in the city (Graham, 2002), a far cry from what would be labeled as 'smart'.

In spite of the many attempts at definitions, the Smart City concept remains elusive. However, it is an indication of the increasing need to develop new ways of looking at the city of the future and to think about structured approaches to provide answers for the diverse and complex questions companies, citizens and governments face there. Rather than attempting a holistic and general definition of what a Smart City is we prefer to clarify our perspective on the concept in the following section.

3 Defining the Smart City

For the purposes of this paper we will take a closer look at mobile services in the city as an example of a sector that is likely to be a significant part of the Smart City. In recent years, mobile services have become an increasingly important business, under the impulse of new entrants to the market such as Apple and Google. These new mobile software distribution platforms also inspired developers to create applications and services that enhance life in the city in divergent ways. As smartphones become more affordable and popular, it is expected that innovative mobile devices and services will be important tools in making life in the city "smarter".

When looking at the mobile industry from the perspective of the Smart City, a few important trends and issues come to light. A first point is infrastructure and the evolutions in networking technology, or how mobile devices connect to the network. The trend of cities aiming to offer ubiquitous wireless coverage (using e.g. WiFi or WiMAX) to its citizens seems to be subsiding after several failed experiments around the world. Although different business models were experimented with, today city initiatives have been outpaced by commercial WiFi projects offered by incumbent operators, or high-speed cellular networks like LTE. One area related to infrastructure where the city is more likely to play a role is the development and deployment of wireless sensor networks, connecting everyday items and city infrastructure (e.g. street furniture). This is often referred to as the "internet of things"

and the amount of data that will be gathered by these sensors in the not too distant future is expected to be overwhelming.

A second important trend impacting the development of mobile services in a city context relates to open data. City governments are currently "sitting" on a wealth of information related to different aspects of life in the city, but this data is either not publicly available or not easily interpretable. This has sparked a movement to encourage the opening of datasets, under the "open data" moniker, which is gaining traction across local and national governments worldwide. Several cities organized "hackathons" and "Apps for x" competitions in order to stimulate developers to create innovative visualizations or new services based on this new source of data. Although many technical questions remain (mainly related to machine-readability, standardization and interoperability of the datasets), these first initiatives are seeing increasing success and providing intriguing initial results.

A third and very important business trend currently at play in the mobile industry is platformisation. This refers to companies employing divergent types of platform strategies, leveraging several "sides" of the market in innovative ways in order to try and attain dominance within the mobile industry in this case. Such strategies are well illustrated by the approach taken by Apple and mimicked by Google, Microsoft, Samsung and others of offering a tight integration between hard- and software (including media content) that creates an attractive value proposition for hardware manufacturers, developers, content providers and end users. These strategies simultaneously have led to and are the result of a highly competitive industry in which the power relations can quickly and dramatically change over short periods of time. This adds an important level of complexity for cities and government administrations that want to be active in this sector.

A final trend we can identify in this area is the changing role of the user within the value network. One of the effects of the democratization of ICTs has been the increased possibility for end users (or citizens in our case) to be more vocal about issues that are important to their context. This has led to new services that facilitate the communication between citizens and governments, but has also resulted in new methods in academia aimed at including a user perspective when developing new tools and applications (e.g. co-creation, Living Lab experiments, see e.g. Schuurman et al., 2012.). An increased involvement of the citizen is thus often referred to as an integral part of the city of tomorrow.

These different trends lead us the operationalization of the Smart City concept we will use in the context of our research. It should be clear we consider cases that are linked to the urban space and the interactions between the physical and the virtual, which are mediated by ICTs (be they social media, innovative wireless networks, mobile devices, cloud technology and so on) or developed using innovative methods (such as co-creation, living labs research, ppp-business models and so on), and that involve or engage citizens in innovative experiences with the goal of increasing their quality of life in meaningful ways. Smart Cities should capture creative and collaborative innovation through (direct) interactions between public bodies, private actors and citizens in:

- dealing with the next data flood (coming from linked open data, big data, the internet of things, sensor data etc.);
- identifying and tackling new relational complexities between actors;
- facing grand societal challenges in a local context (e.g. mobility, security, local and participatory governance etc.);
- offering new and engaging experiences to citizens.

This is the operationalization of the Smart City concept we will use in this paper. The trends and issues listed above can impact business models when a public organization becomes an active actor in the value network. Additionally, we aim to offer a more qualitative viewpoint in the often-quantitative approaches to the Smart City. In what follows we will develop a framework to analyze business models that involve public entities in the value creation process and illustrate it using cases from the mobile services sector.

4 Business Model Framework

Since the general adoption of the concept in the literature related to the rise of internet-based e-commerce (Hawkins, 2001), the focus of business modeling has gradually shifted from the single firm to networks of firms, and from simple concepts of interaction or revenue generation to extensive concepts encompassing the value network, the functional architecture, the financial model, and the eventual value proposition made to the user (Linder & Cantrell, 2000; Faber et al., 2003). In attempt to capture these various elements, one approach has been to consider business modeling as the development of an unambiguous ontology that can serve as the basis for business process modeling and business case simulations (see e.g. Pigneur, 2002; Faber et al, 2003; Osterwalder, 2004). This corresponds with related technology design approaches (Gordijn & Akkermans, 2001) aimed at the mapping of business roles and interactions onto technical modules, interfaces and information streams. Due to the shifting preoccupation from single-firm revenue generation towards multi-firm control and interface issues, the guiding question of a business model has become "Who *controls* the value network and the overall system design" just as much as "Is substantial *value* being produced by this model (or not)" (Ballon, 2009).

Based on the tension between these questions, Ballon proposes a holistic business modeling framework that is centered around control on the one hand and creating value on the other. It examines four different aspects of business models: (1) the way in which the value network is constructed or how roles and actors are distributed in the value network, (2) the functional architecture, or how technical elements play a role in the value creation process, (3) the financial model, or how revenue streams run between actors and the existence of revenue sharing deals, and (4) the value proposition parameters that describe the product or service that is being offered to end users. For each of these four business model design elements, three underlying factors are important, which are represented in Figure 1. Each of the parameters is explained in more detail in Table 1.

CONTROL PARAMETERS				**VALUE PARAMETERS**			
Value Network Parameters		**Functional Architecture Parameters**		**Financial Model Parameters**		**Value Configuration Parameters**	
Combination of Assets		Modularity		Cost (Sharing) Model		Positioning	
Concentrated	Distributed	Modular	Integrated	Concentrated	Distributed	Complement	Substitute
Vertical Integration		Distribution of Intelligence		Revenue Model		User Involvement	
Integrated	Disintegrated	Centralised	Distributed	Direct	Indirect	High	Low
Customer Ownership		Interoperability		Revenue Sharing Model		Intended Value	
Direct	Intermediated	Yes	No	Yes	No	Price/ Quality	Lock-in

Figure 1. Business Model Matrix (Ballon, 2009)

Value network	**Financial model**
The combination of assets: Assets include anything tangible or intangible that could be used to help an organisation achieve its goals; this element also focuses on the synergetic effects of combining different assets. *The level of vertical integration*: Vertical integration is defined as the level of ownership and control over	*Investment structure*: This topic deals with the necessary investments (both capital expenditures and operational expenditures) and the parties making these investments. *Revenue model*: This topic deals with the trade-off between direct/indirect revenue models as well as the trade-off between content-based and transport-based

successive stages of the value chain. *Customer ownership*: This topic looks into the party maintaining the customer relationship and keeping the customer data. Related to customer ownership is the level of openness/lock-in of the case. **Functional architecture** *Modularity/integration*: Modularity refers to the design of systems and artefacts as sets of discrete modules that connect to each other via predetermined interfaces. *Distribution of intelligence*: In ICT systems, this refers to the particular distribution of computing power, control and functionality across the system in order to deliver a specific application or service. *Interoperability*: Interoperability refers to the ability of systems to directly exchange information and services with other systems, and to the interworking of services and products originating from different sources.	revenue models. *Revenue sharing model*: The revenue sharing model refers to agreements on whether and how to share revenues among the actors involved in the value chain. **Value proposition** *Positioning*: Positioning of products and services refers to marketing issues including branding, identifying market segments, establishing consumer trust, identifying competing products or services, and identifying relevant attributes of the product or service in question. *User involvement*: Refers to the degree to which users are consumers rather than prosumers (referring to people being both producer and consumer of content at the same time) of content and services. *Intended value*: This item lists the basic attributes that the product or service possesses, or is intended to possess, and that together constitute the intended customer value.

Table 1. Parameters of the business model matrix (Ballon, 2009)

The use of this matrix as an analytical tool has been validated on several occasions and extensively in relation to mobile services. However, when applying a business model logic to (partly) public services, its shortcomings become apparent. Although the existing parameters certainly remain relevant (as a service or product is still being offered to customers), the matrix cannot capture the increased complexity of a business model including public actors in its current form, due to the particular nature of these organizations and the ways in which they are funded. Given that the matrix has been validated and is a proven method to analyze business models in the ICT-domain, we will use it as the basis for our theoretical framework. In order to capture the intricacies of combining commercial and public control and value creation we propose a reorientation and expansion of the business model matrix. This means the introduction of new parameters that capture these intricacies.

The main division in the business model matrix between control and value highlights the two most fundamental aspects of a business model. We propose a similar in approach in defining the core principals of a public business model which comes down to the questions "Who *governs* the value network?" as well as "Is *public value* being generated by this network?". We thus propose **governance** and **public value** as the two fundamental elements in business models that involve public actors.

Within these two fundamental building blocks, we again define specific indicators that can be used as tools in analyzing and designing public business models. The governance parameters align with the value network and functional architecture, where the public value parameters detail the financial architecture and value proposition. The new parameters we will propose operate on two levels: the first relates to the (Smart City) goals policy makers set out to reach and the second is an organizational level that focuses on how governments organize themselves to reach these goals. The development of these new criteria is the result of an extensive literature review for which some indicative references are provided in the following sections.

The **governance parameters** related to the **value network** are:

Good governance:
Given the relatively vague nature of the different definitions of this concept and the difficulties in operationalizing it, we focus on a recurring factor: a striving towards equilibrium in governing. As existing policies and regulations can in many cases be contradictory, a striving towards consensus and harmonization of interests is deemed essential in good governance (Hirst, 2000; Hyden, 2000). This parameter also captures political motivations at play in offering a service to citizens. Additionally, we emphasize the concepts of accountability and trust, as it is important to consider which public entity

can be held accountable if something should go wrong and how the citizen's rights are protected or can be enforced.

Stakeholder management:
This organizational parameter refers to the choices that are made related to which stakeholders (be they public, semi-public, non-governmental, private etc.) are involved or invited to participate in the process of bringing a service to end-users (Ballon, 2009).

The **governance parameters** related to the **technical architecture** are:

Technology governance (Zimmerman, 1995):
This parameter highlights the importance of transparency, participation and emancipation in making technological choices, especially by public entities. Choices for a particular technology or platform (e.g. by only offering an iPhone application) may exclude certain parts of the population, something a government should be wary of (Graham, 2002). A second element we link to technology governance is the use of open data and whether government information is made available to citizens through the use of ICTs.

Public data ownership:
If the decision to open government data to the public is made, the responsible government body should carefully consider the terms under which this data is opened up and to which actors. This is a technological decision in the sense that selecting or limiting the type and amount of formats the data is available in has consequences to which parties can start working with it (e.g. if the data is machine-readable or not, presented in natural language as well, only available in proprietary formats and so on) (Berners-Lee, 2010). This also relates to licensing schemes and exclusivity of use of the data.

The **public value parameters** related to the **financial architecture** are:

Return on public investment:
This refers to the question whether the expected value generated by a public investment is purely financial, public, direct, indirect or combinations of these, and - with relation to the earlier governance parameters – how a choice is justified (Margolis, 1957). A method, which is often used in this respect, is the calculation of so-called *multiplier effects*, i.e. the secondary effects a government investment or certain policy might have, which are not directly related to the original policy goal.

Public partnership model:
The organizational parameter to consider in this case is how the financial relationships between the private and public participants in the value network are constructed and under which legal entities they set up cooperation (Bovaird, 2004, 2006). One example of such a model is the public-private partnership (PPP). In the context of the business model matrix we choose to emphasize the financial implications and risk distribution effects of a PPP-model.

The **public value parameters** related to the **value proposition** are:

Public value creation:
This parameter examines public value (Moore, 1995; Talbot, 2008) from the perspective of the end user and refers to the justification a government provides in taking the initiative to deliver a specific service, rather than leaving its deployment to the market (Benington, 2011). One such motivation could be the use of market failure as a concept and justification for government intervention.

Public value evaluation:
The core of this parameter is the question whether or not an evaluation (Talbot, 2008) is performed of the public value the government sets out to create and if this evaluation is executed before or after the launch of the service.

Now that we have established which parameters are important in a context where a public entity becomes part of the value network in offering a service, and how we interpret the different terms, they can be added to the business model matrix. The updated matrix is represented in the following figure.

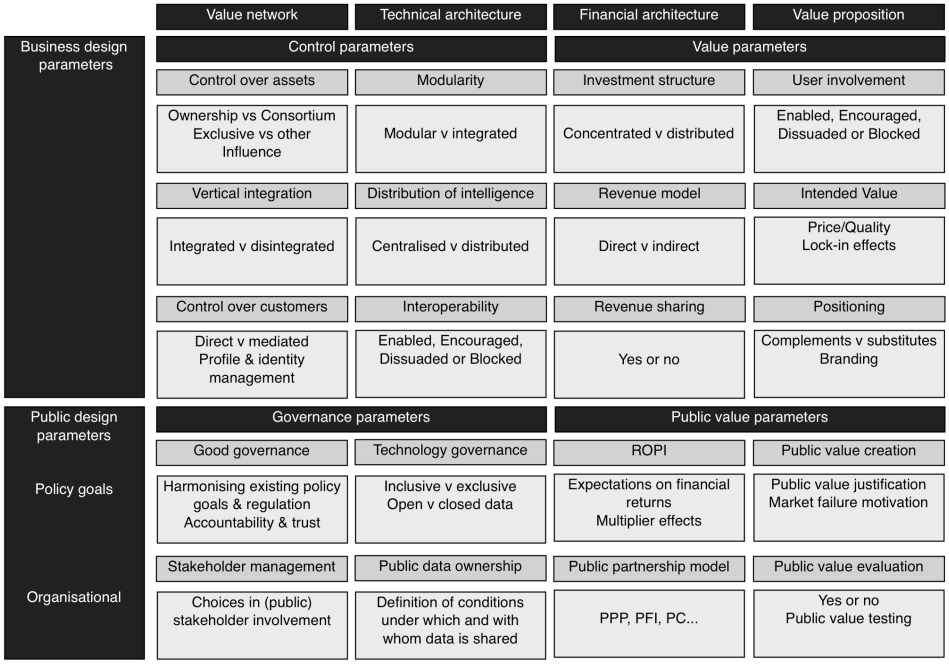

Figure 2. Expanded Business Model Matrix

The detailed, qualitative description of all the parameters of this expanded matrix allows for the thorough analysis and direct comparison of complex business models that involve public actors in the value network. This inspired us to also create a simplified overview, which finds its basis in the theoretical work of the matrix, but dramatically reduces its complexity. In this overview, it becomes possible to compare divergent cases based on the two central parameter sets of the matrix: control and governance on the one hand and (public) value on the other.

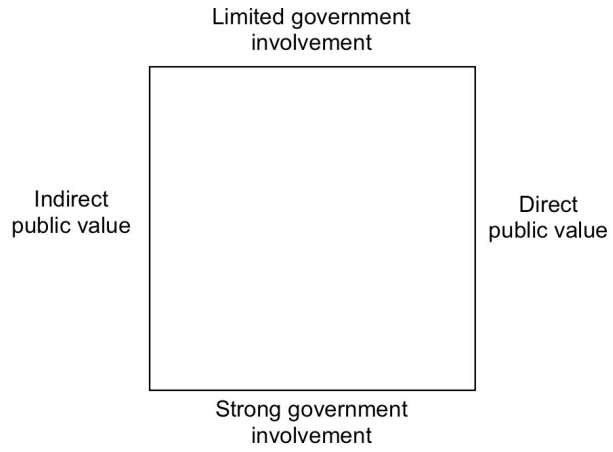

Figure 3. Governance and Public Value Grid

The grid represented in the figure above allows us to map different cases of (in our case mobile) city services and identify how they compare to one another. The top and bottom extremes refer to the governance parameters described in the business model matrix and provide an indication of the level of control the city government has in providing the service to citizens. The horizontal axis provides insight into the type of value that is generated by the services and whether this is direct or indirect: direct public value refers to the citizen having a more immediate relationship with the government, is a more individual value, short term and relates to "what the public values"; while indirect public value assumes a more indirect relationship, is more collective and long term, and relates to "what adds value

to the public sphere" (Benington, 2011). We will use this grid to map some illustrative cases of mobile city services further on in this paper.

In order to determine where to situate a service or initiative on this grid, several guiding questions (based on the indicators in the matrix) about the case can be useful e.g. for government involvement: which actor has ownership over the service, takes the initiative for the service, to what extent the service is part of a concrete policy plan or whether the government interacts with the citizen. To gauge the type of public value one can verify the impact the initiative has on the citizen, whether it is more collective or individual, whether it is aimed more at the short or long term or whether the service relates to "what the public values", rather than "hat adds value to the public sphere" (Benington, 2011: p. 42). Additionally, we can verify the position of the case on the grid with the actors involved during expert interviews. The following section will highlight some interesting cases of mobile services in which cities around the world have been involved in the value network. These cases will be briefly described and mapped onto the newly proposed theoretical framework.

5 Case Analysis

The discussion of these cases is based on a thorough business model analysis, using the theoretical framework introduced above and is presented in a strongly abbreviated version for the purposes of this paper. The material for the cases was gathered from policy documents, publicly available information and expert interviews with people involved with them.

NYC311: 311 is a free 24/7 phone number, Twitter-account, mobile application, website and Skype account citizens can use to report any number or type of small incidents related to their neighborhood. All questions that are not emergencies (for which one would call 911 in the US) can be answered through 311. The service is operated by the city which tags, maps and datamines the different reports coming into it, effectively giving the city control over the data, infrastructure and the citizen relationship (DiGiulio, 2008). There is a strong involvement of the city in the development and operation of the service, moving it down in our grid. The public value that is generated can be both direct in nature when a single citizen's question is answered, as well as indirect since the city generates long-term data from the calls and requests coming in to NYC311.

FixMyStreet: This mobile service allows citizens to report issues with city infrastructure, such as broken traffic lights or vandalism. The city treats these reports as "tickets" and can provide the end user with a status and how close the issue is to resolution. It is a commercial service that is offered to city administrations for £3500 for the first year and £1500/y for subsequent years, including service provision, hosting and technical support. The city is not in control of the value-adding assets required to operate the service as it only reacts to third-party inputs and does only in part control the citizen relationship. The public value that is being generated however leans towards indirect as the resolution of problems with city infrastructure can benefit the public at large (FixMyStreet, 2012).

Carambla: This small Belgian service is a marketplace for open parking spaces on private property and connects companies or property owners with people looking for a parking space on a particular moment in time, offering dynamic pricing per hour between €0.20 and €5 (of which Carambla keeps 25%). The main Carambla interface is a mobile application, available for iOS and Android. No city is directly involved in the creation of the service and although the service has a direct impact on an individual user looking for a parking space, the creators mostly aim for more indirect goals like reducing overall traffic and congestion in the city (Tibeau, 2012). This is why the Carambla service is positioned more to the top left corner of the grid.

London Bike App: This open data based application, created by an individual developer and sold for a low price through the iTunes App Store, provides citizens with the number of available bikes and open slots for the public bike sharing system in the city of London. The city is only mildly involved via the London Transport Authority that provides the required data and the resulting value is direct in nature, applying to the specific situation of one end user (Wise, 2011). For this reason, the London

Bike App is positioned to the far right of the grid and in the center: the city government is not directly involved, but without the opened and real-time data set, the development of the service would have been far more challenging, if not impossible.

These four illustrative cases can be mapped on the simplified governance and public value grid as a result of their business model analysis using the matrix. This mapping is represented in the figure below.

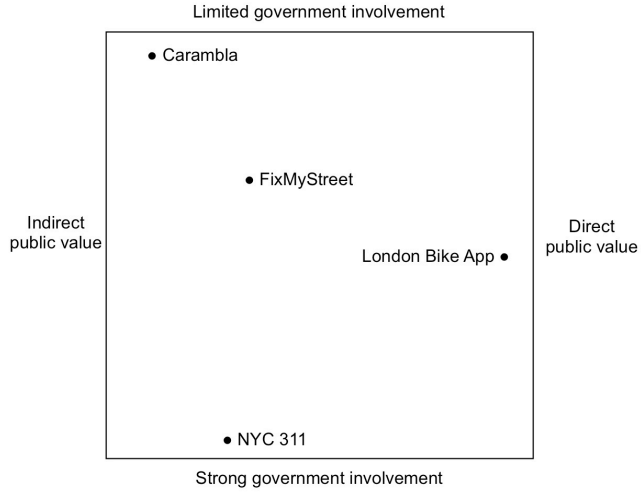

Figure 4. Cases mapped on governance and public value grid

This illustrates how a more thorough comparative business model analysis using the matrix and platform typology can be represented in a simplified way, allowing the comparison of different mobile city services. This grid can be a relatively simple yet powerful tool for city governments to analyze their current or planned mobile service initiatives as they can consider the implications of the positioning of their services in a certain quadrant of the grid and whether that position yields the results they set forward in the definition of the policy goals they wish to achieve. If a certain policy for example aims to increase commercial activity and support local businesses in the city on a limited public budget, we would expect to find more services in the top half of the grid. Or if general and long term policy goals are defined, e.g. lowering the energy consumption of families or stimulating a developer economy in the city, more services would be found on the left hand half of the grid. Policy makers can hence use this grid to verify whether their goals and actions are aligned when it comes to mobile services for the city.

The framework presented above can be linked to the operationalization of the Smart City concept presented in Section 3. The different indicators in the framework aim to provide answers to the questions cities may face in structuring future strategies related to: the next data flood (captured in technology governance and public data ownership indicators), new relational complexities (in the good governance and stakeholder management parameters, as well as the financial indicators) and new engaging experiences for citizens (through the public value indicators) in local urban contexts. Mapping the cases on the grid above can be an additionally helpful tool for policy makers to assess the strategic position of their city services.

6 Discussion

The original business model matrix focuses on the relations between firms and organizations and not so much on the internal organizational structures of companies or agencies. Since the newly introduced parameters build on the original matrix, there is no specific attention to internal organizational processes. This should thus not lead to confusion when a term like governance is used: this is purely to refer to public governance and not the governing principles of single firms (as seen for

example in strategic management literature). The approach is rather one of applying existing business model logic to value networks that include public actors. The initial focus is on mobile services, but it is possible the framework is also applicable to other services.

7 Conclusion

This paper began from the premise that mobile services and their business models can be important elements in a local government's Smart City strategy as tools to help reach certain policy goals. However, the fast evolutions in the sector and the growing complexities of their business models pose significant challenges for city governments wanting to play a part in this ecosystem. Additionally, existing analytical frameworks fail to capture the particular (business model) difficulties cities face in bringing services to citizens. In this light, we applied a "business model logic" to the case of mobile city services and expanded and redefined an existing framework to better capture these specific challenges. This led to a detailed framework of qualitative parameters that need to be taken into account when discussing public business models for mobile city services and resulted in a simplified version of the framework that can be a powerful tool for city governments in aligning their policy goals with their mobile service initiatives.

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