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Extended framework for the analysis of innovative Smart City business models

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Extended framework for the analysis of innovative Smart City business models

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Abstract

Besides the promising forecasts for Smart City market, many projects haven't taken off due to financial restrictions, unsustainable business models or too technological visions instead of citizen orientation. The need for innovative business models in the context of Smart City motivates this study, that first reviews the Smart City business model literature, and then proposes a framework to study several companies within each sector of a broad definition of the Smart City. The results of the analysis show that there is a need to build a holistic framework to analyze all business models included in the Smart City. They also suggest that policy makers should extend their vision of the Smart City, and include a large group of innovative businesses that, using disruptive technologies, are creating deep impacts on citizens' lives.

Keywords: smart city, business model, innovation, services

1. Introduction

The big exodus from rural to urban areas have forced cities' managers to think about new management models that ensure a sustainable and efficient provision of city services. Not for nothing, the challenge gets tougher, because 54 per cent of the world's population resided in urban areas by 2014, and by 2050, it is expected that 66 per cent of the world's population become urban, according to the World Urbanization Prospects published by United Nations (UN, 2014).

To address the ecological, sociological and logistics challenges underlying the population revolution, arise a new paradigm of city based on the combination of Information and Communication Technologies (ICT) with traditional infrastructures, in a coordinated and comprehensive manner (Batty et al., 2012).

Attracted by the promising forecasts – expected market size of Smart Cities reaches a cumulative value of \$1.5 trillion in 2020 (Frost&Sullivan, 2013)– many companies have tried to lead their businesses to respond to the opportunities of the new context of cities. This trend is led today by large technology companies in the ICT sector such as IBM or Cisco, followed by other multinational companies such as Schneider Electric, Siemens or Microsoft, among others (Woods & Goldstein, 2014).

However, despite the promising potential of the Smart Cities, several studies criticize the current situation, –e.g. (Hollands, 2008; Shelton, Zook, & Wiig, 2015)–,

and identify some limitations that are blocking the Smart City take off (Saunders & Baeck, 2015; Vilajosana et al., 2013; Wintrich, 2016). First, most of the projects lack of a sustainable business model where public and private sector could collaborate in the long term. This model should provide enough revenue to pay off the infrastructure and maintain the service across time. Moreover, Smart City initiatives are always projected as expensive hardware infrastructure, rather than opting for cheaper solutions using Internet. Second, most of the projects are technology-oriented, instead of city-oriented. Many companies follow a technology-push strategy launching those products that better fit their strategy, instead of those that meet the citizens' needs. In addition, citizens are not included in the definition of the projects, but they should be in the center of the process to find real needs.

On the contrary, while Smart City initiatives seem to progress slowly, the combination of several socio-technical innovations such as Internet of Things (IoT), mobile Internet access, smartphones, data analytics, open data initiatives, and sharing economy models among others (van Dijk & Teuben, 2015), are giving room to interesting models where citizens collaborate in the provision of the services regardless of governments and local authorities. Data management is in the middle of all those solutions that involve citizens in the definition of the services (Saunders & Baeck, 2015).

Therefore, if Smart City initiatives want to survive, they need to evolve towards new solutions based on collaboration between agents, innovative and sustainable business models, and use of extended technologies such as smartphones (Schaffers et al., 2011). Thus governments are becoming aware that, to introduce Smart Cities, they require new business models for the delivery of services to their constituents (Kuk & Janssen, 2011).

Considering this context, this paper reviews the Smart Cities business model studies, and analyses innovative companies' offers within a broad conceptualization of the Smart City. The present study comprises five sections. Section 2 introduces the concept and evolution of the Smart Cities, and the previous studies regarding the Smart Cities business models. Section 3 shows the methodology of the study. Section 4 presents the results of the analysis for every dimension of the Smart City. Finally, Section 5 contains the conclusions of the paper, as well as its limitations and future avenues of research.

2. Theoretical framework

2.1. Smart City

Smart City is a such a complex and evolving concept that, in their attempt to find a definition, Meijer & Bolivar (2015) identified that different authors provide different definitions or even no definition of a Smart City. According to their analysis,

there are in the literature four types of ideal-typical definitions: technology focus—emphasize the potential of new technologies for the urban environments—, people focus—place humans in the center of the Smart City—, governance focus—highlight the interaction of agents in the definition of the Smart City, and combined focus—including the three perspectives.

Close to the combined definition, van Dijk & Teuben (2015) consider a city as Smart City when “investments in (i) human and social capital, (ii) traditional infrastructure and (iii) disruptive technologies fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.” Figure 1 shows the main areas of a Smart City under this perspective.

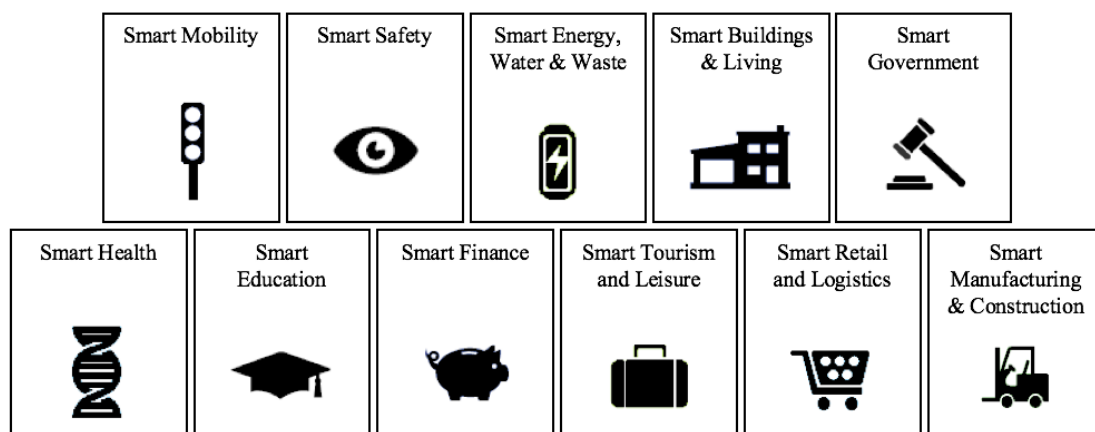


Figure 1. Main areas of the Smart City (van Dijk & Teuben, 2015)

On the one hand, there are new technologies that deeply extend the possibilities of a Smart City, such as cloud, mobile, social media & digital platforms,

big data, open data, artificial intelligence, Internet of things (IoT), robotics and drones, 3D printing and blockchain (van Dijk & Teuben, 2015).

On the other hand, the introduction of some of those technologies has speed up the spread of social innovations such as co-creation, crowdsourcing, sharing economy, and gamification. Beyond the unsustainable Smart City vision composed of gigantic technology-infrastructure, the combination of these new socio-technological trends helps cities' governments and citizens to improve how cities work (Saunders & Baeck, 2015).

2.2. *Business Model Framework*

Besides the extensive literature about business models, it is difficult to find a unique definition, due to the changes in the environment and the different areas where business models might be applied. Additionally, the ICT adoption by business changed dramatically the paradigm, bringing multiple configurations compared to the previous models (Osterwalder, 2004). While the most general definition considers the business model as the way in which the firms do business (Beattie & Smith, 2013; Magretta, 2002; Zott & Amit, 2010), other approaches distinguishes different elements conforming a business model. Thus, Osterwalder et al. (2005), and Osterwalder and Pigneur (2010) identify three main elements: the value proposition– product/service offering, customer segments, customer relationships–, activities,

resources, partners, distribution channels and cost structure, and revenue model. After a profound review of the literature, Richardson (2008) proposes a model with three main components: the value proposition, the value creation and delivery system, and the value capture system. Similarly, Chesbrough and Rosenbloom (2002) operationalize the classical definition of business model identifying six main implicit functions: articulate the value proposition, identify a market segment, define the structure of the value chain, estimate the cost structure and profit potential, describe the position of the company in the value network, and formulate the competitive strategy. Zott and Amit (2010) follow an activity-based perspective also with three main elements: “What”–the activities–, “How”–the activity system structure–, and “Who”–the people involved in the activities. Likewise, Gassman et al. (2014) keep the three latter questions–What do you offer to the customer?, How is the value proposition created?, and Who is your target customer?– and add a fourth question: Why does the business model generate profit?

In the context of the Smart Cities it is even more difficult to find a suitable approach for business model. As mentioned before, Smart Cities comprise very different applications with different perspectives. As a matter of fact, although there is a general agreement on the need to find new business models that make Smart City solutions sustainable and oriented to citizens’ needs –e.g. (Bélissent, 2010; Saunders

& Baeck, 2015; Wintrich, 2016; Zanella, Bui, Castellani, Vangelista, & Zorzi, 2014)—, only a few studies addresses this subject.

Kuk and Janssen (2011) examine the different strategies on providing e-government services and creating new information architectures. To do so, they identify two different approaches comparing two different cities in the Netherlands, although they do not go into detail in the business model analysis, only referring to the Janssen et al. (2008) taxonomy of e-governments business models, adapted from e-commerce business models. Later on Anthopoulos and Fitsilis (2015) also study the potential business models associated to e-services and ICT networks ownership.

Also focused on e-government business models, Molinari (2012) underlines that delivering innovative services to citizens requires the involvement of the citizens in technology adoption, as well as the need to keep a sustainable offer from a financial, societal and institutional viewpoint. To accomplish these objectives, this study proposes, among the many possible strategies, the long tail approach, pre-commercial public procurement and viral marketing.

More recently, Walravens (2015) proposes a list of qualitative indicators for smart city business models. He applies this framework to the study of several cases from the mobile services sector in which governments are implied. Walravens (2015) agrees on the need to replace the concepts of firm and revenue generation from

traditional markets, to focus on firms networks and value networks, adopted in the literature since the introduction of the Internet-based e-commerce models (Timmers, 1998). Thus, he extends the Ballon's (2009) business model matrix –composed of four main groups of parameters: value network, functional architecture, financial model and value configuration–, and besides, he adds two new groups of parameters: governance and public value. Table 1 shows the final framework.

Table 1. Expanded business model matrix (Walravens, 2015)

	Value Network	Technical Architecture	Financial Architecture	Value proposition
Business design parameters	Control parameters		Value parameters	
	Control over assets	Modularity	Investment structure	User involvement
	Vertical integration	Distribution of intelligence	Revenue model	Intended value
	Control over customers	Interoperability	Revenue sharing	Positioning
Public design parameters	Governance parameters		Public value parameters	
	Good governance	Technology governance	ROPI	Public value creation
	Stakeholder management	Public data ownership	Public partnership model	Public value evaluation

3. Methodology

According to the results of the literature review, there is not a holistic approach to study business models in the context of Smart Cities, but general business model definitions or different approaches to e-government services business models. Due to the differentiated areas within a Smart City (van Dijk & Teuben, 2015), and the willingness to include them all in this study, we have combined the general definition of business model that Gassmann et al. (2014) propose in their book, with

variety of solutions included in this category, from systems that try to optimize the present transportation alternatives, to brand new innovative solutions (van Dijk & Teuben, 2015). There are mainly seven types of services within the smart mobility context: smart parking –ability to best locate street, garage or shared parking, as well as ability to manage street parking issues–, smart ticketing –for public transports, street parking, etc.–, real time journey planner, command and control centers, bike sharing, car sharing, and taxi booking services (Benevolo, Dameri, & D’Auria, 2016; van Dijk & Teuben, 2015).

While command and control centers belong to the traditional public infrastructures that have been increasingly incorporating more sophisticated technologies (IBM, 2013), the access to open data, the growing number of connected smartphones, and the more collaborative citizens facilitate the emergence of private companies that offer value to the citizens through innovative business models. The following are some examples of them.

Smart parking. Wazypark is a Spanish startup that helps drivers find street parking thanks to Bluetooth technology. As opposed to other *crowdparking* apps that offer money to free a parking space –which would precise at least a public partnership–, they offer points that users can exchange for discounts in petrol or plane tickets. Wazypark works outside the local authorities, although it produces potential

benefits to the city in terms of pollution and traffic efficiency. While Wazypark only locates street parking spaces, other companies like JustPark (U.K.), ParkWhiz (U.S.A.) or ParkU (Germany, Austria, Switzerland and The Netherlands) help users find, book and pay parking spaces in private parking.

Smart ticketing. EysaMobile is a Spanish mobile payment app developed by EYSA company to pay for parking in the street. This business model needs a public partnership to obtain a license, since payments must go to local governments. Besides the revenues from the local authorities to manage the street parking payments, EysaMobile included in its mobile app the option to sponsor your parking by watching an add, saving some money to the drivers and increasing the revenues for the company.

Real time journey planner. Waze, acquired by Google in 2013, is a community-based traffic and navigation app that shares real-time traffic and user-submitted road information. Waze shows drivers the best route with real-time information from the community. Before Google acquisition, Waze potential profit mechanisms were on-map advertising and licensing data. Working as a community, Waze does not have any relation to public authorities, despite its beneficial outcomes for the city traffic.

Bike sharing. The number of bike sharing programs has increased dramatically in recent years (Larsen, 2013). Local authorities try to substitute cars, promoting this alternative public transport. City councils normally license bike sharing services, and citizens pay fees for using the bikes, that vary from being free—in those cities that promote their use—to equivalent fares to other public transports.

Car sharing. Although car sharing is an old practice in some countries (Meijkamp, 1998), it has changed considerably in the last years. Within the car sharing initiatives there are companies that offer a “grab and go” service to easily rent a fuel car—e.g. Zip Car—or an electric car—e.g. car2go—to move around the city; long-distance ridesharing communities—e.g. Blablacar—, peer-to-peer car rentals—e.g. GoMore—and peer-to-peer ridesharing—e.g. Lyft or Uber.

Taxi booking service. MyTaxi or Hailo are the biggest companies for taxi booking service, offering users to book a taxi through their apps, and charging a commission to the drivers. These apps do not only help users to easily find, book and pay a taxi, but also help taxi drivers to save time and fuel giving them indications on where to go to increase the likelihood to find clients.

4.2. *Smart Safety.*

Smart Safety includes all technologies that contribute to improve public safety. Safety infrastructures like sensors’ networks or security cameras belong to the

traditional and extended context of Smart City, usually provided by big communications corporations (IBM, 2013). Beyond these applications, new technology trends extend the possibilities in this area.

Safety Devices. Drone technology lets security officers to gather images of dangerous places before sending human beings, or prevent natural disasters like fires or earthquakes guarding potentially dangerous zones with specific sensors (Sandvik & Lohne, 2014). Flirtey –drone delivery–, Scath –mapping with drones–, or MicroMultiCopters Aero Technology –firefighting drones–, are only three examples within the numerous companies that manufacture drones for different services. Although they all have to meet restrictive laws, their business model is based on manufacturing devices to provide services or sell drones to public or private institutions. However, their impact on the Smart City infrastructure might be determinant, since some authorities see drones as powerful complements to traditional camera circuits (Rodriguez, 2015).

Safety Data. The increasing amount of data combined with the higher analysis capacity helps better respond or even to prevent accidents or crimes. Companies like Microsoft offers its analytics tools to help police departments to prevent crime (Ortega, 2015), while other business, like Predictive Solutions, are specialized in delivering solutions for predicting and preventing workplace injuries.

Emergency apps. There is a big list of emergency apps provided by governments—e.g. Federal Emergency Management Agency App (FEMA)—, private companies—e.g. Guardly—or institutions—e.g. Hurricanes or Tornado apps by American Red Cross. While public authorities or institutional apps provide their services with no cost for users, private apps revenue model is based on advertisements, pay for download, or specific security services for companies or institutions such as universities or hospitals.

4.3. *Smart Energy, Water and Waste*

Smart Energy. The aim of smart energy is to contribute with greener and more efficient solutions in the three main parts of the value chain: generation, distribution and consumption. The general adoption of new technology trends like renewal energy distributed generation, smart grids, smart metering, smart storage, and smart devices will produce a brand new market (van Dijk & Teuben, 2015). Although big companies like ABB, IBM, Cisco or Schneider Electric provide solutions for the infrastructure in coordination with governments, some new startups offer complementary services using analytics, algorithms, and connectivity to keep supply and demand for electricity in balance. Some examples of these new companies are Gridcure, Utilitidata, Varentec or GreenSync, that offer software platforms to improve the energy management.

Water. Smart water solutions focus on minimizing waste and securing quality.

To do so, the water management technology market comprises sensors and devices—offered by companies like Siemens, Libelium or Ayyeka—, and data analytics platforms—like Valor Water Analytics or Water Smart Software.

Waste. Similarly, waste management is being improved by the combination of hardware and software solutions that help cities and waste management companies to optimize collection logistics, recycling and processing—e.g. enevo, AMCS.

4.4. *Smart Buildings and Living*

Smart buildings and smart homes constitute the largest Internet of Things industry, with thousands of companies trying to improve energy management, and to offer better security, entertaining and communications solutions. Intelligence is spreading along every home device thanks to new companies like Netatmo, Nest, August or SmartThings, and older companies like Honeywell or Phillips. Their business models, out of government action range, try to move from hardware sales to product as a services models (Dawson, 2015).

4.5. *Smart Government*

As mentioned in the Smart City business models literature review, e-government services have usually been considered as the only services included in the Smart City. Although e-government services are important, in this study we want to

focus on the surrounding services that should be aligned or complemented by the e-government services.

4.6. *Smart Social Areas*

While mobility, safety, energy, waste, water, buildings and e-government have been considered the pillars of the original conceptualizations of a Smart City, some other important areas of the society have only been included as long as citizens' needs and well-being have been moved to the center of the model. Since sectors like health, education, finance or retail are very vast and impossible to be analyzed in only one study, we will just introduce one example of disruptive innovation within each sector that shows their impact on Smart City.

Smart Health. Oscar, is a New York health insurance company that uses technology to simplify the entire health insurance experience. They combine a mobile app that connects the patients with the doctor and lets them to access the patients' health history, an intelligent search engine based on the symptoms, data analytics to reduce costs and predict future needs, and use of a smart wearable bracelet that tracks patients' activity and lets them earn money if they work out. By doing so, Oscar offers more affordable plans to their customers, improving their health experience.

Smart Education. Founded in 2008, Knewton created an adaptive learning software that uses algorithms to provide personalized content for each student that

shifts according to his or her personal strengths and weaknesses. Knewton business model bases on partnerships with schools, universities and companies to personalize their teaching curriculum to every student. The combination of this technology with massive open online courses (MOOCs)—another disruptive education trend—, would deeply change the education outlook.

Smart Finance. Financial services industry is living a deep digital transformation that is reshaping the whole sector. Thus, it is difficult to pick only one company among the hundreds of disruptive services that are emerging in the fintech environment. Following the criteria of Fintech 100 from 2015, a collaborative list proposed by H2 Ventures and KPMG (Heap & Pollari, 2015), we have selected the first company of the list, ZhongAn. It is an innovative online insurance company that uses big data to automate and personalize the whole insurance process, from product design to risk management. The use of big data and machine learning techniques serves to provide personalized products and reduce company's risk, while offering better prices.

Smart Tourism & Leisure. If there is a company that is revolutionizing the travel industry, that is Airbnb. The peer-to-peer accommodation market place founded in California in 2008 enable people to list, find and rent private homes, charging a service fee for each booking. Although they are facing several legal issues around the

world, Airbnb impact on the market has changed the perception of peer-to-peer accommodation and has forced most of its traditional competitors to improve their offer to survive.

Smart Retail and Logistics. Although it is easy to choose Amazon as an innovative company, the truth is that they never stop launching new services, some of which have a significant impact on cities. This is the case of Amazon Prime Now, the 1-hour Amazon delivery service. To maintain this service, Amazon needs to keep investing on its infrastructure and data analysis, in order to be able to predict the next customers' orders and adapt its logistics to the real-time demand.

Smart Manufacturing and Construction. WASP, the acronym of "World's Advanced Saving Project" develops huge scale 3D printers to produce low-cost housing units. Although WASP operates as a non-profit, they sell various sizes of delta 3D printers to finance the greater vision, that not only includes printing houses, but also use 3D printers for food, energy or health applications.

4. Conclusions

This study reviews the actual state of art of Smart Cities in terms of business models, and proposes a framework to analyze innovative business models within all the sectors of a broad definition of the Smart City.

From a theoretical point of view, as a result of the analysis, there is a lack of a complete model or taxonomy that includes all the potential business models contained in a Smart City. As a matter of fact, the present study brings to light that those studies that analyze the business models in the context of Smart City refer only to e-government services—e.g. (Anthopoulos & Fitsilis, 2015; Kuk & Janssen, 2011; Molinari, 2012; Walravens, 2015)—, while there is a large amount of dispersed studies that just focus on business models for specific applications within Smart City —e.g. smart mobility (Abdelkafi, Makhotin, & Posselt, 2013) or smart energy (Vincenzo & Fulli, 2012).

The results reflect that the current approach in terms of business models within the Smart City is very narrow. There is a need to expand this framework beyond traditional expensive and unsustainable public infrastructures to provide e-services, towards an open and wide paradigm that includes multiple applications, agents, and technological and social innovations (Saunders & Baeck, 2015). In this sense, Walravens (2015) proposes to expand his methodology with other indicators, as well as to apply the framework to other digital city service initiatives.

The analysis of the business models exposed in this research also reveals that the expansion of high speed mobile connections and the increase of smart phone users, as well as the increasing willingness of citizens to collaborate, act as catalysts

for the emergence of new businesses providing Smart City services. Moreover, most of these businesses rise independently of the public initiatives, and in some cases play as a substitute of public services included in the local Smart City strategy—e.g. apps to find street parking based on real-time data versus parking sensors network technology. Policy makers need to count on these initiatives within their strategic plans, not only to avoid expenses and manage more efficiently their budgets, but also to accomplish the final objective of the Smart City initiative, to fuel sustainable economic growth and high quality of life (van Dijk & Teuben, 2015). As a matter of fact, most of the innovative models showed in this analysis positively contribute to these objectives. This conclusion, obtained from a business model approach analysis, is consistent with other works that doubt of a huge technological infrastructure as the only approach to a Smart City, and emphasize the impact of other initiatives (Shelton et al., 2015).

From a practical point of view, this study compiles multiple examples of public and private initiatives in the context of Smart Cities that shows interesting business model innovations. Compiling business examples and going into detail in the analysis of their business model within a broad conceptualization of a Smart City, will definitely contribute to convince governments to expand their vision and identify new

ways to provide city services, as well as encourage practitioners to count on open governments support to propose new business.

Although this study suffers from following a qualitative analysis, it opens an interesting avenue of research in the study of the future Smart City business models.

References

- Abdelkafi, N., Makhotin, S., & Posselt, T. (2013). Business model innovations for electric mobility—what can be learned from existing business model patterns? *International Journal of Innovation Management*, 17.01.
- Anthopoulos, L. G., & Fitsilis, P. (2015). Understanding Smart City Business Models: A Comparison. In *International World Wide Web Conference Committee (IW3C2)* (pp. 529–533). Florence, Italy: ACM.
- Ballon, P. (2009). *Control and Value in Mobile Communications: A political economy of the reconfiguration of business models in the European mobile industry*. Vrije Universiteit.
- Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., ... Portugali, Y. (2012). Smart cities of the future. *The European Physical Journal Special Topics*, 214(1), 481–518.
- Beattie, V., & Smith, S. J. (2013). Value creation and business models: Refocusing the intellectual capital debate. *British Accounting Review*, 45(4), 243–254. doi:10.1016/j.bar.2013.06.001
- Bélissent, J. (2010). *Getting Clever About Smart Cities: New Opportunities Require New Business Models*. Cambridge.
- Benevolo, C., Dameri, R. P., & D’Auria, B. (2016). Smart Mobility in Smart City. Action Taxonomy, ICT Intensity and Public Benefits. *Lecture Notes in Information Systems and Organisation*, 11, 13–28. doi:10.1007/978-3-319-23784-8
- Chesbrough, H., & Rosenbloom, R. S. (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporation’s technology spin-off companies. *Industrial and Corporate Change*, 11(3), 529–555. doi:10.1093/icc/11.3.529
- Dawson, F. (2015). How To Make Money From “Smart Homes.” *Forbes*.
- Frost&Sullivan. (2013). Strategic Opportunity Analysis of the Global Smart City Market, (August), 1–18.

- Gassmann, O., Frankenberger, K., & Csik, M. (2014). *The Business Model Navigator: 55 models that will revolutionise your business*. UK: Pearson.
doi:10.1017/CBO9781107415324.004
- Heap, T., & Pollari, I. (2015). *Fintech 100. Leading Global Fintech Innovators Report 2015*.
- Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City*, 12.3, 303–320.
- IBM. (2013). *IBM Intelligent Operations Center for Smarter Cities*. NY.
- Janssen, M., Kuk, G., & Wagenaar, R. W. (2008). A survey of Web-based business models for e-government in the Netherlands. *Government Information Quarterly*, 25(2), 202–220.
- Kuk, G., & Janssen, M. (2011). The Business Models and Information Architectures of Smart Cities. *Journal of Urban Technology*, 18(2), 39–52.
doi:10.1080/10630732.2011.601109
- Larsen, J. (2013). Bike-Sharing Programs Hit the Streets in Over 500 Cities Worldwide. *Earth Policy Institute*, (April). doi:10.1007/s13398-014-0173-7.2
- Magretta, J. (2002). Why Business Models Matter. *Harvard Business Review*, 80(May), 86–92. doi:10.1002/1099-0690(200112)2001:23<4391::AID-EJOC4391>3.0.CO;2-D
- Meijer, A., & Bolivar, M. P. R. (2015). Governing the smart city: a review of the literature on smart urban governance. *International Review of Administrative Sciences*, (June 2016), 0020852314564308–. doi:10.1177/0020852314564308
- Meijkamp, R. (1998). Changing consumer behaviour through eco-efficient services: an empirical study of car sharing in the Netherlands. *Business Strategy and the Environment*, 7(4), 234–244.
- Molinari, F. (2012). Innovative Business Models for Smart Cities: Overview of Recent Trends. *12th European Conference on eGovernment (ECEG 2012)*, (actually 39), 483–492.
- Ortega, S. (2015). Fighting crime with big data analytics. Retrieved from <https://enterprise.microsoft.com/en-us/industries/government/fighting-crime-with-big-data-analytics/>
- Osterwalder, A. (2004). *The Business Model Ontology - A Proposition in a Design Science Approach*. Université de Lausanne.
- Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation*. New Jersey: John Wiley & Sons, Inc.
- Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying Business Models: Origins, Present, and Future of the Concept. *Communications of the Association for Information Systems*, 15(May).

- Richardson, J. (2008). The business model: an integrative framework for strategy execution. *Strategic Change*, 17(5-6), 133–214.
- Rodriguez, K. (2015). Drone and CCTVs for Everyone : Surveillance Tech Expands Across Latin America. *Electronic Frontier Foundation*.
- Sandvik, K. B., & Lohne, K. (2014). The Rise of the Humanitarian Drone: Giving Content to an Emerging Concept. *Millennium - Journal of International Studies*, 43.1, 1–20. doi:10.1177/0305829814529470
- Saunders, T., & Baeck, P. (2015). *Rethinking Smart Cities From The Ground Up*. London.
- Shelton, T., Zook, M., & Wiig, A. (2015). The “actually existing smart city.” *Cambridge Journal of Regions Economy and Society*, 8(1), 13–25. doi:DOI 10.1093/cjres/rsu026
- Timmers, P. (1998). Business Models for Electronic Markets. *Electronic-Markets*, 8, 3–8. doi:10.1080/10196789800000016
- UN. (2014). *World Urbanization Prospects: The 2014 Revision. Department of Economic and Social Affairs*. New York. doi:10.4054/DemRes.2005.12.9
- van Dijk, A., & Teuben, H. (2015). *Smart Cities Report: How rapid advances in technology are reshaping our economy and society*. The Netherlands.
- Vilajosana, I., Llosa, J., Martinez, B., Domingo-Prieto, M., Angles, A., & Vilajosana, X. (2013). Bootstrapping smart cities through a self-sustainable model based on big data flows. *IEEE Communications Magazine*, 51(6), 128–134. doi:10.1109/MCOM.2013.6525605
- Vincenzo, G., & Fulli, G. (2012). A business case for Smart Grid technologies: A systemic perspective. *Energy Policy*, 40, 252–239.
- Walravens, N. (2015). Qualitative indicators for smart city business models: The case of mobile services and applications. *Telecommunications Policy*, 39(3-4), 218–240. doi:10.1016/j.telpol.2014.12.011
- Wintrich, G. (2016). How Communities, Funding, and Technology Intersect in Smart Cities. *Harvard Business Review*, January.
- Woods, E., & Goldstein, N. (2014). Navigant Research Leaderboard Report: Smart City Suppliers. Assessment of Strategy and Execution for 15 Smart City Suppliers, 53.
- Zanella, A., Bui, N., Castellani, A., Vangelista, L., & Zorzi, M. (2014). Internet of Things for Smart Cities. *IEEE Internet of Things Journal*, 1(1), 22–32. doi:10.1109/JIOT.2014.2306328
- Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning*, 43, 216–226. doi:10.1016/j.lrp.2009.07.004