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Shaharudin, Ashraf; van Loenen, B.; Janssen, M.F.W.H.A.

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Petra Đurman (pdurman@pravo.hr), Faculty of Law, University of Zagreb

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IDENTIFYING BUSINESS MODELS OF OPEN DATA INTERMEDIARIES: A REVIEW

Ashraf Shaharudin^{1*}, Bastiaan van Loenen¹, Marijn Janssen²

¹ Faculty of Architecture & the Built Environment, Delft University of Technology, Netherlands

² Faculty of Technology, Policy & Management, Delft University of Technology, Netherlands

*correspondence E-mail: A.A.BinAhmadShaharudin@tudelft.nl

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1. Introduction

Open data has many potential benefits including stimulating innovation, enhancing accountability and transparency, and improving the reproducibility and dissemination of research (Janssen et al., 2012; Uhler and Schröder, 2007; Zhu et al., 2019). However, there are various shortcomings in the current open data initiatives such as the mismatch between the supply and demand of open data, the lack of appropriate software to process data, and confusion regarding data licenses (Johnson et al., 2017; van Loenen et al., 2021). The role of open data intermediaries is considered important to address these weaknesses. Open data intermediaries facilitate the use of and access to open data (Chattopadhyay, 2014; González-Zapata and Heeks, 2015) and build connections among open data stakeholders (Mayer-Schönberger and Zappia, 2011). It follows that open data intermediaries are regarded as one of the priority areas in open data research (Davies and Perini, 2016).

Nevertheless, in-depth studies on open data intermediaries are scarce. Within the limited studies, they are found to face several challenges that may undermine their potential contribution to other open data stakeholders. For example, lack of financial planning (Flores, 2020), over-reliance on volunteers (Reggi and Dawes, 2016), and difficulty in securing data experts (Andrason and van Schalkwyk, 2017). Some of these challenges are associated with the lack of development of open data intermediaries' business models (Kitsios et al., 2021; Reggi and Dawes, 2016). Before any research-based development of their business models can be carried out, a clear view of the existing business models is needed. Given this, the objective of this extended abstract is to review existing business models of open data intermediaries from the academic literature through a systematic literature review (SLR).

Section 2 provides a brief background on the concept of a business model. Section 3 describes the research method. Section 4 presents the findings. Last but not least, Section 5 discusses the findings and proposes considerations for future studies.

2. Background: What is a business model?

There are various definitions of a business model. For example, Timmers (1998) defined it as “an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues”. Twenty years later, Afuah (2018) defined it as

“the set of activities that [a business] performs to build and use resources to generate, deliver, and monetize benefits (embodied in products and services) to customers”.

Osterwalder (2004) identified nine components of a business model, which were then refined and developed into a business model canvas (Osterwalder and Pigneur, 2010). The nine components are (1) key partners, (2) key activities, (3) key resources, (4) value proposition, (5) customer relationships, (6) channels, (7) customer segments, (8) cost structure, and (9) revenue streams. Meanwhile, Al-Debei and Avison (2010) identified four components of a business model: (1) value proposition (products/services offered), (2) value architecture (technological architecture and organisational infrastructure), (3) value network (relationships with businesses and customers), and (4) value finance (cost, pricing methods, and revenue structure). It can be seen that the components identified by Osterwalder and Pigneur, (2010) and Al-Debei and Avison (2010) are similar and the difference is only a matter of specificity.

Despite various interpretations of a business model, most scholars agree that it contains at least three main elements (as summarised by Afuah, 2018; Andreini and Bettinelli, 2017; Voigt et al., 2017), namely, (1) value proposition (potential benefits for the customers), (2) value creation (methods deployed by companies to deliver the value proposition to customers), and (3) value capture (payments, not necessarily in monetary form, from customers to companies). As it is beyond the scope of this extended abstract to define or refine what is a business model, we adopted the three elements (value proposition, value creation, and value capture) as a guide in conducting our review.

3. Research method

We followed the eight steps of the SLR process by (Xiao and Watson, 2019). First, we formulated the problem that we wanted to achieve from the SLR. In our case, we want to answer: what are the business models of open data intermediaries in the literature? Second, we developed the review protocol, as presented in this section. Third, we searched for the literature. Fourth, we screened for inclusion by reviewing the title and abstract. Fifth, we assessed the quality of each piece of literature by reviewing the full text. Sixth, we extracted data from the literature. Seventh, we analyzed the data. Lastly, we reported the findings.

We searched for relevant publications in three academic databases, namely Scopus, Web of Science (WoS), and Google Scholar. We conducted the literature search on September 21, 2022. We used the search terms shown in **Table 1**. Although the scope of this extended abstract is not limited to open government data but open data as a whole, we also included the term “open government data” since the academic sub-area of open government data has gained tremendous interest over the years, resulting in much literature in this area. We included the term “infomediaries” and “infomediary” in our searches since our initial literature scanning shows that it is often used as a synonym for data intermediary. We also included the term “intermediation” to capture literature that uses it instead of “intermediary”. Besides the terms “business model” and “business models”, we also included the terms “revenue” and “value” since both are keywords closely associated with business models.

Table 1. Search terms (Boolean operator OR across rows and AND across columns)

Boolean operator	AND		
OR	open data	intermediaries	business model
	open government data	intermediary	business models
		infomediaries	revenue
		infomediary	value
		intermediation	

In total, there were 35 publications compiled from the three databases (**Table 2**). We removed eight duplicated publications and a publication with no author's information in the first filtering stage, giving us 26 publications. We then removed 19 irrelevant publications (publications that are not about open data intermediaries or business models) based on the title and abstract, and three non-English language publications, leaving us with four publications. Based on the content of each publication, one of them is found irrelevant to the objective of this extended abstract as it is on the business models of open data initiatives of which open data intermediaries are only one of the elements of the business model. In the end, three publications were selected: Janssen and Zuiderwijk (2014), Magalhaes et al. (2014), and Germano et al. (2016).

Table 2. Search strategy and number of results for each database

Database	Search in	Results	Notes
Scopus	title, abstract, keywords	22	N/A
WoS	title, abstract, author keywords, and Keywords Plus	11	N/A
Google Scholar	title	2	Google Scholar only allows terms searched either in the title or in the whole publication. The latter will give about 965,000 publications, hence, the search is only done in the title.

4. Results

Janssen and Zuiderwijk (2014) studied the business models of “infomediaries” in the Netherlands that are driven by open data and social media through 12 cases. They adopted the concept of a business model by Al-Debei and Avison (2010). However, in their analysis, they only focused on the value proposition and identified six business models:

- i. Single-purpose apps: Apps that process one type of open data and present it visually
- ii. Interactive apps: Single-purpose apps that allow users to add content such as ratings and feedback

- iii. Information aggregators: Apps that integrate open data from multiple sources
- iv. Comparison models: Apps that aggregate and compare open data from various sources
- v. Open data repositories: Portals that publish open data
- vi. Service platforms: Platforms that allow the searching, importing, cleansing, processing, and visualisation of open data

In the same year, Magalhaes et al. (2014) studied the business models of commercial reuse of open government data by 500 firms based in the United States. Like Janssen and Zuiderwijk (2014), they adopted the concept of business model by Al-Debei and Avison (2010) but focused only on the value proposition in their analysis. They identified three business models:

- i. Enablers: On the supply side, enablers provide public agencies with the services to collect, manage, and publish open data. On the user side, they offer products and services for users to aggregate data from different sources
- ii. Facilitators: They simplify and promote access to open data such as by repackaging and republishing data and providing Application Programming Interfaces (APIs)
- iii. Integrators: They use open data to complement their internal/private data to augment their business capabilities

A couple of years later, Germano et al. (2016) studied the business models of seven open government data intermediaries in Brazil. They did not clarify which interpretation of business model they adopted. They identified three business models based on the source of revenue:

- i. Consultancy services
- ii. Sponsorship to brands that want to advertise on their platforms
- iii. Products' subscription

5. Discussion

The business models identified from the publications reviewed do not cover all the three main elements considered key in business models, namely value proposition, value creation, and value capture. In particular, business models identified by Janssen and Zuiderwijk (2014) and Magalhaes et al. (2014) only represent the value proposition whereas business models by Germano et al. (2016) only represent the value capture. A holistic view of existing business models of open data intermediaries in terms of what value is offered (value proposition), how the value is delivered (value creation), and how the value is compensated (value capture) is needed to propose research-based development of their business models.

Future studies should consider identifying business models of open data intermediaries that capture all three main elements of business models. Besides, since the three studies reviewed are all country-specific, future studies should consider looking at different geographical scopes to support the generalisability of the current open data intermediaries' business models. Due to the limited studies of open data intermediaries' business models in academic literature, future studies should consider utilising grey literature including use case catalogues (e.g., opendataimpactmap.org) to identify open data intermediaries and subsequently identify their business models.

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