

11

Business Models

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Abstract

This discussion will be structured by first considering the issue of business plans at the “smart city level”, before focusing on the business models associated with urban data platforms and before delving into the issues faced by adding a citizen’s personal data into the mix, and how this addition can help contribute to the evolution of urban data platforms.

However, this is not simple, as we are considering an amalgam of inter-related and interconnected social, human, technical, and economic variables, all at the same time and focused on an ever-shifting and ever-developing city landscape. The situation could be described as “the scourge of tidy minds!”

Approaches derived from a series of EU funded projects will be described.

What is significant is the amount of information which collectively these projects featured have produced on this topic and derived from hundreds of sources in their research. Many provide a range of tools and advice far in what you would expect to find on a project website.

11.1 Introduction

This discussion will be structured by first considering the issue of business plans at the “smart city level”, before focusing on the business models associated with urban data platforms and before delving into the issues faced by adding a citizen’s personal data into the mix, providing a stimulus to the deployment of urban data platforms.

However, this is not simple, as we are considering an amalgam of inter-related and interconnected social, human, technical, and economic variables, all at the same time and focused on an ever-shifting and ever-developing city landscape. The situation could be described as “the scourge of tidy minds!”

A potentially useful tool to help with the analysis of “How a smart city is run” is a technique developed by the UK Open University in relation to working out how best to describe “How a country is run”.¹

To answer this question, three common models are used simultaneously, like shining a light on an object with three different torches. The three models being hierarchy, markets, and networks defining them loosely as follows:

- A hierarchy is as how we commonly use it, with a government or corporate organisation being able to pass down instructions so that something happens.
- The key concepts in market coordination are enforceable contracts and property rights. Communication in a market is through prices, which serve as the basis for behaviour of both buyers and sellers.
- Networks are characterised by the complementarity of member’s interests and the reaching of an agreement between them. Coordination and agreement within networks are achieved through discussion rather than through the impersonal mechanisms which work in markets and hierarchies.

The value in the use of these three models to analyse the process of coordinating smart city activities and usage of data is that a different perspective is reached through each one, which, when combined, give a better view of what is happening.

On one end of the scale is the logic of the UK post-Brexit advocates of the free market approach. A very serious argument has to be put forward to the government for any form of hierarchical government intervention in the data economy, despite the numerous reasons why data cannot be classified as a simple product, conforming to a theoretical concept of how a market functions. This is reflected in the current strategy prepared for the Department for Culture and Media.²

As we recognise, data can be used repeatedly and in different combinations and for a variety of reasons, in addition to those for which it was collected or

¹ G. Thompson, J. Frances, R. Levačic, and J. Mitchell, Eds., *MARKETS, HIERARCHIES AND NETWORKS. The Coordination of Social Life*. Newbury Park: SAGE Publications, 1991.

² “Increasing access to data held across the economy-GOV.UK.” <https://www.gov.uk/government/publications/increasing-access-to-data-held-across-the-economy> (accessed Jul. 26, 2022).

those which might make a profit for an enterprise. It is a non-rivalrous good. And as we touch on in later chapters, the price mechanism for data cannot rely on simple supply and demand graphs and a whole new approach is sought after to put value on what is occurring within a complex eco-system, lubricated by interlocking networks.

And, of course, a government at any level, with wider aspirations than “rolling back the state” has a wide range of policy objectives which can be supported through a more enlightened approach to data and in the light of it being a “non-rival” good available for use by many at the same time, without it diminishing. This is particularly so, when faced with the overall objective of becoming climate-neutral.

We will look further how we put a value on data in Chapter 13. What is clear is that a “one size fits all” solution will not emerge.

11.2 Business Models and Smart Cities

When the European Innovation Partnership on Smart Cities and Communities was launched a decade ago, it was to primarily create a number of “Lighthouse Initiatives” to deliver common smart city solutions. This would enable the creation at scale; whilst reducing risk for political decision-makers as well as investors”, the Lighthouse Initiatives were expected also to adhere to the fulfilment of its second objective: to “Apply new business and financial models, public-private partnerships that combine industry with public investments at European, national, regional and local level”, in order to deliver improvements faster across the three vertical areas identified as priorities”.³

The three priorities are sustainable urban mobility/sustainable districts, built environment and integrated infrastructures, and processes across energy, ICT, and transport.

Funded Lighthouse projects were expected to contribute and to come up with novel business models to close potential gaps between achieving the policy goals and the availability of investment, which should become replicable and adopted widely within the smart city movement.⁴

³ “EIP-SCC Strategic Implementation Plan - Smart Cities Marketplace.” <https://smart-cities-marketplace.ec.europa.eu/media/2261> (accessed Jul. 26, 2022).

⁴ Smart Cities, “Towards A Joint Investment Programme For European Smart Cities. A Consultation Paper to Stimulate Action,” Marketplace of the European Innovation Partnership On Smart Cities and Communities, 2016, Accessed: Jul. 26, 2022. [Online]. Available: https://smart-cities-marketplace.ec.europa.eu/sites/default/files/2021-04/EIP-SCC_TOWARDS%20A%20JOINT%20INVESTMENT-Paper.pdf

The following sections will trace the evolution of the approach to the smart city business model followed by the Lighthouse projects.

11.3 Smart City Networks Creating Best Practice Repositories

Thus, in recent years, a plethora of projects and cities have been working on novel business cases at a smart city level. The Lighthouse cities themselves have formed a network to continue to collaborate within scalable cities, as part of the Smart Cities Marketplace.⁵

Another initiative within the Smart Cities Marketplace is “City Wisdom” which forms a knowledge hub for business models and finance from real-world smart city projects which has the intention to “Identify and collect a complete collection of business models and finance analysis from city projects”.⁶

11.4 SmartEnCity Project

Along with other Lighthouse projects, work was carried out in developing a new business model to identify the path to be followed on project replication and on business models that will make projects similar to SmartEnCity economically feasible, without public subsidies. They used the basic business model canvas as a basis for developing their business models.⁷

Recommendations are based on existing business models being implemented for working areas such as building retrofitting; energy supply and use; smart mobility and investments in ICT in Lighthouse projects. Here, a logic can be seen in using the “normal” business model canvas as the individual application areas appeared as being suited to being approached almost as distinct products.³

⁵ “Scalable Cities - Smart Cities Marketplace.” <https://smart-cities-marketplace.ec.europa.eu/scalable-cities> (accessed Jul. 26, 2022).

⁶ “City Wisdom - Smart Cities Marketplace.” <https://smart-cities-marketplace.ec.europa.eu/action-clusters-and-initiatives/action-clusters/business-models-finance/city-wisdom> (accessed Jul. 26, 2022).

⁷ “SmartEnCity -D2.3. New business models, procurement schemes and financing mechanism for the smart city projects ,” SmartEnCity Consortium, 2016, Accessed: Jul. 26, 2022. [Online]. Available: https://smartencity.eu/media/smartencity_d2.3_new_business_models_procurement_schemes_and_financing_mechanisms_for_smart_city_projects_v1.0_1.pdf

The SmartEnCity approach was that from the European Innovation Partnership on Smart Cities and Communities Strategic Implementation Plan. This covered the issues faced and the approach to business models at the same time:

“In most cases, new investments will be needed to generate the broad uptake of smart city solutions. However, due to the economic crisis and increased demand for public services (demographic change, care, transfer of tasks from central government levels etc.), the public sector – locally and centrally – has limited budgets. This means that new market-oriented and sustainable strategies of public private cooperation must be developed and cities must seek greater levels of external investment. The investment community seeks certainty, and scale. However, most cities, at an individual level, presently deliver neither of these. Continuing ‘business as usual’ will not create enough value and scale for city administrations, cities, businesses and solution providers”.

The SmartEnCity project defined its business model according to the business canvas model.⁸

It was selected as a model that everybody can understand and can make themselves. “The challenge is that the concept must be simple, relevant, and intuitively understandable, while not oversimplifying the complexities of how enterprises function”.

We will see the adaptation and evolution of this original canvas business model approach as a recurring theme as cities and projects struggle to define their business model approach.

Issues which SmartEnCity encountered included that the goals developed in the three vertical priority areas cannot be achieved using traditional methods, for several reasons.

- First, there is a need for smart solutions that are developed in collaboration between citizens, local and global industries, municipal utilities, and the local public agencies – this often defies conventional procurement and tendering procedures.
- Second, although solutions must be local, such typically small-scale individual solutions are unnecessarily expensive and preclude the development of a business case for innovative smart city solutions at pan-European scale.

⁸ A. Osterwalder and Y. Pigneur, *Business Model Generation*. Strategyzer, 2009. Accessed: Jul. 26, 2022. [Online]. Available: <https://www.strategyzer.com/books/business-model-generation>

- Finally, the matching and combining of complex city needs with industrial needs for long-term process and product innovation can be improved significantly.

But a major obstruction identified, and one we will return to in Chapter 13, is that progress is hindered by the need for all stakeholders involved in the processes of city transformation to be able to identify the added value of the investments. This requires a deeper public and private collaboration and a stronger integration of the value chain, with it matching city needs with industrial solutions as a strategic issue to leverage public and private investments.

11.5 Urban Data Platforms

We started by looking at the smart city approach as a whole, but we begin to see the importance of factoring in the general use of data within a smart city.

So, the business models being considered for deploying smart cities also spilled out into the development of models for deploying “urban data platforms”.

The SmartEnCity Deliverable 6.6⁹ focuses on the value added services on top of their “City Information Open Platform”. In this document, they focused on creating a toolbox to help build local value added services that match the context. This involves identifying capabilities, partners, and use-cases, after which use-cases should be evaluated, deployed, and results validated. Section 4.3 of D6.6, “Examples of value added services”, provides an extensive list.

This section contains a table with the most significant value added services examples identified in the “state-of-the-art” and broken down into the main verticals and other domains.

11.6 REPLICATE Project

The conclusion from the REPLICATE Lighthouse project, however, was that work still needs to be done in this direction, as it was concluded that:

“Supported by the empirical evidence provided by the municipalities about the REPLICATE project interventions, rounds of data collection from the REPLICATE cities, and an extensive literature search, this Work Package has found that replicable business models, as interpreted in a narrow firm-oriented sense as exemplified by much of the Business Model Innovation

⁹ “SmartEnCity - D6.6. Strategies for Value Added Services ,” SmartEnCity Consortium, 2017, Accessed: Jul. 26, 2022. [Online]. Available: <https://smartencity.eu/media/del6.6.pdf>

(BMI) literature, are not by themselves a sufficient means of bridging this financing gap”.¹⁰

Further it was recognised that “close cooperation is required to make smart cities a more attractive investment, from devising innovative new business models to aggregating demand to access economies of scale and pooling risk”. This implies an increased emphasis on the network as a means of coordination.

The REPLICATE Report on the Business Models of the Lighthouse Cities presents a framework for analysing the business models of the Lighthouse cities involved in the project. This framework is called the city model canvas which can be downloaded.¹⁰

11.7 IRIS Project

Like REPLICATE, the Iris project produced a study which took forward the evolution of the basic business canvas and built upon it, the smart city business model canvas.

This study reviewed business model development frameworks and developed a practical tool to help cities assess business models by adapting components of the business model canvas (BMC) and adding new ones that operationalise the smart city dimensions. The smart city BMC (SC-BMC) proposed provides a practical framework that supports developing and communicating a more holistic and integrated view of a smart city business model. It also supports creatively innovating toward more sustainable value creation. As a framework, the SC-BMC bridges sustainable value creation for business model development and smart city innovation.

11.8 IRIS Study and the Smart City Business Model Canvas (SC-BMC)

An extensive study by IRIS shines further light on the topic.¹¹

As smart, data-based value propositions can generate complementary benefits and attract private investment, smart city business models should

¹⁰ “REPLICATE-D2.2 Report on the Business Models of the Lighthouse cities,” REPLICATE Consortium, 2017, Accessed: Jul. 26, 2022. [Online]. Available: https://replicate-project.eu/wp-content/uploads/2018/09/REPLICATE_D2.2_Report-on-the-Business-Models-of-the-Lighthouse-Cities.pdf

¹¹ P. Giourka et al., “The Smart City Business Model Canvas—A Smart City Business Modeling Framework and Practical Tool,” *Energies* 2019, Vol. 12, Page 4798, vol. 12, no. 24, p. 4798, Dec. 2019, doi: 10.3390/EN12244798

address the ownership of data and legal issues for data privacy in the design phase of the solutions deployed. An extra component was thus proposed to complement the value proposition in the SC-BMC, where the value of the data generated offers a multiplier effect in creating new business opportunities and increasing quality of life.

The SC-BMC builds on Osterwalder & Pigneur's original business model canvas, borrows from the BMC for mission-driven organisations and from the "triple bottom line" BMC,¹² and incorporates the importance of using a network-centric approach where the quintuple helix actors co-create a value and utilise data that adds value to the network of actors and other stakeholders such as new ventures.

This study emphasised that it is the network of actors – and not the city or one venture alone – that creates, delivers, and captures value. In that sense, while the BMC was aimed at helping individual firms to fit their BM to circumstances, customers, and markets, the SC-BMC was shifted to assist a group of actors aiming to deliver value to a more diverse set of end-users in a collaborative effort. Mapping out this network early on should precede the entire SC-BMC canvassing exercise. The development of this tool is based on a publication of Fruhwirth *et al.* (2020).¹³

The canvas can be found on the Iris website.¹⁴

But the study also found that "In the literature, however, there is a lack of a business model framework to determine clear paths to steady revenues for smart city projects encompassing the specific characteristics of each city".

But in a smart city context, value creation is shifted from products and technologies themselves to focusing directly on the verticals identified earlier, "to the services provided to users. Therefore, a service-dominant business model is prominent in the business modelling design and the value creation logic".¹⁵ So the network-centric value proposition and a service-oriented business model canvas were used to describe the value created by the network for each actor separately in a smart city context.

¹² A. Joyce and R. L. Paquin, "The triple layered business model canvas: A tool to design more sustainable business models," *Journal of Cleaner Production*, vol. 135, pp. 1474–1486, Nov. 2016, doi: 10.1016/J.JCLEPRO.2016.06.067.

¹³ M. Fruhwirth, G. Breitfuss, and V. Pammer-Schindler, "The Data Product Canvas - A Visual Collaborative Tool for Designing Data-Driven Business Models," *BLED 2020 Proceedings*, Jan. 2020, Accessed: Jul. 26, 2022. [Online]. Available: <https://aisel.aisnet.org/bled2020/8>

¹⁴ "The Smart City Business Model Canvas – IRIS Smart Cities." <https://irissmartcities.eu/smart-city-business-model-canvas/> (accessed Jul. 26, 2022).

¹⁵ R. Lusch and S. Nambisan, "Service Innovation: A Service-Dominant Logic Perspective," *MIS Quarterly*, vol. 39, pp. 155–175, Jul. 2015, doi: 10.25300/MISQ/2015/39.1.07.

11.9 REPLICATE Project

The main objective is for the three lighthouse cities and the three follower cities to have, at the end of the project, fully optimised smart city business models.

This involved analysing the different models and possibilities, and the key elements that the three cities involved (San Sebastián, Florence, and Bristol) took into account to select and work with their models. The task provided a tool called city model canvas (CMC) to reflect how smart city solutions create and deliver value to their residents, again derived from the basic business model canvas.⁸

The main objective was to develop new sustainable and cost-effective services to citizens and public administrations providing integrated infrastructures that improve efficiencies in the use of municipal public resources and the delivery of public services in the area of urban mobility, energy, transport, ICT, and data management.¹⁶

As observed in D2.3, “Internal Report on Findings”, the majority of business and management literature is focused on the firm, but not the city in its organisational form as the municipality. Whilst the business model could be considered as central to a theory of the firm, the same is not true of the municipality. Hence, the development of the REPLICATE city model canvas as a tool for municipalities to explore design, implementation, and governance issues, and so on to define the smart city business model as:

“...the way in which a city government organizes its services to create and deliver value for its citizens in a way that is economically viable, socially inclusive and environmentally sustainable”.

“...while such smart services have the potential to deliver value to the city’s residents, city governments cannot take for granted that they will in fact deliver value. This depends on how they are designed, implemented and governed; i.e. on the business models of smart services”.

Assumptions still often take it that there is economic viability in what is being modelled. The question of what counts as value for citizens in the context of the delivery of services by a municipality is broad. Rodríguez Bolívar (2019)¹⁷

¹⁶ “REPLICATE - D2.4 Report on the Replication Potential of City Business Models,” REPLICATE Consortium, 2021, Accessed: Jul. 26, 2022. [Online]. Available: https://replicate-project.eu/wp-content/uploads/2021/12/REPLICATE_D2.4_Report_on_replication_potential_of_city_business_models.pdf

¹⁷ M. P. Rodríguez Bolívar, “Public value, governance models and co-creation in smart cities,” *Public Administration and Information Technology*, vol. 35, pp. 271–280, 2019, doi: 10.1007/978-3-319-98953-2_11.

argues that: “public value creation is the new lens for analysing smart cities. Based on participative governance models, local governments in smart cities must provide the tools and context to foster citizen engagement in public decisions and co-creation of public services. All this have to be addressed to increase the quality of life of citizens in their urban life”.

Whilst the city model canvas developed in D2.2, “Report on the Business Models of the Lighthouse Cities”¹⁰, and as transferred to the pilot cities, has provided a means for capturing a triple bottom line view of the city business model, there, nonetheless, remains the problem of connecting this perspective to the essentially financial view of businesses within industries expecting to supply solutions over the next 20–30 years. Businesses’ single financial bottom line is the only one that eventually matters when it comes to maintaining a sustainable and viable firm. The industrial view presented from D9.3, “Sectorial Business analysis/Exploitation potential in the field of energy, ICT, sustainable mobility and other remaining sectors included in REPLICATE”, certainly underlines this point in terms of the expected market size for certain types of solution.

“Big data and analytics as strategies to generate public value in smart cities: Proposing an integrative framework”.¹⁸

The conceptualisation of business models in value creation ecosystems and the consideration of the municipality as the central actor in the “smart-city-as-a-network”¹⁹(Yearworth, 2020) aligns well with the influential analysis approach of Amit and Zott (2001),²⁰ which positions business models as configurations of activities within strategic networks. In terms of our initial models of coordination, we are looking for hierarchical coordination to play a leading role, supported by networking and the market just where it can play its “normal” role.

The conclusions of the study have shown that achieving replicable business models is not the core problem to be solved in order to offer municipalities a way forward in their commitments to achieving climate change targets, arguing for a change in focus to the question of financing the capital

¹⁸ F. Cronemberger and J. R. Gil-Garcia, “Big Data and Analytics as Strategies to Generate Public Value in Smart Cities: Proposing an Integrative Framework,” Springer, 2019, pp. 247–267. Accessed: Jul. 26, 2022. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-319-98953-2_10

¹⁹ Yearworth, M. REPLICATE - D2.3 Internal Report on Findings REPLICATE Project Deliverable (pp. 89), University of Exeter, 2020.

²⁰ R. Amit and C. Zott, “Value creation in E-business,” *Strategic Management Journal*, vol. 22, no. 6–7, pp. 493–520, Jun. 2001, doi: 10.1002/SMJ.187.

investments required and the range of financing models that municipalities can implement to raise the necessary finance.

“The problem facing cities in scaling-up interventions to meet their climate change targets is not the absence of available capital in the world... Nor is there an absence of industries ready to sell technical solutions”. “The problem is that to place the burden on municipalities to solve the business model problem would seem to be an abrogation of responsibility on the part of Governments, who should really be providing the necessary capital investment at city level to bridge the financing gaps that municipalities are facing”.

11.10 RUGGEDISED Project

Previous sections have touched upon the process of value creation within business models. RUGGEDISED has derived a framework for understanding value creation through urban data platforms (UDPs). The proposed framework provides a systematic and comprehensive approach for understanding UDP adoption, use, and value creation by identifying key dimensions of UDPs and describing their effects on value creation.

This follows, on the one hand, from urban data platforms being regarded as a specific type of digital platform and key dimensions that determine the success of digital platforms are likely to also be relevant to a UDP. On the other hand, UDPs are part of smart city initiatives, representing the keystone that connects the digital technologies infused into city systems to handle growing urbanisation and keep cities liveable and thriving. Accordingly, the key dimensions of a smart city are also likely to be relevant to the success of a UDP. And as we have argued in this work, the addition of personal data into the equation can be regarded as the “icing on the cake”.

RUGGEDISED undertook two literature reviews to cover these topics and provided insights concerning the key UDP dimensions. These all directly or indirectly relate to the business model required as they address the overall purpose for the UDP.²¹

1. What should be the purpose of an urban data platform?
2. Who should be the owner and manager of an urban data platform?

²¹ S. Bagheri, T. Brandt, H. Sheombar, and M. van Oosterhout, “Value Creation through Urban Data Platforms: A Conceptual Framework,” in Proceedings of the 54th Hawaii International Conference on System Sciences, 2021, pp. 2464–2473. Accessed: Jul. 26, 2022. [Online]. Available: <https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1576&context=hicss-54>

3. What kind of value should be created with urban data platforms?
4. Why should urban data platforms be interoperable?
5. Why is citizen engagement needed for urban data platforms?
6. How can trust be fostered and who needs to be trusted?

(This work carried out by RUGGEDISED essentially laid the foundations for this book.)

Further, they focused upon another key dimension that has received considerable attention which is the platform business model.

“An important element of the institutional arrangement for an UDP is the funding of the platform. The availability of public funding and private financing resources as well as the return on investments for organizations investing in UDPs are crucial for the success of a UDP in a city ecosystem,^{11,22,23} to create and contribute to economic, environmental, and social value— often referred to as the triple bottom line¹² – in a city ecosystem. Accordingly, the returns of investments of UDP projects are not always captured in monetary value and can be broadened”.

Interoperability refers to the ability of different systems to interact and share information.²³ Lack of interoperability might lead to incompatible data exchange formats and protocols, which may in turn reduce the economies of scale of value added services using shared data of the platform.²⁴ A higher degree of interoperability also makes the UDP more appealing for new partners to join. Furthermore, UDP interoperability also facilitates data sharing between cities. We have addressed this issue further in Chapter 7.

A business model in these conditions needs to relate governance models with the mechanisms for generating income from the services it provides and how this income is utilised or shared (see also Chapter 14). And the sources for this revenue generation are countless. Examples from deployment of a smart card in a city environment showed that costs for deployment could be

²² G. F. Camboim, P. A. Zawislak, and N. A. Pufal, “Driving elements to make cities smarter: Evidences from European projects,” *Technological Forecasting and Social Change*, vol. 142, pp. 154–167, May 2019, doi: 10.1016/J.TECHFORE.2018.09.014.

²³ P. Pierce and B. Andersson, “Challenges with smart cities initiatives – A municipal decision makers’ perspective,” Jul. 2017. doi: 10.24251/HICSS.2017.339.

²⁴ M. de Reuver and W. Keijzer-Broers, “Trade-offs in designing ICT platforms for independent living services,” 2015 IEEE International Conference on Engineering, Technology and Innovation/ International Technology Management Conference, ICE/ITMC 2015, Mar. 2016, doi: 10.1109/ICE.2015.7438645.

raised from unexpected sources – lower insurance premiums for a university using it for access control, reduced staff needed in a bus company due to faster turnaround of buses with quicker payment mechanisms, etc. Similarly, in deploying an UDP, pleasant surprises may be around every corner.

The identified sources of revenue by RUGGEDISED for the data platform focussed on²⁵:

- payments by data providers or users in the form of a subscription – over a period of time;
- commission for each transaction;
- advertising.

A lesson to be learned when dealing with attracting personal data to a platform is the requirement to reach a critical mass. Final revenues for a platform are equally dependent on a successful recruitment strategy which could entail cross-subsidising, with a pricing structure to support this.^{24,26,27}

It is expected that the establishment of the right pricing structure by the platform manager influences the adoption decisions of platform users and supports network effects within a platform ecosystem.²⁸ In relation to the models set out, here the manager is acting hierarchically, being in a position to make and implement such pricing decisions, which are transmitted through the pricing mechanism of the market. But equally, with a role of creating a growing eco-system, it is also likely that networking will be extremely important and decisions may be negotiated to achieve these aims. Thus, the “platform manager implements two types of control mechanisms: formal control (gatekeeping and process control) and informal control (e.g., shared norms and values) over the city stakeholders involved in the provisioning and utilization of urban data”.

²⁵ R. Schüritz, S. Seebacher, and R. Dörner, “Capturing value from data: Revenue models for data-driven services,” *Proceedings of the Annual Hawaii International Conference on System Sciences*, vol. 2017-January, pp. 5348–5357, 2017, doi: 10.24251/HICSS.2017.648.

²⁶ M. Schreieck, A. Hein, M. Wiesche, and H. Krcmar, “The challenge of governing digital platform ecosystems,” *Digital Marketplaces Unleashed*, pp. 527–538, Sep. 2017, doi: 10.1007/978-3-662-49275-8_47/COVER.

²⁷ M. de Reuver, B. Nederstigt, and M. Janssen, “Launch strategies for multi-sided data analytics platforms,” *Proceedings of 26th European Conference on Information Systems, ECIS, 2018*. Accessed: Jul. 26, 2022. [Online]. Available: https://pure.tudelft.nl/ws/portalfiles/portal/53104707/1360_doc_2.pdf

²⁸ M. Engert, M. Pfaff, and H. Krcmar, “Adoption of Software Platforms: Reviewing Influencing Factors and Outlining Future Research,” Jul. 2019.

Informal control refers to the degree to which the platform manager relies on norms and values that it shares with all stakeholders involved in a platform ecosystem, and a similar set of values, beliefs, and shared norms provides a common foundation for the stakeholders within a city ecosystem. It can promote their commitments to the objectives of the UDP and encourage desirable behaviours.

11.11 Safe-DEED

The work carried out in the Safe-DEED project²⁹ provides a firm foundation for taking the next step in ascertaining how adding personal data into the mix can be valued and the topic will be returned to in Chapter 13.

Underpinning the project was the recognition of the weakness that “many companies have no data valuation process in place, Safe-DEED provides a set of tools to facilitate the assessment of data value, thus incentivising data owners to make use of the scalable cryptographic protocols developed in Safe-DEED to create value for their companies and their clients”.

In terms of business model innovation, the objectives of Safe-DEED included quantifying and demonstrating the economic value for users and buyers of the developed privacy preserving technologies. The project developed “new multi-actor business models for privacy enhancing and data valuation technologies as well as a decision-support tool for designing and testing business models”.

They explored the space spanned between existing threats to the confidentiality and privacy of user data and the actual data assets that users wish to see protected. By following a user-centric approach, they sought to ensure that the asset analysis was “not tainted with presuppositions of underlying needs of organizations, and instead focus on a utilitarian perspective contributing privacy enhancements for the good of end-users”.

Before adding further actors, companies and third parties to the model “explore the practical incentive situation to identify a model that facilitates an ideal outcome for all involved parties”.

They validated the model in two operational use-cases, (manufacturing and telecom) and open data, each with its own business model, making it

²⁹ “SAFE-DEED.” <https://safe-deed.eu/> (accessed Jul. 22, 2022).

clear “how data owners can enhance the value they create and capture thanks to the technologies developed”.^{30,31}

These case-specific business models were then developed into generic business model designs, which subsequently formed the basis for a tool made available for free to entrepreneurs.

Another key aspect of Safe-DEED’s work was related to private and public data. A work-package focused on “on the design and implementation of the Big Data Valuation component to be used to predict knowledge value of a certain corpus of a structured data without, however, having to completely analyse it”. A task here was to develop “context-unaware valuation and context-aware valuation algorithms that will go into making the valuation tool and Implement the building blocks of the Big Data Valuation component”.³²

The Safe-DEED deliverable D4.3 report on the context-aware and context-unaware valuation³³ has an extensive review of the literature on the topic of data valuation methods. It starts from a tentative definition of data value around several key areas: contexts, data quality, privacy, aggregation, and reporting. It also discusses the properties that make data difficult to assess and brings valuable examples from data valuation applied to personal data. Focusing on the central notion of data quality, the document reviews a number of data quality assessment methodologies, discussing the diversity of data quality dimensions that they employ and the metrics that support their operationalisation. The report concludes with a discussion on the challenges of aggregating these aspects under a composite measure, and how reporting through certification or impact-based narratives can be a feasible alternative. We will return to this topic in Chapters 13 and 17.

11.12 The Safe-DEED Tools

- Safe-DEED data-driven business canvas³⁴: The Safe-DEED data-driven business canvas is designed to help develop a data-driven service

³⁰ M. de Reuver, W. Agahari, R. Dolci, G. Breitfuss, and M. Fruewirth, “Safe-DEED - D2.2 Business models for use cases and generic business models,” Safe-DEED Consortium, 2020, Accessed: Jul. 26, 2022. [Online]. Available: www.safe-deed.eu

³¹ G. Breitfuss, M. Fruewirth, L. Disch, M. de Reuver, and W. Agahari, “Safe-DEED - D2.3 Business model decision support tool,” Safe-DEED Consortium, Accessed: Jul. 26, 2022. [Online]. Available: www.safe-deed.eu

³² “Data Value - Safe-DEED.” <https://safe-deed.eu/wp-data-value/> (accessed Jul. 26, 2022).

³³ M. Tufiş, “Safe-DEED - D4.3 Report on context-aware and context-unaware valuation Status Final,” 2020, Accessed: Jul. 25, 2022. [Online]. Available: www.safe-deed.eu

³⁴ “Safe-DEED Data-Driven Business Canvas - Business Makeover.” <https://businessmakeover.eu/tools/safe-deed-data-driven-business-canvas> (accessed Jul. 26, 2022).

innovation. The five main sections of the canvas support the structuring and concretisation of a data-driven use-case idea including first financial considerations. The provided descriptions and examples facilitate the work in interdisciplinary teams on future data-driven services.

- Safe-DEED data map³⁵: The Safe-DEED data map helps with the identification of possible data sources that can be utilised to develop new data-driven services. It is divided into four quadrants. The four quadrants vary mainly in terms of ownership and usage rights of the data.
- Safe-DEED data service cards³⁶: The Safe-DEED data service cards help enhance or develop new data-based services through the systematic combination of data sources, analysis methods, customer benefits and revenue opportunities. There are 50 cards as inspiration in the development process of data-driven innovations.

11.13 DUET Project

The DUET project focused on the creation of digital twins, and their contribution to business models focuses on the exploitation of these digital twins. Cities across Europe are using DUET to create their own digital twins for systemic policy impact exploration and experimentation based on policy-ready-data-as-a-service (PRDaaS) in a virtual environment. This advances global standards for city data enabling a digital twin to be set up in one-click for systemic policy impact exploration and experimentation.³⁷

Essentially, the business model focuses on how DUET can improve the workings of a public administration, and the perceived benefits of a public sector twin include:

- improved operations;
- making service decisions based on a unified view of city processes;
- real-time information and predictive impact simulations;
- increased value for money;
- ability to experiment with different policy options online;

³⁵ “Safe-DEED Data Map - Business Makeover.” <https://businessmakeover.eu/tools/safe-deed-data-map> (accessed Jul. 26, 2022).

³⁶ “Safe-DEED Data Service Cards - Business Makeover.” <https://businessmakeover.eu/tools/safe-deed-data-service-cards> (accessed Jul. 26, 2022).

³⁷ “DUET - D7.6 Business and Exploitation Scenarios v1,” DUET Consortium, 2021, Accessed: Jul. 26, 2022. [Online]. Available: www.digitalurbantwins.eu

- exploring impacts across multiple domains, rather than running multiple costly on-the-ground pilots;
- better citizen experience;
- ability to act quickly and seamlessly on citizen real-time needs;
- help people understand why certain planning or operational decisions have been made.

11.14 DataVaults Project

The business model for the DataVaults project can be viewed from a variety of viewpoints:

- from that of a large company incorporating evolving technology and knowledge into its normal day-to-day activities;
- from the viewpoint of SMEs having a specific niche in their activities;
- how the project as a whole may collectively move forward on these views;
- how taking a “smart city exploitation approach” differs.

An example based on the conventional state of thinking from the DataVaults project at an early stage of its work was designed around having a product to exploit, rather than also being seen as an integral part of a smart city’s evolution.

Two broad pathways towards commercial exploitation of the DataVaults outputs were explored:

- bringing into the market the DataVaults offering one or more personal data marketplace(s) backed up and operated by an entity that is composed of the various consortium partners, either in the form of a joint venture or individually;
- licensing the code and the DataVaults framework to interested organisations that would like to run the platform on their own and, in addition, providing consulting, training, and customisation services.

The early thinking around the business model was based on the lean canvas business innovation instrument, proposed by Ash Maurya.³⁸ This was the basis for creating a specific DataVaults’ lean canvas, described below

³⁸ A. Maurya, *Running Lean: Iterate from Plan A to a Plan That Works* (2nd Ed.). O’Reilly Media, Inc., 2012, ISBN: 9781449305178.

The lean canvas is a simple one-page business plan template, similar to that of the business model canvas, and aims to deconstruct a business idea into its key assumptions. When compared with the business model canvas, developed by Alex Osterwalder, many practitioners agree that the lean canvas is more appropriate for start-ups or for bringing innovations to the market, as opposed to the business model canvas that functions better as a descriptive canvas for an existing business model, with the scope of sharing knowledge with the whole team within an enterprise.³⁹

The sectors to be completed are: customer segments, the problem to be solved, existing alternatives, the unique value proposition, high level concept, solutions, channels, revenue streams, early adopters, cost structures, key metrics, and “unfair advantage held”.

The high-level concept part of the canvas aims to provide a high-level description of the value proposition for users, often drawing a parallel to a well-known service/product that the customers know quite well. For example, DataVaults, as a high-level concept, can be seen as an “eBay” for personal data from the side of data owners, where they can decide what to sell and how much, keeping also part of their anonymity. On the other side, data seekers can think of DataVaults as a market research service that is directly targeting and pulling data from individuals, once they consent to share these data.

Key metrics identified included:

- number of available datasets;
- the mean value of compensation per data transaction paid out;
- the size of the data owners population;
- the size of the population of the data seekers.

11.15 Viewpoint from a DataVaults SME’s Perspective

11.15.1 Assentian

Returning to our models, a simple example of how just the market might be used for a typical SME engaged in the trading of personal data can be seen in this analysis of the business opportunities and basis for the business model.

In regard to the opportunity, the technology on its own has limited value. What the technology does is enabling access to where the derived

³⁹ I. Jeffries, “How To Fill In A Lean Canvas ,” 2020. Accessed: Jul. 26, 2022. [Online]. Available: <https://isaacjeffries.com/blog/2020/9/23/how-to-fill-in-a-lean-canvas>

value resides. We provide a capability for data owners/custodians to share and monetise data. The attractiveness lies in:

- regulatory compliance;
- maintaining control;
- transparency over who sees what;
- access to big pools of data which can support commercial planning, service delivery, research and development, etc.

But the SME is faced with determining the costs of providing such a service, of making the data accessible in order to share it. It is hard to provide concrete figures as data comes from diverse sources and is stored in different ways and forms. Cost estimates have to be made based on some general characteristics of data source/type, examples of which are:

- mobile app data;
- social media data;
- GIS data;
- healthcare data (from public/private healthcare systems);
- public sector data (held by local authorities and/or central government departments in data centres/cloud and on proprietary systems typically), etc.

Clearly, the cost of access to enable sharing would have to be lower than the perceived monetary value or benefit. This value can be derived through a number of potential criteria:

- utility of data;
- business value and/or economic value;
- performance value;
- urgency;
- validity;
- scarcity;
- coverage;
- useful life;
- market value – what is the willingness to pay and the demand for it?

The range of revenue models under consideration include:

- access to data sharers for free;
- the percentage of revenue earned by sharers is fee charged to facilitate sharing;
- regular data sharers pay a monthly fee for access and additional cost(s) for high volume utilisation;
- 100% of sales revenue kept by data sharers.

The data buyers can be categorised as either being “one off users”, where a single fee is paid to access the platform, and those regular users who pay a monthly or annual fee.

11.15.2 Andaman7

Andaman7 operates in the health sector and their approach is summed up as:

“The solution touches on a universal problem: human health and our Business Model is based on a wide distribution of the application in “Freemium”. As such, revenues come from paid advertising and add-ons (including clinical studies apps). Our application is currently well differentiated and complementary to existing solutions. We do not want to be profiled as a competing solution to EHR.”

Freemium is a business model in which a company offers basic or limited features to users at no cost and then charges a premium for supplemental or advanced features.

11.16 Digital Twins and Business Models

A study into business models and implementation challenges facing a digital twin is “Urban digital twin: Business models and implementation challenges”.⁴⁰

Urban digital twins are a virtual representation of a city environment with bi-directional communication links. They require collaborations between different actors in the urban ecosystems in order to provide a complete picture of

⁴⁰ R. D’Hauwers, N. Walravens, and P. Ballon, “From an Inside-In Towards an Outside-Out Urban Digital Twin: Business Models and Implementation Challenges,” *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. VIII-4/W1-2021, pp. 25–32, 2021, doi: 10.5194/isprs-annals-VIII-4-W1-2021-25-2021.

the situation in the city. In order to define the complex relationships between the different actors in the urban digital twin ecosystem, the business model literature helps to answer questions on how value can be created, and how the value network can be controlled. In this chapter, we identified four different types of business models for urban digital twins based on whether they are used by the government or the ecosystem, and whether the government or the ecosystem controls the value network of the urban digital twin. Interviews were held in five different existing urban digital twins to identify which challenges the different existing digital twins have when implementing the urban digital twins.

The outcomes of the business model scenarios support the design of urban digital twins:

- by identifying which decisions need to be made by cities when developing urban digital twins;
- by proposing cloud requirements for technology providers supporting cities, in the development of urban digital twins.

11.17 Conclusion

In this chapter, we have witnessed a wide range of approaches, all working in the same direction and contributing to the discussion of how best to take forward data platforms within a smart city and how these will make the most of scarce resources and we will return to this in subsequent chapters.

What is significant is the amount of information which collectively these projects featured above have produced on this topic and derived from hundreds of sources in their research. Many provide a range of tools and advice far in what you would expect to find on a project website. For example, DUET⁴¹ provides a whole range of useful information divided into topics such as policy-making, technology, etc.

Most other projects will go into similar effort to make their findings readily accessible and hence useful to practitioners in cities across Europe.

⁴¹ “Results - DUET Digital Urban European Twins.” <https://www.digitalurbantwins.com/outputs> (accessed Jul. 26, 2022).

