

# Smart City and Simplicity? Modular Business Models for Smart Cities

## Authors' names and affiliation

Sari Perätalo, Petri Ahokangas, and Saara Pekkarinen  
Martti Ahtisaari Institute, Oulu Business School, University of Oulu

## Abstract

This paper discusses a modular business model approach in the public smart city context. Up to date, the implementation of smart city business models has been challenging due to the complexity and fragmentation of the created models. This study aims at contributing to research by introducing a modular and simpler business model approach for smart cities.

## Key words

Business model, smart city, modularity

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(2.500 words: max. 2 figures or tables)

## Introduction

Digitalization has brought about new opportunities for cities to become smarter – or smart cities (Diaz-Diaz et al., 2017) – giving rise to the idea that business model thinking could be given a role in the field of city development. For example, numerous cities have made available a myriad of digital services to their inhabitants, and with the introduction of each service they have been forced to think about the business model by which they offer the services. However, many of the created business models appear at the same time as complex and fragmented, making it hard for the users to understand them. Hence, it has become challenging for city representatives to see the full benefits that digitalization and smart city development could bring to their cities.

In parallel, public sector financial crisis and municipal bankruptcies are influencing cities (Belissent, 2010), meaning that the city representatives find themselves busier than ever doing their normal everyday work. In this kind of city context, there is a need for simpler and modular business model approach to be applied in the city governance to reach the economic and political goals of the city.

The ongoing smart city development is one of the biggest challenges that our society is facing (Brutti et al. 2019). This is also reflected in the increasing number of smart city business model

literature, combined, e.g., with themes such as smart energy, smart health, and smart traffic. Despite the constantly increasing number of smart city research, there is no widely accepted conceptualization of the smart city. One of the most well-known smart city conceptualizations is the “smart city wheel”, and its six dimensions created by Cohen (2013) who addresses the dimensions of governance, economy, mobility, environment, living, and people in smart cities.

According to Kuk and Jansen (2011), successful business model implementation requires solid and relevant architecture. As a product, and as a strategy of organizational design, modularity provides a way to easily understand how complex relationships can be governed (Brusoni et al. 2007). Based on the above discussion, we find it relevant to take a closer look at the business model related opportunities, values, and advantages (e.g. Amit & Zott, 2001; Teece 2010) in the smart city context especially from the modularity perspective. This paper explores modularity as a basis for a simpler business model approach in the field of city governance. Specifically, we aim to answer the following question: *How to reduce the complexity of the business models in the smart city by using modular business model thinking?*

## Approach

This conceptual paper builds on a literature review for which we selected a topically relevant set of papers about business models, smart cities, and modularity. This review was performed in February 2020, and it contains outcomes from articles that were published until that point.

### **Business model approach**

The business model can be defined as the content, structure and governance transactions made inside an organization, supporting the organization's value creation, delivery and capture (e.g. Zott & Amit, 2010). In cities, a particular business model describes the architecture or design for value creation, delivery, and capture mechanisms it employs, even though there is no widely accepted definition or conceptualization of the business model for the city context (Teece 2010). A business model can act as a tool to align economic value creation, technology development (Glova et al. 2014; Iivari 2016) and can provide a holistic view on modularity and its consequences along the value creation system (Schön 2012) in the smart city context.

In the city context, the business model approach and its anchoring concepts provide a new perspective to a city organization's strategic thinking as it supports planning and implementation of change (Bridgeland & Zahavi, 2009, p.25). The three anchoring concepts of the business model include *opportunity, value, and advantage* (e.g. Amit & Zott, 2001; Teece 2010). These concepts are also related to each other. An opportunity can be defined as something positive to be reached (Holm et al., 2015), and it is dependent on the external context.

Therefore, the business model can be seen as a source of value creation and capture (Amit & Zott, 2001). Value creation can be a source of competitive advantage, and competitive advantages are needed for an organization to become and remain competitive (Casadeu-Masanell & Ricart, 2010). Competitive advantage can be seen as an ability to create greater value for organizations, shareholders, and stakeholders, and thus, it gives a competitive edge related to competitors

(Iivari, 2016). In addition, scalability, replicability (e.g. Giesen et al., 2010), and sustainability (e.g. Evans et al., 2017) are important outcomes of the business model.

### **Smart city context**

One of the most well-known smart city definitions, Cohen's (2013) smart city wheel, includes six dimensions: *governance, economy, mobility, environment, living, and people*. Smart governance denotes the modernization of city administration by open data and public investment in a transparent way (Buhalis and Amaranggana 2014). The linkage between all these dimensions is the use of ICT, and it is also seen as the factor that makes a city smart (Brutti et al. 2019). In the wheel, governance implies participation, transparent governance structures, and decision-making.

Smart environment is related to energy optimization that leads to sustainable management of available resources. Mobility refers to accessibility within the city as well as outside the city and availability of modern transportation systems, but also sustainable resource management. Economy, in turn, denotes the implementation of economic strategies based around digital technology, new innovations, and flexibility. This means that people are linked to the qualification level of city's human capital in terms of creativity, flexibility, and education. Finally, living involves the quality of life which is measured in terms of healthy environment, social cohesion, tourist attraction and availability of cultural and educational services (Ruohomaa et al., 2019; Buhalis and Amaranggana 2014 according to Baudouin 2012).

Cities have numerous heterogeneous solutions related to one smart city dimension (*governance, economy, mobility, environment, living, and people*), and none of these solutions are interacting or communicating with the other similar solutions or with the other city stakeholders in the different department (Brutti et al. 2019). Cities also lack horizontal interaction and communication between the city administration (Brutti et al. 2019). Thus, cities seem to be formed from many self-consistent silos. In the research community, there is a common understanding that there is an urgent need for smart city development because of increasing urbanization, technological development, and environmental challenges (Kunttu 2019). Thus, we address smart city as a research context that binds together government, technology, and society, meaning the smart city development is not just about technological development, but it requires also a new way of thinking (Ruohomaa et al., 2019) and governing of cities.

### **Modularity and business models**

According to Baldwin and Clark (1997), modularity means "*building a complex product or process from smaller subsystems that can be designed independently yet function together as a whole*". On the other words, modularity is "a very general set of principles for managing complexity" (Langlois, 1999). In practice and as its simplest, modularity means the reduction of independencies between modules to a minimum, and at the same time increasing the interdependence within modules (e.g. Schön, 2012). Thus, when the complexity of modern technology is ever-increasing, modularity becomes more and more important not just in the context of technological design but also in the context of organizational design (Langlois, 1999).

The benefits of modular systems are related to increasing efficiency and simplifying the

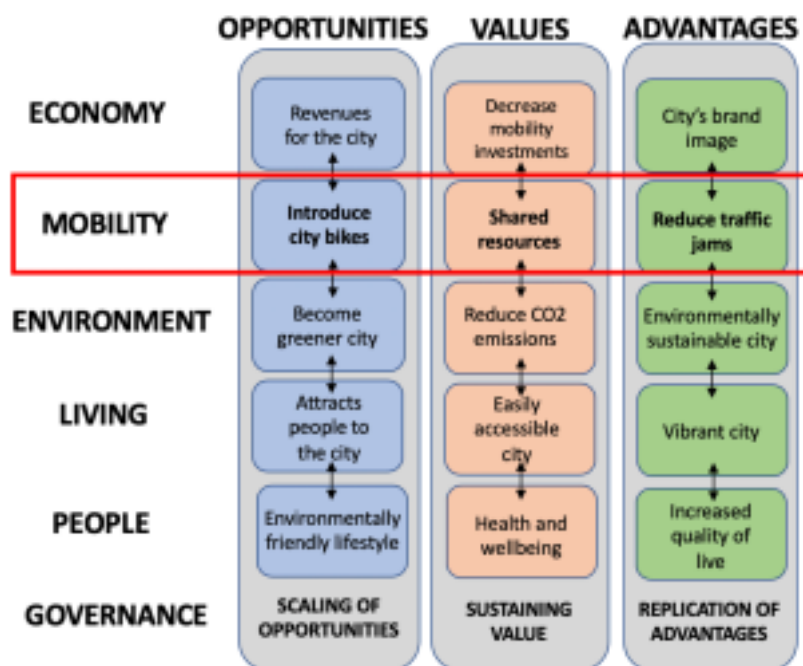
management, and modularity can be seen even as a new paradigm how to design processes and organizations (e.g. Baldwin & Clark, 1997). The business model modularity enhances the organization's strategic flexibility, and hence, we use the concept of modularity when designing a simpler business model approach for smart cities (Gärtner & Schön, 2016). This argument is based on the assumption that modular business models in the smart city context should be scalable, replicable, and sustainable, and these denominators can be regarded also as an important outcome of smart city governance.

## Key insights

### Modular Smart City Business Model = SimpliCity

Technological development and digitalization drives both business model and smart city development, creating a sharing economy that is based on open business models (Perätalo & Ahokangas, 2018). In this paper, we want to take a closer look at a bike-sharing service the number of which have increased at an astonishing speed worldwide. Through this example, we introduce a new modular business model approach for the cities. We call this a “*simplicity approach*.”

The simplicity approach is based on the *three anchoring concepts*, and *three important outcomes of the business model*, combined with the *six smart city dimensions*. The business model related concepts – *opportunity, value, and advantage* - are presented in the vertical axis of the model, and the six smart city dimensions – *economy, mobility, environment, living, people, governance* – are presented in the horizontal axis. The model is depicted in figure 1. below.



**Figure 1.** Simplicity approach applied to smart cities' bike-sharing service.

The model shows how the opportunities, values, and advantages of different smart city dimensions are linked together, and how they complement and strengthen each other when city governance applies a modular approach. Furthermore, we think that the governance dimension of the smart city should scale opportunities, sustain values, and replicate advantages across all dimension of the smart city. Through the modular business model approach, a city can get a unified understanding of its different opportunities explored, values created and captured, and advantages replicated when it comes to different services, but also see how the siloed smart cities can develop their functions while also lowering its silos at the same time. We argue that the smarter the city is the simpler it should be to govern.

## Discussion and conclusions

Smart city initiatives are important, but hard to implement. City governance is at its simplest moderating between different issues and deciding what to do. Practices of governance influence the way of how our society is organized and steered. They comprise also private resources and associated practices and choices as well as collective actions of the society. Today, the attention of governance is on the issues and politics of the urban development, and urban governance is under high pressure to deal with issues from macro-dilemmas to micro-dilemmas. It is often seen that governance is under-performing to deliver value, or too expensive for the citizens. Thus, it is highly relevant to seek for improvement. Effective governance must recognize and handle traditional modes of economic activity, but also new modes of sharing economy. These new modes create new public value when they enable others to participate in opportunity recognition, value co creation, and gaining competitive advantage.

The modular business model approach in smart cities creates value for all city entities and stakeholders, also for businesses, when different pieces of knowledge and skills are brought together via lowering the boundaries of different siloes in a city. In conclusion, both the business model and smart city concepts and their dimensions are multi-faceted. Modularity can provide a new way to approach and understand smart city business models and their practical implications. Until now, academic research has not widely addressed how smart cities could utilize the business model approach in their development (Díaz-Díaz et al., 2017), thus, this short paper provides some preliminary thoughts on how the modular business model thinking could work in smart cities.

## References

1. Amit, R. & Zott, C. (2001). Value creation in e-business, *Strategic Management Journal*, Vol 22, pp. 493-520.
2. Baldwin, C. Y. & Henkel, J. (2011). The Impact of Modularity on Intellectual Property and Value Appropriation. Dec 08, 2011. *Harvard Business School, Working Paper 12-040*.
3. Belissent, J. (2010). *Getting Clever About Smart Cities: New Opportunities Require New Business Models*. Cambridge, Massachusetts. For Vendor Strategy Professionals. Forrester Research Inc. Available at: <http://193.40.244.77/iot/wpcontent/>

uploads/2014/02/getting\_clever\_about\_smart\_cities\_new\_opportunities.pdf

4. Bridgeland, D. M., & Zahavi, R. (2009). *Business Modelling - A Practical Guide to Realizing Business Value*. Burlington: Morgan Kaufmann.
5. Brusoni, S., Marengo, L., Prencipe, A., & Valente, M. (2007). The value and costs of modularity: a problem-solving perspective. *European Management Review*, 4(2), 121-132.
6. Brutti, A. et al. (2019). Smart City Platform Specification: A modular approach to achieve interoperability in Smart Cities. In: Cicirelli F, Guerrieri, A., Mastroianni, C., Spezzano, G., Vinci, A. (eds). *The Internet of Things for Smart Urban Ecosystems*. Internet of Things (Technology, Communications and Computing), Springer, Cham.  
[https://doi.org/10.1007/978-3-319-96550-5\\_2](https://doi.org/10.1007/978-3-319-96550-5_2).
7. Buhalis, D., & Amaranggana, A. (2014). Smart tourism destinations. In *Information and communication technologies in tourism, 2014* (pp. 553-564). Springer, Cham.
8. Casadeus-Masanell, R. & Llanes, G. (2011). Mixed Source. *Management Science*, Vol. 57, No. 7, pp. 1212-1230.
9. Cohen, B. (2013). Smart city wheel. Retrieved from *SMART & SAFE CITY*: <http://www.smartcircle.org/smartcity/blog/boyd-cohen-the-smart-city-wheel>.
10. Díaz-Díaz, R., Muñoz, L. & Pérez-González, D. (2017). The Business Model Evaluation Tool for Smart Cities: Application to Smart Stantander Use Cases, *Energies* 2017, 10, 262; doi:10.3390/en10030262.
11. Fehrer, J.A., Woratschek, H. & Brodie, R. J. (2018). "A systemic logic for platform business models", *Journal of Service Management*, Vol. 29 Issue: 4, pp. 546-568, <https://doi.org/10.1108/JOSM-02-2017-0036>.
12. Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy* 43, 1239-1249.  
<http://dx.doi.org/10.1016/j.respol.2014.03.006>.
13. Giesen, E., Riddleberger, E., Christner, R., Bell, R. (2010). When and how to innovate your business model, *Strategy & Leadership*, Vol. 38, Iss. 4., pp. 17-26
14. Glova, J., Sabol, T. & Vадja, V. (2014). Business Models for the Internet of Things Environment. *Procedia Economics and Finance*, vol. 15, pp. 1122-1129.
15. Gärnter, C. & Schön, O. (2016). Modularizing business models: between strategic flexibility and path dependence. *Journal of Strategy and Management*. ISSN: 1755-425X.39:2255-2276.

16. Holm, D., Johanson, M. & Kao, P.T. (2015). From outsider to insider: opportunity development in foreign markets networks, *Journal of International Entrepreneurship*, Vol. 13, Iss. 3, pp. 337-359.
17. Iivari, M. (2016). Exploring Business Models in Ecosystemic Contexts. Doctoral dissertation, Acta Universitatis Ouluensis.
18. Kuk, G. & Janssen, M. (2011). Business Models and Information Architectures of Smart Cities, *Journal of Urban Technology*, 18:2, 39-52, DOI: 10.1080/10630732.2011.601109
19. Kunttu, I. (2019). Editorial: Smart Cities, *Technology Innovation Management Review*, Vol 9., Iss 9.
20. Langlois, R. N. (1999). Modularity in technology, organization, and society. *Organization, and Society (August 1999)*.
21. Perätalo, S. & Ahokangas, P. (2018). Toward Smart City Business Model, *Journal of Business Models*, Vol. 6, No. 2, pp. 65-70.
22. Ruohomaa, H., Salminen, V. & Kunttu I. (2019). Towards Smart City Concept in Small Cities, *Technology Innovation Management Review*, pp.
23. Schön, O. (2012). Business Model Modularity – A Way to Gain Strategic Flexibility? *ZfCM|Controlling & Management*, Sonderheft 2|2012, pp. 73-78.
24. Teece, D. (2010). Business Models, Business Strategy and Innovation, *Long Range Planning* 43(2-3), pp. 172-194.
25. Zott, C. & Amit, R. (2010). Business Model Design: An Activity System Perspective. *Long Range Planning* 43, 2-3, 216-226.