6 Data-driven value creation in digitalizing public service

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Introduction

Innovation can be a new practice, an idea, a service delivery, or a technology that can lead to value; public innovation is about innovation in the public-sector context (Bertot et al. 2016). Innovation in the public sector is essential for the enhancement of public performance (Gieske et al. 2019). Incremental innovation leads to great performance benefits, and moving away from the norm to adopt different innovation (types) positively impacts performance (Damanpour et al. 2009). According to Meijer and Thaens (2020), society is being modified at a high rate, and governments are expected to be agile and flexible in addressing the changes with regard to technology, social environments, and citizen demands. It is understood from the aforementioned that public innovation can have performance benefits, a positive impact on society, but requires public-sector organizations to embrace innovation to address changing citizen needs.

The presence of digital platforms changes the way in which digital products and services are being consumed, and these platforms utilize autonomous agents to co-create value (Hein et al. 2020). For instance, digitization has a transformative effect on the degree of openness in innovation and entrepreneurship with regard to who can participate (e.g., actors or stakeholders), what the actors can contribute (e.g., resources/inputs), how the actors can contribute (e.g., processes), and what outcomes are generated (Nambisan et al. 2019). The authors also point to examples of companies like Fitbit Care and Garmin Connect that provide data analysis capabilities to consumers through a digital platform arrangement and that generative actions by third-party developers in a digital platform architecture can lead to innovation. As Zutshi and Grilo (2019) point out, digital platforms function by offering open data and application programming interfaces (APIs) to third-party developers to develop new services, and digital platforms serve to unlock business opportunities and create business ecosystems that facilitate value creation. Digital platforms play a vital role in innovation. For instance, in US manufacturing firms, a 10 per cent increase in IT input was associated with a 1.7 per cent increase in innovation output between 1987 and 1997 (Kleis et al. 2012). Digital platforms help nurture innovation in firms in key activities such as customer relationships, manufacturing, and procurement (Sambamurthy et al. 2003). From the previous arguments, it is evident that digital platforms play an

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important role and trigger innovation-related activities by involving partnerships, technology, and processes.

Moving on from innovation and digital platforms, data is seen as an important resource in organizations. To create value from data, organizations also need to possess data analytics capabilities. For instance, data analytics capabilities have been shown to improve firm performance (Akter et al. 2016; Wamba et al. 2017) and the innovative capabilities of the firm (Ashrafi et al. 2019). A review of empirical studies shows that data analytics capabilities lead to improved business performance, strategy development, decision-making, and innovation (Madhala et al. 2021).

Chesbrough et al. (2018) define value creation as an actor's endeavour to increase value, which is a resource deployment process where the perceived benefits outweigh the perceived sacrifices. Therefore, in this chapter, value is viewed as an end goal based on the interactions between several actors or stakeholders. The actors engage with each other in a digital platform arrangement for public innovation. To provide an understanding of the previous statement, a theoretical framework or conceptual model is introduced which encourages public innovation by looking at two important components – namely, data and data analytics capabilities. These two components trigger public innovation as a result of actor or stakeholder engagement. The two components are chosen because of their potential to create value for organizations. The chapter presents the theoretical explanations of public innovation, data and data analytics, and value creation. The chapter also shows the conceptual model of the public innovation process in a digital platform arrangement with an example case.

Many faces of public innovation

It is first necessary to define what the term "public innovation" or "public-sector innovation" means. Public-sector innovation can be defined as a dynamic process (micro and macro) by which several actors in the public sector and their processes are transformed by the introduction of a novel idea (Potts & Kastelle 2010). Innovation in the public sector is about finding new methods to enhance society, government, and the public (Janssen et al. 2017). According to Arrona et al. (2020), innovation in the public sector differs from innovation in the private sector because public-sector innovation is context-specific and aims at creating public value. Economic benefits are not so important for public innovation, in contrast to private innovation (Fuglsang & Pedersen 2011). Bekkers et al. (2011) describe innovation in the public sector as a learning process in which the government attempts to address certain societal challenges.

Windrum (2008) classifies public-sector innovation into six types – namely, service innovation, where a new service product or its improvement is introduced; service delivery innovation, which involves different ways of delivering to or communicating with clients; administrative and organizational innovation, which deals with organizational structures and routines with regard to services; conceptual innovation, which is about bringing or developing new concepts or trying to alter existing service products or processes; policy innovation, which deals with behaviours associated with a policy belief system; and systemic innovation, which is about ways of interacting with other organizations and public bodies associated with the organization.

Some of the factors that influence the public-sector innovation process include the role of governance in moulding innovation, source of ideas for innovation, innovation culture, capabilities and tools required for managers to facilitate innovation, objectives, outcomes, drivers, and hindrances (Arundel et al. 2019). Several drivers have been identified as having an impact on innovation. Agolla and Lill (2013) identify internal drivers (strategy, climate, leadership, entrepreneurship, resources) and external drivers (political, economic, social, technological, ecological, legal) for public innovation to take place. Public innovation is driven by external parties (e.g., enterprises and citizens) combined with internal processes (Janssen et al. 2017).

Four levels of the innovation process in organizations in the public-sector domain are identified: (1) introducing innovation into the overall strategy, (2) management's role in promoting innovation, (3) structuring or aligning innovation processes, and (4) organizational competencies (Bloch 2011; Cepilovs et al. 2013). There are also barriers to innovation. According to Bloch (2011), barriers to innovation can spring up due to many factors, such as political factors (e.g., lack of funding, lack of impetus for an organization to be innovative, stringent laws and regulations), organization and culture (e.g., possibility of failure, absence of cooperation within the organization), internal conditions (e.g., scarce/poor allocation of time for innovation activities, lack of reasons for staff to innovate), external conditions (e.g., rules of the contract hinder any collaboration with stakeholders or suppliers, fixated on suppliers who lack innovative capabilities, user resistance to changes).

Four different types of antecedents were found by De Vries et al. (2016) – namely, environmental antecedents (e.g., public demands), organizational antecedents (e.g., incentives/rewards, conflicts, leadership styles), innovation characteristics (e.g., ease in use of innovation, compatibility), and individual antecedents (e.g., organizational position, creativity, knowledge, and skills related to the job). Empirically, the authors found effectiveness (28 per cent), increased effectiveness (27 per cent), decreased effectiveness (1 per cent), increased efficiency (10 per cent), private partners' involvement (6 per cent), customer involvement (5 per cent), increased customer satisfaction (5 per cent), other (safety, fairness, etc., 6 per cent) as possible outcomes of public-sector innovation. In their study, Vigoda-Gadot et al. (2008) provide a theoretical model of the antecedents (responsiveness, organizational politics, professionalism, leadership and vision, ethics and morality) and outcomes (trust in governance, public-sector image, citizens' satisfaction) of public-sector innovation.

Data-driven value creation

Data plays a central role across many sectors and has become a form of capital for many industries – namely, manufacturing, finance, infrastructure, technology, and energy (Sadowski 2019). It is an objective fact about events (e.g., purchase transactions; Davenport & Prusak 2000). Over the years, the size of data has increased tremendously and is often termed "big data". When the dataset sizes become bigger it becomes difficult to handle them using traditional database software tools for capturing, storing, and analyzing (Manyika et al. 2011). This occurrence of the massive size of data is due to the widespread use of social media (e.g., YouTube, Facebook, Twitter), applications resulting from the "internet of things" (IoT; Fosso Wamba et al. 2015), clickstream data from the web, location data from mobile devices, and data from RFID chips and sensors (Davenport 2012).

All of the data that is collected is analyzed to find answers hidden inside the data. According to Guerrero (2010), data analysis is performed to answer one significant question: "What does the data reveal about the underlying system or process from which the data is collected?" In scientific research, data analysis is used for evaluating or finding evidence in data (Hicks & Peng 2019). Analysis of data is necessary, and according to Liew (2007), data leads to information and knowledge. Over the years, data analysis has been used as a significant tool for business. Data analysis is a key component in the process of mining business data (Bose & Mahapatra 2001) and is a useful tool in creating business value by assessing hotel performance from online consumer reviews, for instance (Xie et al. 2014).

The firms that aim to improve their performance using data analytics must also possess data analytics competencies or data analytics capabilities. Data analytics competency can be defined as the ability to deploy data analytics–based resources in combination with other firm resources and capabilities for enhanced and quicker decision-making (Ghasemaghaei et al. 2018). On the other hand, big data analytics capability is the ability of an organization to make use of data in combination with IT and human assets to create a competitive advantage (Garmaki et al. 2016). In other words, a firm can group and deploy its big data resources (Gupta & George 2016). According to LaValle et al. (2010), there are three levels of data analytics capabilities (and these levels follow a linear path with regard to functionality): aspirational, experienced, and transformed.

Value creation is examined from two perspectives – namely, value-in-use (subjective conceptualization of value) and value-in-exchange (objective conceptualization of value) (Eggert et al. 2018). For instance, value-in-use is related to the qualities of the product or service and is subjective in nature, and value-in-exchange is the price paid for the product or service. The product has both types of value at the time of sale (Bowman & Ambrosini 2000). Chesbrough et al. (2018) define value creation as an actor's attempt to increase value through the two aforementioned perspectives. In the value-in-use perspective, the authors define value creation as the effective use of resources to achieve a certain goal, and in the value-in-exchange perspective, value creation is defined as providing resources to a partner who values the resources based on potential later use.

According to Kristensson (2019), value creation specifies how actors (e.g., consumers, business customers, citizens, and patients) benefit by using one or more combinations of resource offerings. Individuals, organizations, and society act as a source of value creation (Lepak et al. 2007). These different actors form relationships in which capabilities are joined to co-create value. What the end customer perceives as valuable defines what kinds of capabilities are needed in creating the value (Helander & Kukko 2009). As Brandenburger and Stuart (1996) point out, value creation stems from the "willingness to pay" of the buyer, i.e., the end customer, and the "opportunity cost" of the supplier. Value creation depends on the context in which value is discussed. For instance, Sweeney and Soutar (2001) identify three dimensions in the context of consumer value: emotional, social, and functional. These value dimensions further lead to value creation (Suseno et al. 2018). Value creation is also important in the public sphere, where public value is the key factor in the development of new public services, for example, on-demand government services (Chatfield & Reddick 2018) and prediction of food safety (McBride et al. 2019). Digital innovation ecosystems enable the creation of value through the development of new products and services (Suseno et al. 2018). Therefore, different sources of value creation enable the creation of different types of value.

Public innovation process in digital platform

The public innovation process under a digital platform arrangement is shown in Figure 6.1. The new process begins with the identification of data-driven digital technologies. The term "data-driven digital technology" refers to technology applications that collect data from external objects or processes. These include barcode technology, contact memory buttons, RFID, smart labels, GPS, laser scanners, webcams, and portable computers (Caldas et al. 2017). RFID and IoT are two digital technologies that can be grouped into a data collection architectural layer (Pagoropoulos et al. 2017). Therefore, several digital technologies like the ones previously mentioned enable the collection of data in the digital platform. In this regard, this study considers all types of applications that enable the capture of data to be data-driven digital technologies.

Upon identifying the data-driven digital technologies, it is important to look at the framework from the perspective of the resource-based view introduced by Barney (1991). Due to the continuous flow of data from data-driven digital technologies, it is vital to recognize data as an important resource and valuable ingredient in the process of value creation. Data from digital technologies will be used as input for the creation of value for the stakeholders involved in the digital platform arrangement.

As understood in the literature, data analysis is used for finding information hidden within the data. The data analytics process is vital to the transformation of raw data into meaningful information. However, this also raises the question: How does the data owner transform raw data into value? In a digital platform consisting of many stakeholders, there is a need to identify the capabilities of each stakeholder involved in the process of public innovation. After identifying who has what capabilities, it is vital to discuss the potential for stakeholder agreement on providing capabilities to other partners in the digital platform to enable the process of value creation. The stakeholder connection in a digital platform in the context of public innovation is illustrated in Figure 6.1.

The example shown in Figure 6.1. is of an arrangement where there are many stakeholders. In a real-world scenario, the number of stakeholders is not limited,

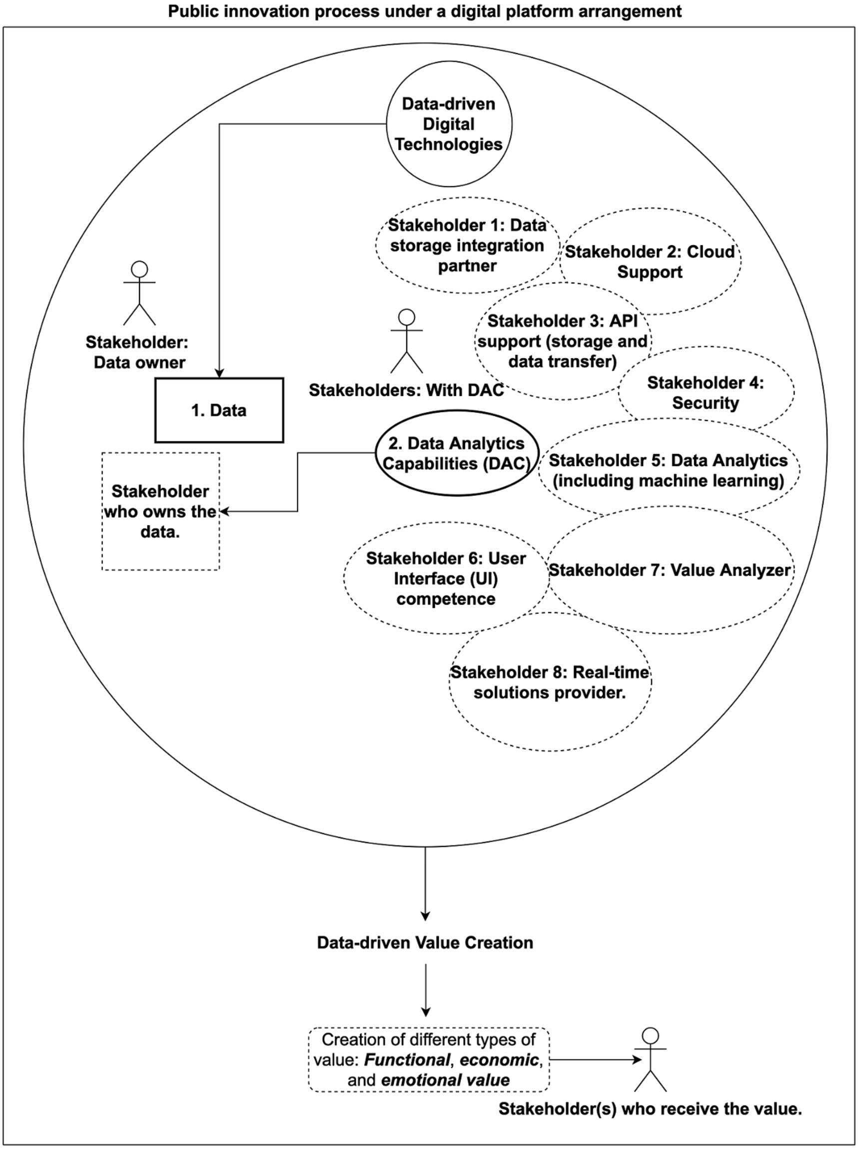

Figure 6.1 Public innovation process under a digital platform arrangement.

i.e., it can be n number of stakeholders. Referring to Figure 6.1, the stakeholder (data owner) has the capabilities (which may also include infrastructure) to collect data and the other stakeholders in the digital platform arrangement have data analytics capabilities. Another way to look at this is that, for instance, the data owner and other stakeholders (on the right side of Figure 6.1) have capabilities that are of mutual significant importance. The solution providers (cluster of n number of stakeholders) provide the data owner with data analytics capabilities. The result is that a service or a product is created that serves as a valuable offering for citizens, the municipality, and the school, who are important stakeholders in the public innovation process.

The framework proposed in this study highlights three different aspects of the process of public innovation. First, the recognition of data as an important resource. Second, the emphasis on data analytics capabilities in the digital platform arrangement. Third, value creation is the consequence of the first two factors. As mentioned before, there can be room for more stakeholders who can act as sources of data and others who can provide data analytics capabilities. Finally, value creation is not considered a unidirectional process, as there is also the presence of perceived value gained by stakeholders other than citizens. However, this claim should be evaluated based on empirical examination.

Data-driven value creation in practice

The 4APIs research and innovation project, funded by Business Finland,[1] brought together several actors, including universities, companies, the public sector, and funding organizations, to understand the role of APIs in value creation. As part of the project, a case prototype was developed, which incorporated the concepts of digitalization, digital platforms, public innovation, APIs, data analytics capabilities, and value creation. In this digital platform arrangement, the City of Turku[2] was able to leverage capabilities from several actors to enable the digitalization process to produce innovations that create value. In brief, the goal of the project was to accomplish the following:

1) Define techniques and competencies for creating APIs for systems that consist of numerous subsystems, where newly introduced IoT capabilities enable connectivity.
2) Pilot the techniques in the context of the participating companies and their existing technologies.
3) Experiment with innovation ecosystem creation using the defined APIs and potential business models in the context of the participating companies, possibly including customers.

The research was carried out in close cooperation with the participating companies, who also participated in the steering group of the project. Company use cases and needs also drove the technical prototypes and pilot ecosystem formation effort. In summary, new business may stem (items 2 & 3) from an improved understanding of digitalization as a whole (item 1).

As part of the project, it was decided to experiment with innovation ecosystem creation using real systems, provided by the participating companies. As part of this experiment, APIs were used to access key functions and objects that would be designed, tested, and evaluated, in the best case with potential customers or true early adapting end users. Concrete means would include industrial hackathons, interviews, and prototype implementations, which would also serve as starting points for ecosystem building with external companies. Furthermore, the experiment would also serve as a criterion for selecting some of the project participants.

As the concrete case, the public building called Ypsilon was selected. The Ypsilon building is a community centre located in Yli-Maaria, Turku, Finland. The case was carried out by a large group of actors in order to achieve a true value co-creation process.

The Ypsilon building offers public spaces and connectivity – for instance, sensors that can be used to measure temperatures, relative humidity, in and out airflow in real time, and the number of people in a room. The public spaces include normal multipurpose classrooms; rooms for teaching handicrafts, sports, etc.; a public healthcare centre; and a library. Illustrated in Figure 6.2, this environment would support numerous roles for participants, including, for instance, building information management, document management, security-related operations, service management, and networking facilities for accessing the sensors. As a new urban building, numerous data sources contain different kinds of information about the Ypsilon Community Centre, its connection to other urban environments and infrastructures, and daily activities and maintenance in the building. In addition, the data from the sensors provided an opportunity for data-related operations.

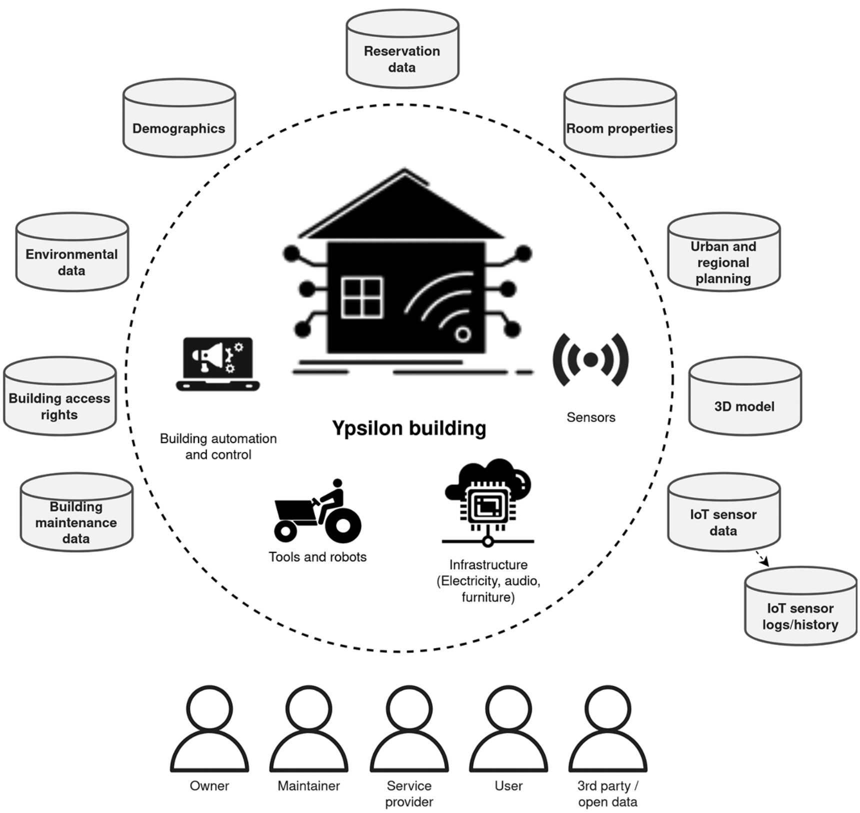

Figure 6.2 Domain model.

Figure 6.2 Domain model representing the Ypsilon building, its surrounding environments and infrastructure, daily activities, and related data. Within this environment, the majority of the planned participants were able to identify their roles and to combine their own knowledge and data processing capabilities.

Service design workshop and stakeholder interviews

To further study the value creation potential in the case, a service design workshop and stakeholder interviews were held. The service design workshop was organized in the Ypsilon building, especially for exploring the potential value propositions. The workshop included participants from the aforementioned project organizations and employees of the City of Turku responsible for infrastructure and was facilitated by an experienced service designer from Digia. In the workshop, the potential users of the envisioned service were first identified, which included housing co-operatives, societies, or clubs, groups of friends, and businesses. Moreover, various objectives were also identified, ranging from better services for citizens, optimizing the use of the Ypsilon building, and sustainability. Finally, different use cases were innovated and captured for the users and the objectives. In the workshop, use cases were primarily identified for access and use outside school hours. In addition, security and energy saving were other key themes covered by the use cases.

In order to elaborate on the potential value prospects, we conducted three stakeholder interviews using a semi-structured qualitative approach. The interview data was analyzed thematically to find categories of perceived value. All of the interviewees were potential users of the building information modelling (BIM) and data solution, covering roles from energy operations (from the City of Turku) to school management (school principal) and real estate services (at the Ypsilon building).

The general perception of possibilities from the interviewees was mainly very positive. We found this perception of potential value to be based mainly on the promises of efficacy, safety, and well-being. By "efficacy", we refer here to the precise allocation of scarce resources ranging from money, energy, and environment to space, time, and attention. Data combined with BIM holds a lot of promise as a tool for better understanding of very context-specific conditions, their variation over time, and anomalies that we might otherwise have difficulty perceiving. Possibilities, especially with real-time data, predictive modelling, and machine learning can enhance the excitement and the feeling of novel opportunities. One key aspect of efficacy would also be the integration of data from several, currently fragmented, information systems into one real-time API.

The themes of "safety" and "well-being" were raised especially in the context of a very special concern, even a public trauma of sorts, regarding some of our public spaces. Throughout recent decades there has been growing concern over the quality of indoor air, especially in schools. Being able to collect more precise and rich data on the environments in which children spend their days could have a reassuring function. When data indicates problems in conditions, especially problems that are difficult for human senses to perceive directly (e.g., related to correct humidity levels), proper actions can be taken in time. Another given concrete example relates to acute crisis situations, e.g., a fire, when real-time data could be used to monitor the flow of people to get everyone safely out of the building.

Other potentially valuable functions included the use of BIM and data as pedagogical tools and as examples of smart tech relating to the very meaningful and tangible environment of everyday life for pupils and teachers alike. What holds promise here is the possibility of combining two types of information: First, the subjective and sensory information directly generated by embodied engagement, observation, and sensing the environment, combined with the objective and unobservable conditions provided by data and BIM. The subjective experience gives meaning to the environment and its changing conditions; this is then given complementary illumination from data on objective conditions such as temperature or humidity level. Together they show how the subjective and the objective relate and might differ, acting as cues from one modality of information to the other. By helping to perceive the effects of even minor adjustments and optimizations in conditions and behaviour alike, data and BIM could also be used to provoke awareness and positive behaviour change towards environmental goals, for example.

This combination of physical, tangible, and sensory information provided directly by the human body and the objective information provided by data is nicely mediated by BIM. The 3D model makes data-measured conditions easy to perceive, understand, and interpret in relation to the actual environment. This has been illustrated in Figure 6.3.

In the interviews, this was also brought up in the context of maintenance, where the solution could provide help when people were not physically present to perceive the environment (e.g., remotely and holistically grasping the conditions

Figure 6.3 A virtual reality illustration of the Ypsilon demo (BIM).

of the whole building quickly) or when physically present but now also being able to perceive and locate more objective data-informed conditions and their temporal variation (e.g., history, future predictions).

Technical implementation

The project resulted in a prototype application optimized for a mobile device for monitoring heating, ventilation, and air conditioning (HVAC), and person count. The architecture follows state-of-the-practice, micro-service architecture with REST APIs and JSON messages deployed in a Microsoft Azure cloud infrastructure, as depicted in Figure 6.4. The HVAC and other sensors in the Ypsilon building produce sensor data that is pushed to the microservices in the cloud, i.e., storage that divides the data stream into a hot path and a cold path, meaning almost real-time access to data and storing data for later usage, respectively. Another essential source of data was the more static 3D BIM of Ypsilon that enabled viewing of different rooms, the locations of sensors, and other information about the building.

The resulting application based on the hot path shows the user a browsable 3D model that is augmented with almost real-time sensor data from the cold path. The user can see both the BIM model and sensor data, separately or combined.

The data from HVAC sensors in the cold path along with BIM information is used for advanced analytics purposes for the prediction of temperature and CO_2, beyond simply displaying different sources of information (depicted on the left of Figure 6.4). The analytics rely on machine learning (ML) and its typical processes: exploring different ML models and their options, resulting in selecting boosted regression trees, teaching the selected ML models, and deploying the model to provide the user with analytics information.

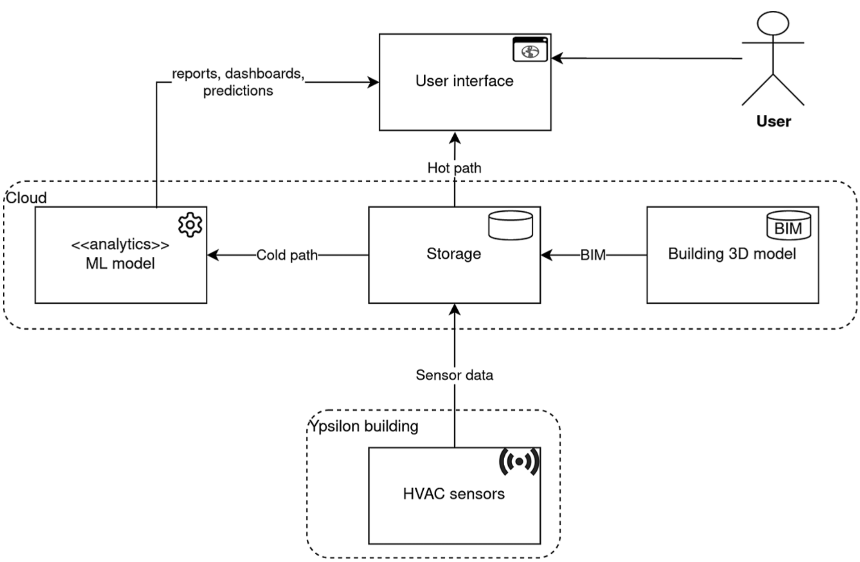

Figure 6.4 Technical architecture.

Figure 6.4 shows the technical architecture of the prototype created for real-time building monitoring. Several stakeholders were involved in this technical implementation.

Table 6.1 expresses the multiple roles of the stakeholders in the project.

Figure 6.5 shows the process of value creation and the various stakeholders involved in the project.

As far as the types of value created by data in the Ypsilon case are concerned, there were signs of functional, economic, and emotional elements of value. However, as the building is owned and operated by a municipality, there were no direct monetary incentives apart from a desire for more efficient use of buildings.

Table 6.1 The roles of the stakeholders in the project

Stakeholder	*The Role of the Stakeholder*
Digia[3]	Digia is a Finnish information communication technology (ICT) consultant, which played a lead role in setting up a cloud computing environment where various services, provided by the different actors, could be easily integrated. In addition, they were, in general, in charge of technology selection.
F-Secure[4]	F-Secure, one of the leading security companies globally, provided new technology for monitoring API usage which can recognize possible deviations from usual operations.
HH Partners[5]	HH Partners is a law firm based in Helsinki, Finland, that serves business customers in most areas of law, including in particular intellectual property rights and technology law. They provided legal support for determining privacy and copyright issues.
M-Files[6]	M-Files is a Finnish software product company whose key offering is M-Files intelligent information management platform. In the demo, they provided document management software for archiving and sharing purposes.
Solita[7]	Solita, a Finnish ICT consultant company, creates impact that lasts by combining tech, data, and human insight. The Ypsilon case was brought by Solita, and Solita had a role in integrating and aggregating the data sources.
Vaadin[8]	Vaadin offers an open-source platform that makes API usage easier. The Vaadin platform handles data transfers between several parts of the demo. The company also provided the user interface (UI) and technology related to UI.
Vertex[9]	Vertex Systems has its own CAD software together with a visualization (Vertex Showroom) and their role was to create and visualize the 3D BIM models that enable visualization of temperatures and relative humidity in real time.
University of Helsinki[10]	University of Helsinki, Department of Computer Science assumed the lead in data operations involving ML and in-service access at an architectural level. In addition, it participated in implementation-related tasks.
Tampere University[11]	Tampere University, Unit of Information and Knowledge Management was responsible for analyzing the value creation potential in the demo.

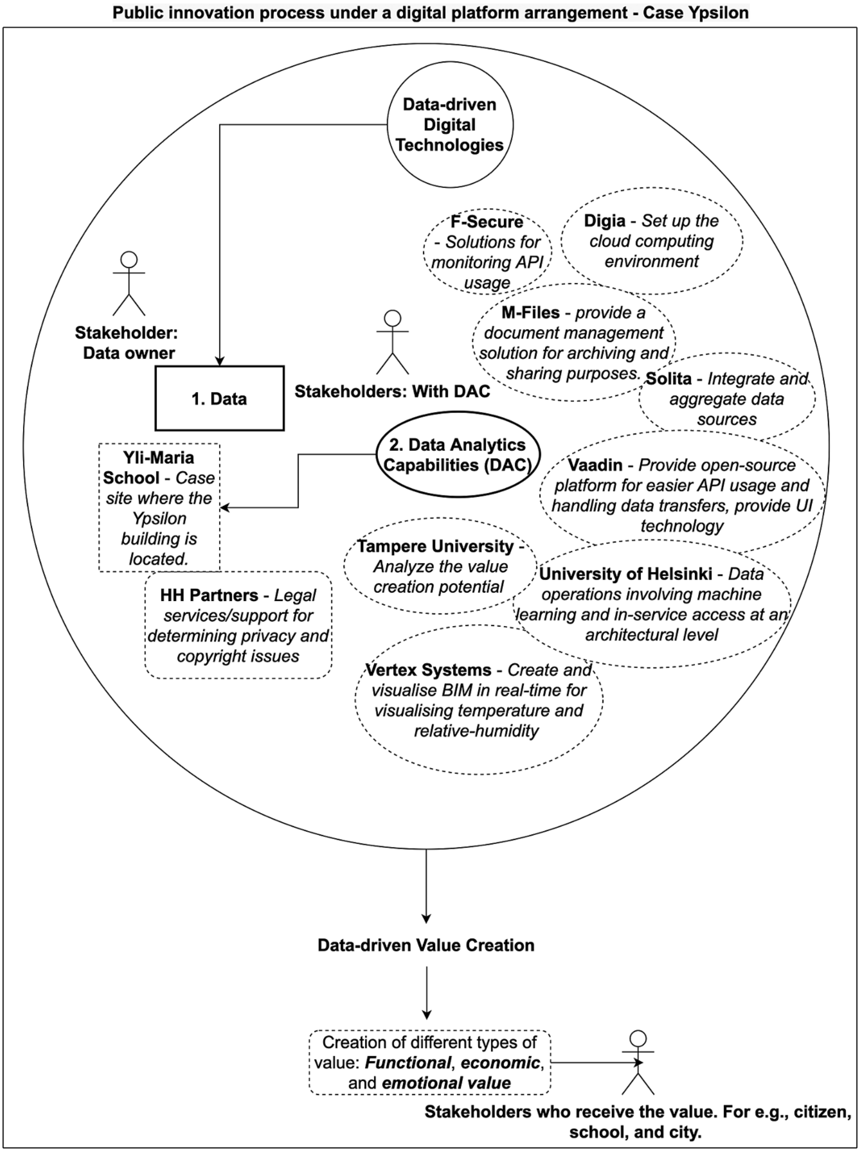

Figure 6.5 Value creation process involving different stakeholders.

In other words, functional value gains had a more central role than direct economic value gains. Sustainability is also nowadays a key concern, ranging from simple energy saving to the broader societal context of avoiding long journeys, and facilitating the use of public transport, bicycles, and walking. Moreover, it is desirable for efficacy and sustainability if the same building can be used efficiently for different purposes rather than constructing and maintaining many buildings. For example, a school occupies a building only for a limited time of day and year while the building remains empty most of the time. In terms of emotional value, the interviews were able to show that many emotional elements are also involved. However, many of the elements raise the question of conflicting values and legal restrictions on surveillance and privacy. For example, the identified value conflicts concerning digital services built on top of the application infrastructure were related to security, safety, and privacy. To enhance security and safety, data about the presence of people, especially children, in the building could not be disclosed to the public in real time. Disclosing full data even in a delayed manner was not feasible as outsiders would be able to predict the presence and activities of children and other people. Privacy is related to data about people in the building. For example, although personal information cannot be interpreted from data directly, teachers tend to have their own specific classrooms; combining the information on which rooms teachers use with information about when there are people in the room could reveal when a specific teacher is in the room, thus violating the teacher's privacy.

Although we mentioned economic value as an outcome of the digital platform arrangement of stakeholders, this is only on the surface and through the perceptions of the interviewees. This is a limitation as we did not attempt to uncover the detailed aspects of how economic value is created in the context of public-sector innovation. Even though it is the municipality that owns the building and hosts the services, this provides an opportunity to understand the operational elements and support business opportunities for sustainable buildings. These complementary services have business potential, which can be understood through the lens of business models and at an ecosystem level.

The innovation potential of the public sector organizations is evident from the present case. The City of Turku has established an innovative culture by creating different types of value through this arrangement. Since the digital platform arrangement has many stakeholders, more empirical data to identify what is valuable for different ecosystem actors is needed.

Based on the Ypsilon case, we can state that it is vital to make the value potential as concrete and visible as possible. Naturally, this is not easy when speaking of data because data as such is not information; it does not inherently lead to understanding, let alone require actions. In fact, it rarely does. This is something we know about our cost from encountering organizations that equate more data with better decisions. Interpretation can be tricky. Easy-to-grasp communication, intuitive visualization, and contextualization of data are usually important factors. "No one is interested in my Excels! … But when I have nice visualizations to show…," in the words of one interviewee.

This need for easy interpretation holds especially true for multipurpose premises with modifiable spaces like the Ypsilon building. Data on Ypsilon (and similar sites) has a broad spectrum of potential user groups, ranging from building maintenance and its partners to energy authorities and more site-specific user groups like service coordinators, teachers, pupils, and local residents. Therefore, we need to help different users to read, contextualize, and understand the data, as "with new data, there's always the possibility of misinterpretation" (as stated by the aforementioned interviewee). Yet even this is not enough. Even after data turns into understanding, understanding still needs to be turned into action. For this, we need to consider the organizational drivers of action and work to incentivize and structurally motivate people's behaviour. Otherwise, the possibilities for efficacy, safety, and well-being will remain only latent.

The value categories such as functional, emotional, and economic are evident from the case. However, these categories should not be considered as absolute (in reality) value categories concerning public innovation. Even though it is not explicitly stated, the City of Turku is expressing a symbolic or even social value among its category of schools. The innovative culture established by the municipality through innovation can also be seen as social status and establishing a sense of identity and standing out among other municipalities regionally or nationally, the City of Turku's way of branding itself.

Discussion and conclusions

The world is constantly being filled with new innovations that embody little to no understanding of the very people that the product or service is built for. They fail fast. It is common knowledge that most new products do not make it through their first year on the market. Some thought has probably been given to the "users" of the product or service, but too often only in the form of unvalidated hypotheses conjured out of thin air, or by reflecting the needs and assumptions of the team building the product, and then projecting those assumptions onto the market. Challenges are also introduced when insight into users is formed only by looking at people from afar, through spreadsheets and quantitative abstractions that lack a tangible understanding of what really drives potential users and their perception of value.

The first question of any innovation work should be: how does this product or service of ours relate to and produce anything of value for people and society? What kind of needs does it answer? What kind of human and cultural practices, functions, and meaning should it be part of? What actual problems might it solve for actual people and how? How does our product make life better? Suffice to say, this was something we also needed to think hard about during the 4APIs project and in the Ypsilon case. As such, our BIM and data may be of no value. They will become valuable only through performing functions and holding meaning perceived to be valuable by people and institutions. Can they make life better? For whom? How? How do they create value and for whom?

In this case, there are no business reasons to restrict access to data. However, allowing access should neither cause harm nor extra data maintenance effort. Access to data is also limited by the practical concern that digital services and data management are not among the core competencies or duties of municipalities. Therefore, while a lot of data exists, it is not necessarily in a convenient form and accessible through APIs even if the data is publicly available. In addition, there are other challenges such as evolution and data ownership that, however, appear to be quite general, not case-specific (Joutsenlahti et al. 2021). This also brings our attention to the topic of data ownership. As it is evident that data is a vital resource in creating value, the question concerning who owns the data is no trivial matter.

Does it belong to the public or the private sector? The case outlines this aspect clearly where the public sector owns the data about the citizens and the digital platform arrangement brings in the private sector to create the value. Similarly, should the resource that is gathered via the use of the building be given back for public usage? These are some of the issues that must be addressed more. In conclusion, this case was able to reveal or confirm previous ideas already presented in the literature and, additionally, to present some big questions that merit further investigation.

Notes

1 https://www.businessfinland.fi/en
2 https://www.turku.fi/
3 https://digia.com/
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