Platform Business Models for Smart Cities: From Control and Value to Governance and Public Value

Nils Walravens and Pieter Ballon, iMinds-SMIT

ABSTRACT

This article presents a theoretical framework for the analysis of platform 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 an analysis of the business models of new (mostly digital) services offered by cities. It then applies this framework to several divergent cases from the mobile services sector in which city governments are involved as part of their efforts to become "smarter cities."

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 radio frequency identification (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 information and communications technologies (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 show 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 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 article 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 platform business models in a public context and proposes a new theoretical framework to tackle pressing questions in this sector.

SMART CITIES

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 from 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 [1, 2]. 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.

Other approaches single out a certain topic to define the concept. The city of Amsterdam, for example, clearly focuses its smart city efforts on projects related to sustainability and green ICT, as does the European Commission in the definition of the research topics within Europe 2020, the Digital Agenda, the 7th Framework Program, and the Competitiveness and Innovation Program (CIP) funding mechanisms. Another take on the smart city starts from the internal processes of the city administration and how these may be enhanced to increase the efficiency of those processes.

These architectural or infrastructural viewpoints are contrasted by a more experimental, bottom-up view of the smart city. From 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

0163-6804/13/$25.00 © 2013 IEEE

applications based on cities' databases, or the use of social media to organize local and ad hoc or more structural events and even protests. From 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 for its self-congratulatory tendency, as well as its focus on I(C)T and the potential consequences of reinforcing a digital divide [3]. 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 a negative sense, creating even larger inequalities and social divisions in the city [4], a far cry from what would be labeled 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 think about structured approaches to provide answers to the diverse and complex questions companies, citizens, and governments face there.

Mobile in the Smart City

For the purposes of this article we 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 smart phones 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" and that the requirements for smart city services in turn place new technical requirements on ICT platforms and mobile services.

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).

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 have 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 data sets), these first initiatives are seeing increasing success and providing intriguing results.

A third and very important business trend currently at play in the mobile industry is platformization. This refers to companies employing divergent types of platform strategies, leveraging several "sides" of the market in innovative ways in order to try to 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 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.

The trends and issues listed above can impact business models when a public organization becomes an active actor in the value network. In what follows we develop a framework to analyze (platform) business models that involve public entities in the value creation process and illustrate it using cases from the mobile services sector.

Business Model Framework

Since the general adoption of the concept in the literature related to the rise of Internet-based e-commerce, the focus of business modeling has gradually shifted from a 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 [5]. Due to the shifting preoccupation from single-firm revenue generation toward 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)" [5].

Based on the tension between these questions, Ballon proposes a business modeling framework that is centered around control on one hand and creating value on the other. It examines four different aspects of business models:

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.

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	Centralized	Distributed	Direct	Indirect	High	Low
Customer ownership		Interoperability		Revenue sharing model		Intended value	
Direct	Intermediated	Yes	No	Yes	No	Price/quality	Lock-in

Table 1. *Business model matrix [5].*

- The way in which the value network is constructed, or how roles and actors are distributed in the value network
- The functional architecture, or how technical elements play a role in the value creation process
- The financial model, or how revenue streams run between actors and the existence of revenue sharing deals
- 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 Table 1.

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. 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 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 two fundamental elements in business models that involve public actors.

Within these two fundamental building blocks, we again define specific parameters 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 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 the references are available from the authors upon simple request.

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: striving toward equilibrium in governing. As existing policies and regulations can in many cases be contradictory, striving toward consensus and harmonization of interests is deemed essential in good governance. 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 citizens' 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.

The governance parameters related to the technical architecture are:

- Technology governance: This parameter highlights the importance of transparency, participation, and emancipation in making technological choices, especially by public entities. Choices of a particular technology or platform (e.g., only offering an iPhone application) may exclude certain parts of the population, something of which a government should be wary. 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.

	Value network	Technical architecture	Financial architecture	Value proposition
Business design parameters	**Control parameters**		**Value parameters**	
	Control over assets	Modularity	Investment structure	User involvement
	Concentrated vs. distributed	Modular vs. integrated	Concentrated vs. distributed	Enabled, encouraged, dissuaded, or blocked
	Vertical integration	Distribution of intelligence	Revenue model	Intended value
	Integrated vs. disintegrated	Centralized vs. distributed	Direct vs. indirect	Price/quality Lock-in effects
	Control over customers	Interoperability	Revenue sharing	Positioning
	Direct vs. mediated Profile and identity management	Enabled, encouraged, dissuaded, or blocked	Yes or no	Complements vs. substitutes branding
Public design parameters	**Governance parameters**		**Public value parameters**	
	Good governance	Technology governance	ROPI	Public value creation
Policy goals	Harmonizing existing policy goals BS regulation Accountability and trust	Inclusive vs/ exclusive Open vs. closed data	Expectations on financial returns Multiplier effects	Public value justification Market failure motivation
	Stakeholder management	Public data ownership	Public partnership model	Public value evaluation
Organizational	Choices in (public) stakeholder involvement	Definition of conditions under which and with whom data is shared	PPP, PFI, PC…	Yes or no Public value testing

Table 2. *Expanded business model matrix.*

• 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 in which the data is available has consequences to which parties can start working with it (if the data is machine-readable or not, presented in natural language as well, only available in proprietary formats, etc.). 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 of whether the expected value generated by a public investment is purely financial, public, direct, indirect, or combinations of these, and — in relation to the earlier governance parameters — how a choice is justified. A method often used in this respect is the calculation of so-called *multiplier effects*, that is, the secondary effects a government investment or certain policy might have that 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. 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 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. 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 of whether or not an evaluation 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 Table 2.

The detailed qualitative description of all the parameters of this expanded matrix allows thorough analysis and direct comparison of complex

	No control over citizens	Control over citizens
	Enabler city platform	**Integrator city platform**
Control over data and/or infrastructure	**Facilitating city services.** Can be be open data initiatives or outsourcing of service creation based on provided datasets. Stimulation development is key.	**Governmental city services.** Somewhat more closed approach, can be high-cost depending on implementation.
	Examples: SF Data, Apps for Amsterdam, NYC Big Apps, NYC Data Mine	*Examples: 311*
	Neutral city platform	**Broker city platform**
No control over data and/or infrastructure	**Commercial or crowdsourced city services.** City government does not take initiative and relies on privately funded or bottom-up projects	**City-branded services.** An unlikelier scenario that wold be targeted at city branding and city marketing, more than service provision itself
	Examples: Lonely Planet, Metro, SeeClickFix, FixMyStreet	*Examples: Ljubljana, Tourist Card*

Table 3. *City platform typology.*

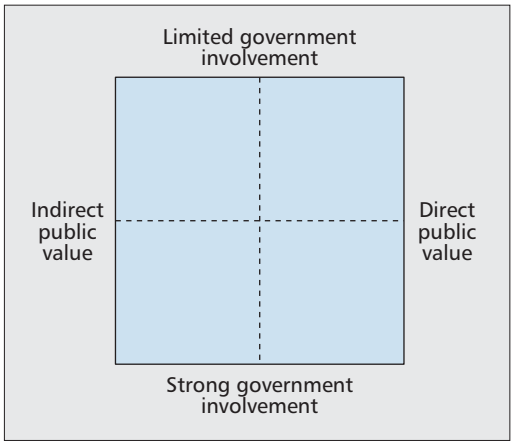

Figure 1. *Public business model grid.*

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.

The grid represented in Fig. 1 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" [6]. We use this grid to map some illustrative cases of mobile city services further on in this article.

A second important theoretical framework we propose to analyze business models for services in the smart city relates to platformization and platform business models. Although the idea is tentatively conceptualized in scholarly literature on ICT platforms [7], Ballon [5] describes specific characteristics of, and differences between, several types of platforms in the mobile industry. He identifies four types of platforms depending on whether the platform owner has control over value-adding assets and the customer. Depending on the orientation of these control parameters, Ballon identifies enabler, integrator, neutral, and broker platforms [5].

We propose this conceptualization also holds strong potential when discussing services offered by cities and take the perspective of the city as a platform. This means redefining what control over assets and customers entails in an urban context. For our purposes, having control over the value-adding, tangible, and intangible assets that form the value proposition means that a city is in control of data and information on one hand, and city infrastructure on the other. The definition of "control over the customer" stands (referring to control over profile information and the billing or branding relationship); however, to make the distinction clearer between the end user of the service and any third parties or companies with which the city might have a client-provider relationship, we refer to this parameter as having "control over the citizen" in this case. The typology for different city platform strategies is represented in Table 3.

Together with the expanded business model matrix, this city platform typology offers a new tool to analyze and structurally compare the (platform) business models of cities' mobile service offerings. The two frameworks are also closely linked to each other: the extremes of light vs. strong government involvement from the "governance and public value grid" in Fig. 1 run in parallel with the control over data

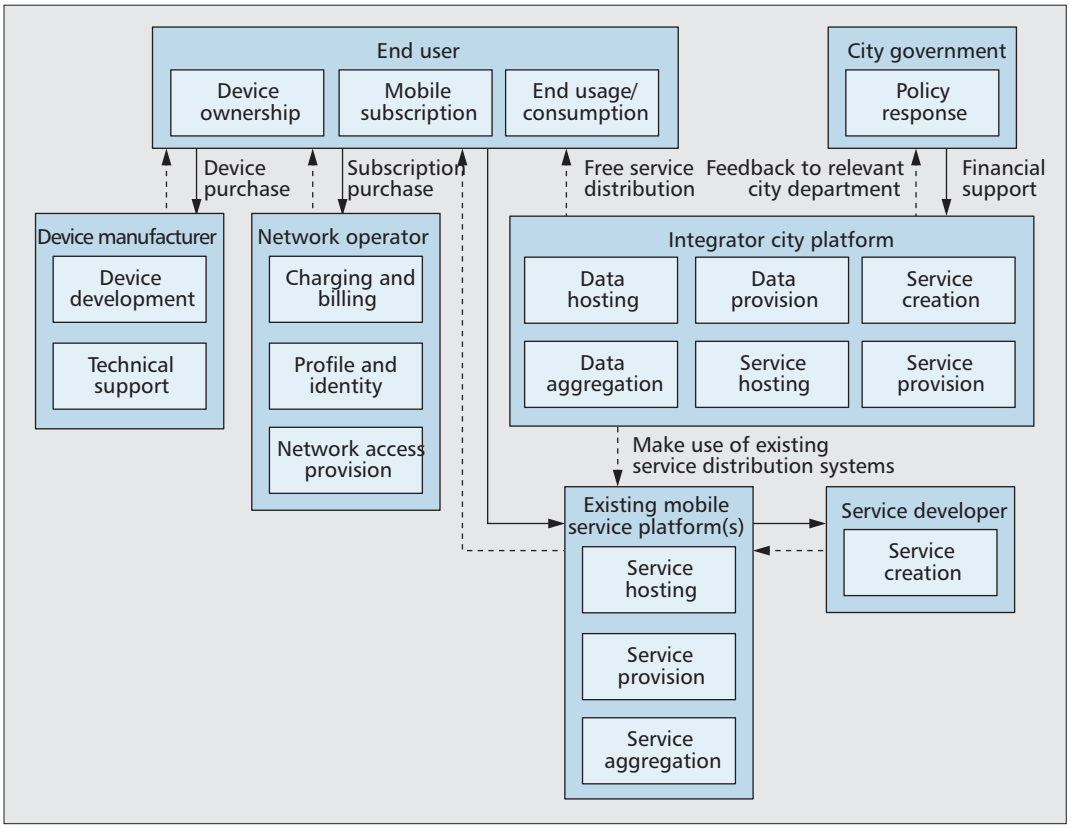

Figure 2. *Value network for the Integrator City Platform and NYC311.*

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 approach in defining the core principles 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?"

and infrastructure criterion in the platform typology. Additionally, indirect public value is linked to not having control over the citizen, while direct public value is tied to controlling the relationship with the citizen. Thus, when the city plays a platform role, the platform typology may in part overlap with the public business model grid, strengthening its analytical power.

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.

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 an extremely abbreviated version. By way of illustration, a stylized representation of the business model of the first case is provided.

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 United States) 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 citizen relationship. In this sense, NYC311 plays the role of integrator city platform, which is represented in Fig. 2 in a stylized way. Solid arrows represent money flows, and dotted arrows indicate the service flow between actors (in the light blue boxes) that are playing certain roles (in the darker blue boxes).

FixMyStreet

This mobile service allows citizens to report issues with city infrastructure, such as broken traffic lights and 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/year 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 input and only in part controls the citizen relationship. The public value being generated, however, leans toward indirect as the resolution of problems with city infrastructure can benefit the public at large.

PulsePoint

This mobile application alerts users who have indicated they are trained in cardiopulmonary resuscitation (CPR) when someone in a nearby public place is having a cardiac emergency and may require CPR, as well as list the nearest automated external defibrillator (AED). The software was developed by two university stu-

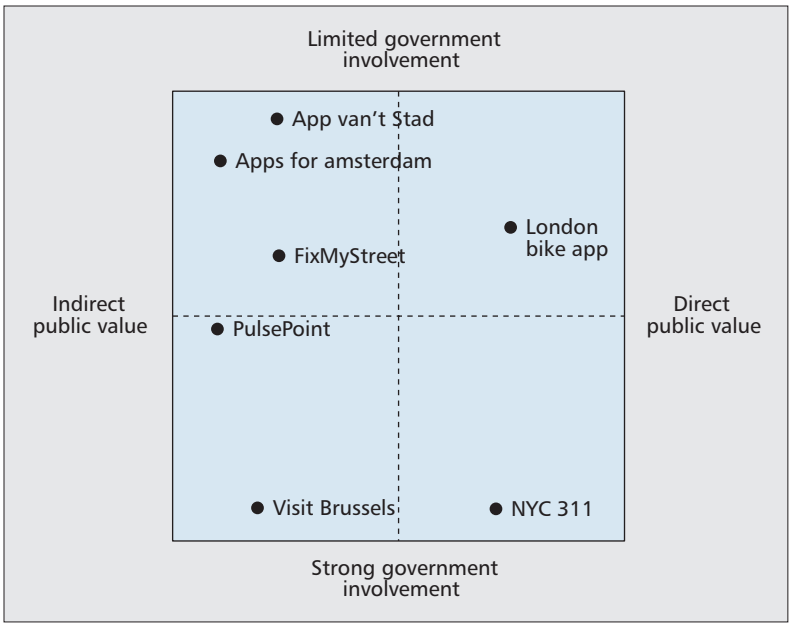

Figure 3. *Cases mapped on s public business model grid.*

dents, together with the fire department of the San Fernando Valley municipality, and has attracted interest from the city of San Francisco for a potential larger-scale rollout. In this case the city is only involved to some extent through its emergency services and does not have the citizen relationship, while the public value being created is more indirect.

Apps for Amsterdam

This recent yearly competition is in part organized by the Economic Affairs Department of the city of Amsterdam and provides developers with open data on the city and a financial incentive to create innovative and useful applications. The government is involved in the organization of the event, but has little to no control over the customer relationship, and the value created leans toward indirect public value.

App van't Stad

This commercial application (the name of which translates to App of the City) was developed and launched by one of the large newspaper publishers of Belgium, Concentra. It allows large and small business owners and merchants in Antwerp to create deals that are offered to citizens via the mobile application. The city itself is little to not involved in the initiative, while the resulting public value is indirect in nature (better marketing for local businesses, potentially resulting in higher turnover).

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 as it provides the required data, and the resulting value is direct in nature, applying to the specific situation of one end user.

Visit Brussels

This official mobile application of the city of Brussels provides tourists and travelers with some general information on the city as well as contact information for merchants and businesses in broad categories such as "eat and drink," "nightlife," and "do and see." While the city government is closely involved in the development of the application, the generated value is more indirect in nature as it pertains to very general information, which aims to enhance the tourist attractiveness of the city.

These seven illustrative cases can be mapped on the simplified governance and public value grid following their business model analysis using the matrix. This mapping is the result of a qualitative analysis based on the new parameters that will be further formalized and checked with the involved stakeholders in further research. The grid is represented in Fig. 3.

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, for example, a certain policy 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 of the grid. However, 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 in the left 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.

Conclusion

This article begins 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 evolution in the sector and the growing complexities of their (platform) 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.

ACKNOWLEDGMENT

This work was performed in the framework of a Prospective Research for Brussels grant, funded by Innoviris and the Brussels Capital Region, and carried out at iMinds-SMIT, Vrije Universiteit Brussel.

REFERENCES

[1] R. Giffinger *et al.*, "Smart Cities: Ranking of European Medium-Sized Cities," research rep., Vienna Univ. of Tech., 2007, http://www.smartcities.eu/download/smart_cities_final_report.pdf
[2] A. Caragliu, C. Del Bo, and P. Nijkamp, "Smart Cities in Europe," *Proc. 3rd Central European Conf. Regional Science*, 7–9 Oct. 2009, http://www.cers.tuke.sk/cers2009/PDF/01_03_Nijkamp.pdf.
[3] R. Hollands, "Will the Real Smart City Please Stand Up?," *City*, vol. 12, no. 3, 2008, pp. 303–20.
[4] S. Graham, "Bridging Urban Digital Divides: Urban Polarisation and Information and Communication Technologies," *Urban Studies*, vol. 39, no. 1, 2002, pp. 33–56.
[5] P. Ballon, "Control and Value in Mobile Communications: A Political Economy of the Reconfiguration of Business Models in the European Mobile Industry," Ph.D. thesis, Dept. Commun., Vrije Universiteit Brussel, 2009, http://papers.ssrn.com/paper=1331439.
[6] J. Benington and M. Moore, *Public Value: Theory and Practice*, Palgrave MacMillan, 2011, 314p.
[7] A. Gawer and M. Cusumano, *Platform Leadership: How Intel, Microsoft and Cisco Drive Industry Innovation*, Harvard Business Review Press, 2002, 336p.

BIOGRAPHIES

NILS WALRAVENS (nils.walravens@vub.ac.be) has been a researcher at iMinds-SMIT since 2007, working on national and international projects related to new media business models with a focus on mobile services. He is currently writing his Ph.D. on mobile services and business models in the context of the city and the implications for public administrations. He holds a degree in communication sciences (2007) from the Vrije Universiteit Brussel.

PIETER BALLON (pieter.ballon@vub.ac.be) is a professor in media economics and media structures at the Vrije Universiteit Brussel and leader of the Market, Innovation and Sector Transitions research group at iMinds-SMIT. He is an expert in open innovation and platform business models in the fields of mobile telecommunications and new media. He holds degrees in modern history (1990–1995) and information and library science (1995–1996), and attained a Ph.D. in communication sciences in January 2009.