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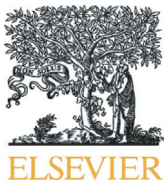
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Exploring the economic value of open government data

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ABSTRACT

Business models for open data have emerged in response to the economic opportunities presented by the increasing availability of open data. However, scholarly efforts providing elaborations, rigorous analysis and comparison of open data models are very limited. This could be partly attributed to the fact that most discussions on Open Data Business Models (ODBMs) are predominantly in the practice community. This shortcoming has resulted in a growing list of ODBMs which, on closer examination, are not clearly delineated and lack clear value orientation. This has made the understanding of value creation and exploitation mechanisms in existing open data businesses difficult and challenging to transfer. Following the Design Science Research (DSR) tradition, we developed a 6-Value (6-V) business model framework as a design artifact to facilitate the explication and detailed analysis of existing ODBMs in practice. Based on the results from the analysis, we identify business model patterns and emerging core value disciplines for open data businesses. Our results not only help streamline existing ODBMs and help in linking them to the overall business strategy, but could also guide governments in developing the required capabilities to support and sustain the business models.

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1. Introduction

During the last decade, governments and businesses across the globe have struggled to comprehend and adapt to the changes brought on by the ubiquitous growth of Information Technology and the Internet (Casadesus-Masanell & Ricart, 2011; Goethals, 2009). One of the most significant developments on the Internet is the emergence of the web of data resulting from opening up and sharing of non-sensitive information about the operation and services of government and businesses organizations (i.e. open data) (Davies, Perini, & Alonso, 2013; Ren & Glissmann, 2012). Open data constitute an important resource due to its potential to empower citizens, businesses, and transform how government delivers public services (Manyika et al., 2013). Opening up government data will enable greater accountability, delivery of higher quality and new services, reduction in operating costs, and stimulation of open innovations in both government organizations and businesses (Manyika et al., 2013; Vickery, 2011; Zuiderwijk & Janssen, 2013; Zuiderwijk & Van Den Braak, 2012). However, to harness the economic value of open data assets and leverage associated business opportunities, governments must develop the capacity to sustain the availability of high quality open government data as a core input resource for the open data industry. In this regard, the European Commission estimates that the economic gains from opening government data could amount to €40 billion a year. This has spurred

a growing number of small and medium enterprises seeking to tap into the potentials of open data. As new entrants flood the marketplace, businesses are seeking to uniquely position themselves through specialization to create and capture value for their stakeholders (IBM Business Consulting Services, 2005).

Business models and business architectures are conceptual instruments for describing how value is created for customers (Brettel, Strese, & Flatten, 2012; Casadesus-Masanell & Ricart, 2010; IBM Business Consulting Services, 2005; Krčmar, Böhm, Friesike, & Schildhauer, 2011), how revenue is generated, and how value is captured (Bekkelund, 2011; Plé, Lecocq, & Angot, 2008; Zott, Amit, & Massa, 2010). Business models developed to tap into the potential value of open data are increasingly available but not well understood. There are very few scholarly studies on business models for the open data industry. The lack of rigor (e.g. the use of a proper conceptual framework) in describing and analyzing existing ODBMs makes delineation and comparison of the models difficult. In fact, ODBMs are used interchangeably with revenue models, pricing strategies, distribution models, marketing techniques and architectural models (Doligalski, 2010; Plé et al., 2008). For example, while Howard (2014) claims that Open Source is an ODBM, The 451 group (2008) claims otherwise. Yet another example is the use of different names and labels for very similar business models making analysis difficult.

We address this problem by consolidating reported ODBMs in both academic and practice literature, rigorously describe the models based on a business model conceptual framework, and determining the ODBMs patterns. Our contribution in this work is four-fold: 1) Consistent elaboration of existing ODBMs based on a business model conceptual framework we constructed grounded in traditional business

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models literature, 2) Determination of core open data business patterns, 3) Determination of value disciplines for the open data business, and 4) Providing recommendations on the role of governments and the capabilities they must develop to support a viable open data ecosystem and industry.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature on ODBMs. Section 3 presents the research methodology. Section 4 presents the conceptual framework. Section 5 presents the elaboration of business models based on the conceptual framework. The analysis of the models is presented in Section 6. Evaluation of the resulting ODBMs is presented in Section 7. Discussion, recommendations, and conclusions are presented in Sections 8 and 9 respectively.

2. Literature review

In this section we describe existing business model frameworks and ODBMs. In Section 2.1, three well-known general business model frameworks and their components are described, while concrete business models for open data businesses follow in Section 2.2.

2.1. Business models

A business model describes how value is created and captured by an organization through the decisions made and the resulting consequences (Lambert, 2008). In our study, we adopt the notion of business model provided by Osterwalder (2004) which considers a business model as a conceptual tool that contains a set of inter-related elements that allows a business to earn money. It comprises a description of the value the business offers to one or several segments of customers, the architecture of the firm, and its network of partners for creating and delivering this value in order to generate profitable and sustainable revenue streams.

Three major business models are reviewed in this section. The various elements or components of these models were elicited from various sources including (Angot, 2010; Bonina, 2013; Boons & Lüdeke-Freund, 2013; Casadesus-masanell & Ricart, 2009; Casadesus-masanell & Zhu, 2011; Calia et al., 2007; Janssen & Zuiderwijk, 2014; Lambert & Davidson, 2013; Lüdeke-freund, 2009; Morris et al., 2005; Plé et al., 2008).

2.1.1. Osterwalder and Pigneur business model

Osterwalder and Pigneur (Osterwalder, 2004; Osterwalder & Pigneur, 2009) presents a business model canvas with nine building blocks (Fig. 1). Building blocks are: key partnership, key activities, key resources, value proposition, relationships with the customers, customers, channels, revenue stream and cost structures.

Customer Segment defines the groups of people or entities a business aims to reach and serve; Customer Relationship describes the types of relationships a business establishes with specific Customer Segments; Channel describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition; Value proposition describes the bundle of products and services that create value for a specific Customer Segment; Key activities describe the most important things a company must do to make its business model work; Key resources include important assets required to make a business model work; Key partners describe the network of suppliers and partners that make the business model work; Revenue stream is the income a business generates from each Customer Segment (costs must be subtracted from revenues to create earnings); and Cost structure describes all costs incurred to operate a business model.

2.1.2. Shafer, Smith and Linder business model

Shafer, Smith, and Linder (2005) based their framework on the four elements (Fig. 2) common to most business models: Strategic choices; value creation; value network; and capture value.

Strategic choices defines the strategies a business has to be able to develop to offer a unique product to the customer. This is an element of the strategy formulation process. Strategic choice adds value to a strategy; Value network defines network of suppliers and partners required to implement the business model; Create value describes value creation mechanisms from the different activities; and Capture value defines the process of recovering some or all of the value created from the customer.

2.1.3. Hamel business model

The business model framework described by Hamel (2000) comprises three main components (Fig. 3): Customer benefits – the link the strategy to the customer needs; Configuration – company-specific combination of resources, skills and procedures, which is used to support a given strategy; and Company frontiers – decisions regarding activity, which require recourse to the added value of an external network.

Customer logic defines segment of people a business aim to reach and serve. The Logic part defines all the activities required to maintain and improve the segment; Strategy defines strategies a business must develop to offer a unique product to the customer. This is an element of the strategy formulation process. Strategic choice adds value to a strategy; Resources describes the most important assets required for a business model work; and Network defines network of suppliers and partners that make the business model work.

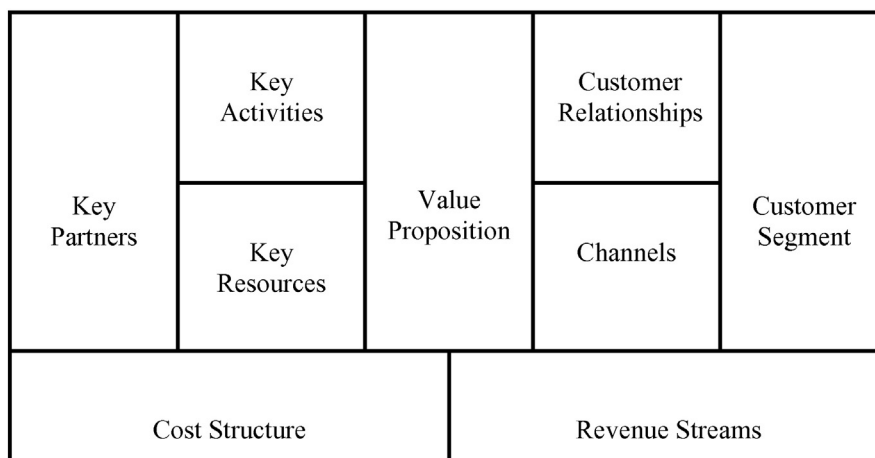


Fig. 1. Osterwalder business model canvas (Osterwalder & Pigneur, 2009).

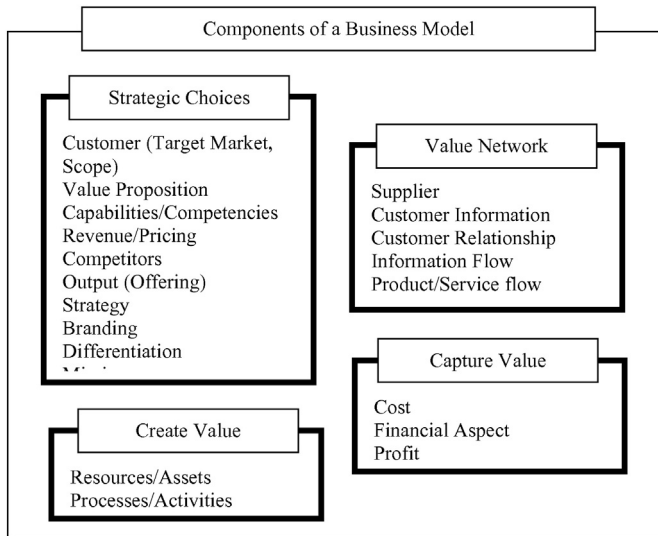


Fig. 2. Four components of a business model (Shafer et al., 2005).

2.2. Open data business models

Open data is any machine-readable information, particularly government data, that is made available in common standards to others (Davies et al., 2013; Manyika et al., 2013). The data can take different shapes and forms and are located in different parts of the government. Data can be raw or processed data. It may be related to public services or related to internal processes (Deloitte, 2012a; IBM Institute for Business Value Government, 2011; Julien, 2012; Ren & Glissmann, 2012; Vickery, 2011). However, there are also limits to what can be released (Vickery, 2011).

Given increasing demand for open data (Deloitte, 2012b), businesses are seeking ways to develop ODBMs to capture the value generated from open data (Julien, 2012). Using open data can help both public and private organizations improve the productivity of current business processes and also lead to new products, services, and entire lines of business for both established companies and entrepreneurs (Bonina, 2013; Manyika et al., 2013). For open data to be useful and beneficial to businesses, it needs to be structured, timely, accurate, reliable and sustained over time (Manyika et al., 2013; van den Broek, Rijken, & van Oort, 2012). Open data publishers or open data businesses need to have suitable business models that enable their activities to be self-sustaining (Musings, 2012).

A number of ODBMs have been identified in literature, mainly in the practice community. These include Howard (2014), Ferro and Osella (2013) which have cataloged the following eight ODBMs: Premium, Freemium, Open Source, Infrastructural Razor and Blades, Demand-Oriented Platform, Supply-Oriented Platform, Free as Branded

Advertising and White-Label Development. Models identified by Musings (2012) are: Cost Avoidance, Sponsorship, Dual Licensing, Support and Services, Charging for Changes, Increasing Quality through Participation, and Supporting Primary Business. Description of each aforementioned model is presented in the Appendices A, B, C as well as in (Zeleti, Ojo, & Curry, 2014). In Table 1, we present a brief description of each model.

3. Research methodology

This is a qualitative research approach which follows the Design Science Research (DSR) tradition. According to (Hevner, March, Park, & Ram, 2004; March & Smith, 1995), Design Science Paradigm is fundamentally a problem-solving paradigm in which the boundaries of organizational capabilities to create new and innovative artifacts is extended together with the knowledge and understanding of a problem domain through the building and application of the design artifact. In our work, we apply the DSR approach to gain better understanding of ODBMs in literature through rigorous elaboration and analysis of existing models to build more robust models and identify patterns that better capture the essence of existing ODBMs.

A design science research framework comprises two axes (March & Smith, 1995): ‘research activities’ and ‘research outputs’. Research activities include ‘building’ of the design artifacts; ‘evaluation’ of the artifact; generalization or ‘theorization’ of the artifact and ‘justification’ which is supplying evidence for the external validity or generalizability of such artifacts. ‘Build’ and ‘evaluate’ are design science research activities aiming at improving performance or problem-solving while ‘theorize’ and ‘justify’ are the activities of natural science research aiming at extracting knowledge by testing theories (Peffer et al., 2006; Schermann, Systems, München, Pohl, & Engineering, 2009). Research outputs cover ‘constructs’, ‘models/patterns’, ‘methods’ and ‘instantiations’ (Hevner et al., 2004; March & Smith, 1995). The framework is shown in Fig. 4.

However, we only focus on the Build and Evaluate elements of the research framework. We show in Table 2 how we operationalized the design science research framework described in (March & Smith, 1995) in our work. As shown in the Table 2, in this research, we only build and evaluate two design artifacts: ‘constructs’ and ‘models/patterns’. The ‘Theorize’, ‘justify’, ‘methods’ and ‘instantiation’ activities of the framework are beyond the scope of this research (marked “BS”).

3.1. Building constructs and model

We used NVivo10 to build constructs included in the conceptual model. Specifically, we coded relevant phrases from related literature into one or multiple nodes in NVivo10, we classified the nodes into categories which each category represents a context and then we generated some models as basis for further analysis and development of our

CUSTOMER BENEFITS	CONFIGURATION	COMPANY FRONTIERS	
<p>Customer Logic</p> <p>Customer Service Information and Anticipation Relational Dynamics Price Structure</p>	<p>Strategy</p> <p>Objective Products and Market Segments Differentiation Compared to Competitors</p>	<p>Resources</p> <p>Skills Strategic Resources Methodologies or Manufacturing Processes</p>	<p>Network</p> <p>Suppliers Partners Alliances</p>
Efficiency, Uniqueness, Appropriateness, Profit Accelerators			

Fig. 3. Hamel business model (Hamel, 2000).

Table 1
List of existing ODBMs.

Models	Description
Premium	In the premium business model, the offering is high end open data products and services which are paid for (Huber, 2011).
Freemium	In the freemium model, quality products are provided free of charge for a short period of time after which customers are requested to pay for the products (Teece, 2010).
Open source	Products in this model are provided in open format that allows free usage and redistribution without any technical barrier (Ferro & Osella, 2013).
Infrastructural razor and blades	A razor-blade business model entails selling a product for a low price in order to generate revenues from the complementary products (Pietersz, 2013).
Demand-oriented platform	This model involves charging consumers of the data products (e.g. developers) for the added value (Howard, 2014).
Supply-oriented platform	This business model entails the presence of an intermediary business actor providing infrastructural services for data consumers (Ferro & Osella, 2013).
Free as branded advertising	This model encourages audience towards a brand or a company by delivering commercial messages through visualized data which is also called “display advertising” (Ferro & Osella, 2013).
White-label development	A white-label product is a new product or service developed by one company but acquired and rebranded by another as theirs (Howard, 2014).
Cost avoidance	This model reduces the cost of data publishing by having a sustainable publishing solution (Epimorphics Ltd, 2012).
Sponsorship	This model entails giving the product for free to customers and obtaining revenue from some sponsors (Casadesus-masanell & Zhu, 2011).
Dual licensing	Dual licensing is based on the idea of simultaneous use of both open source and proprietary licenses (Välimäki, 2003). Products are given away in an open license for certain purposes and under a closed license for others (Musings, 2012).
Support and services	This model ensures that the paid packages are given away with guarantees for paying customers (Musings, 2012).
Charging for changes	In this model, fee is applied for changes made to the product (Musings, 2012).
Increasing quality through participation	This model involves increasing participation to co-creation value with the goal of generating higher margins (Angot, 2010).
Supporting primary business	This model entails releasing data towards supporting the primary goals and processes of a business or organization (Musings, 2012).

conceptual model (see Figs. 5 and 6). To refine our codes and categories, we performed four coding cycles. First cycle includes our initial codes and classifications. Second cycle includes rearrangement and reclassification of the initial codes. Third cycle included more serious reorganization, rearrangement and reclassification of codes. The main purpose was to subcategorize the nodes in each category. The last cycle includes final

check and configuring what models best suits the purpose of the research. The two authors work together on the four cycles and had four iteration tests to ensure consistency and efficiency of codes, categories and classifications.

3.2. Evaluating constructs and model

We evaluate the developed constructs by mapping back to the existing business model literature. The evaluation is discussed further in Section 7. According to (March & Smith, 1995), each specified cell in Table 2 may call for a number of other methods resulting in an overall method mix. Table 3 shows the mixed-methods used in this research.

In library search, literature analysis, speculation, model comparison, and conceptual research the following keywords are used to search for related work in Google Scholar and Scopus: ‘business models’, ‘open data business models’, ‘business model framework’, ‘economic value of open data’, ‘value of open government data’, and ‘value added to open government data’.

These methods are briefly explained below:

- *Library search* – Research that is based mainly on the review of existing literature.
- *Literature analysis* – Research that critiques, analyzes, and extends existing literature and attempts to build new ground work.
- *Speculation* – Research that derives from thinly supported arguments or opinions with little or no empirical evidence.
- *Model comparison* – Research that is based on comparing existing well-known models with the developed model for completeness.
- *Conceptual research* – Research that intends to develop a framework or a conceptual model.
- NVivo10 – Nvivo10 is a leading qualitative data analysis platform for analyzing unstructured data.

4. Conceptualization

This section presents the conceptualization developed from the linking the core constructs developed from extant literature. Fig. 5 shows the compositions of all six core constructs from NVivo10. For example “Value Adding Process” with corresponding elements including “Strategic Choice”, “Operational” and “Knowledge management” processes. The same figure also shows the different elements of the five other constructs – Value Proposition, Value in Return, Value Management, Value Network and Value Capture.

To address the objective of this study, it is necessary to understand the relationships between the constructs based on literature. Fig. 6 explores the relationships between the main 6 components of the 6-V model. One rhombus represents one relationship between any two components. For example, *Value Adding Process* and *Value Network* are interdependent and *Value Capture* is dependent on *Value in Return*.

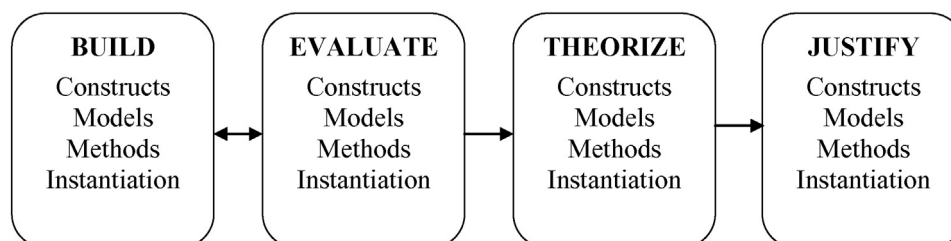


Fig. 4. Design science research framework (March & Smith, 1995).

Table 2
Research framework.

		Research activities			
		Build	Evaluate	Theorize	Justify
Research output	Constructs	Finding underpinning concepts for business models and framework through a detailed qualitative analysis (using NVivo 10 as a tool, Section 4) of extant literature in the domain. This resulted in the identification of 6 core components (the 6-V model main components)	Completeness and understandability of components (Section 7)	BS	BS
	Models/patterns	Elaboration of ODBMs using the 6-V main components (Models) and clustering models into patterns based on value orientation of the models. Modeling business model framework by NVivo 10 and defining patterns that express and represent open data business models (Section 6)	Completeness, level of detail of the model and patterns, We argue for the internal consistency of synthesized patterns (Section 7)	BS	BS
	Methods Instantiations	BS BS	BS BS	BS BS	BS BS

Building on existing conceptual and theoretical roots (see Table 4), we develop a detailed framework for characterizing a business model. After a careful analysis of consolidated elements of the different business model frameworks in literature, we identified the various elements of the 6 core constructs that could be used to characterize a business model. We refer to our resulting framework as the 6-V Business Model Framework (see Fig. 7). The elements of the 6 core constructs of the Business Model Framework are described below:

- *Value proposition* – specifies the value that business is offering. Value proposition included product, services, distribution channel, information and price.
- *Value adding process* – delivering value requires value-adding process including key activities and resources such as physical resources,

human resources, supply chain management, partnerships, and technology. Value adding process is classified into three:

1. Operational includes activities, organizational structure, technologies and logistics systems, revenue model, resources and assets and financial model;
 2. Strategic planning includes market or the target customer, competencies, capabilities, pricing and the control of costs, branding, differentiation, legal issues, mission and trust;
 3. Knowledge management includes innovation and documents.
- *Value in return* – what is received from the value adding process either monetary or non-monetary value including revenue,

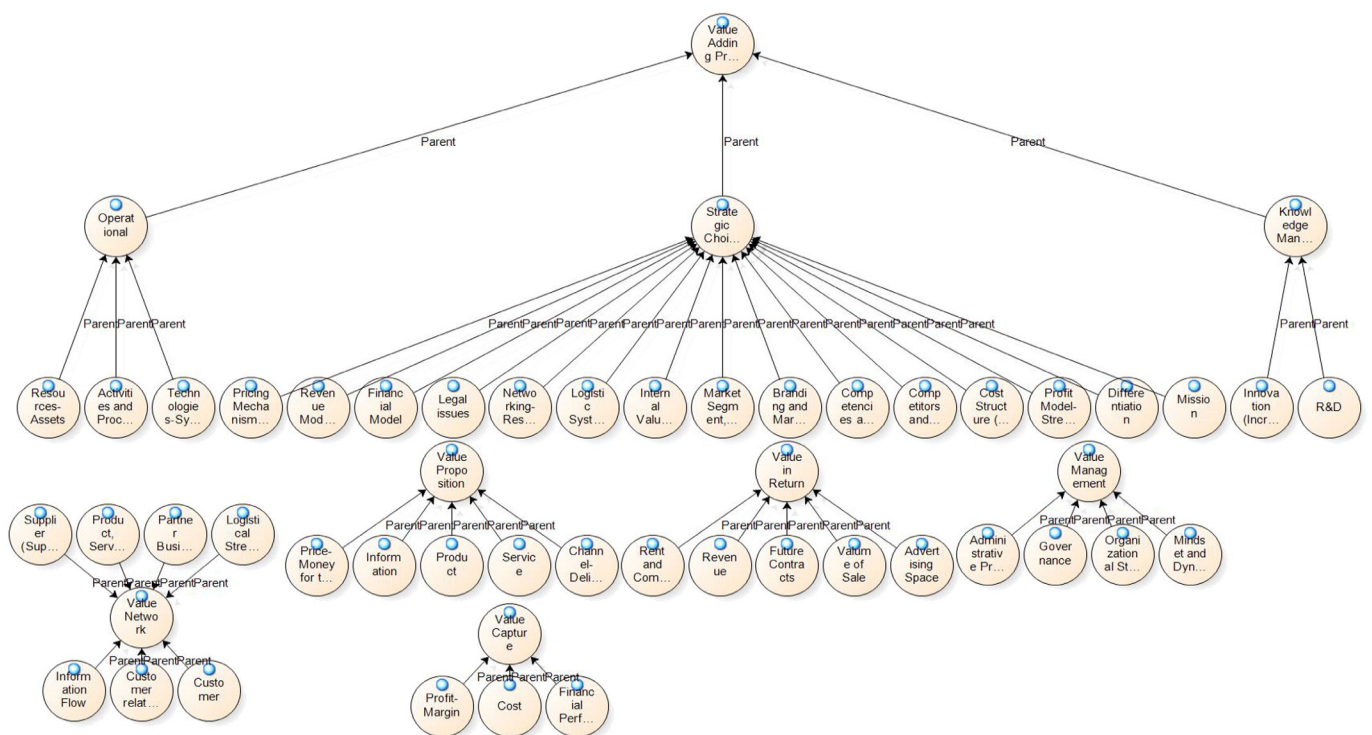


Fig. 5. 6-V's component and subcomponents – Model generated from NVivo10.

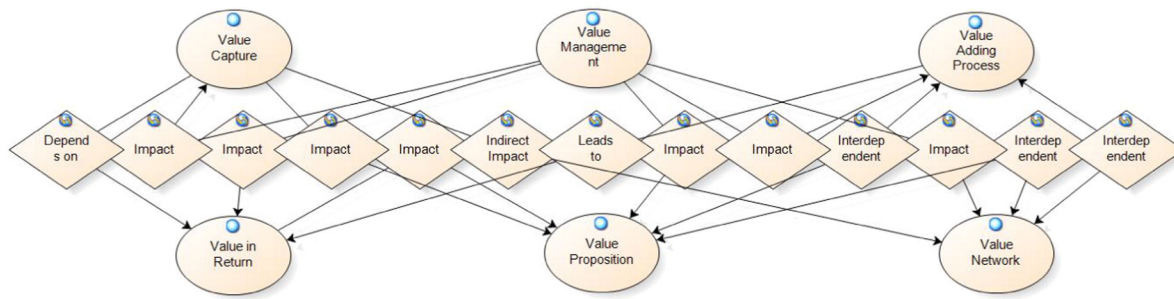


Fig. 6. 6-V business model main 6 components and their relationships – Model from NVivo.

advertising space, future contracts and opportunities and rent or commission.

- **Value capture** – Value capture is the process of retaining some percentage of the value produced in transactions. This allows the business to use the output from the value in return to rethink and redesign to support the value proposition. The degree to which an organization can capture produced value depends on its competitiveness and negotiation capability with partners and customers.
- **Value management** – top managers play a significant role to the whole process. Therefore, this includes mind-set, organization, governance, stakeholders and shareholders.
- **Value network** – all the business activities are done within the value network. This includes customers, suppliers, information flow, product flow, service flow and partner businesses.

Elaborating the 6-V business model framework presented in Fig. 7 to facilitate better understanding the model components, we present the 6-V model in table form that provides second-level and third-level components. Each of the 6-V business model main component includes sub-components (second-level components) in which each sub-component consists of other sub-components (third-level components). For example, value proposition can include offer, channel and value in which offer can include product, services and information; channel can include delivery method and value can include better price or the value for money. Table 4 shows this classification.

5. Applying the 6-V model in characterizing existing open data business models

In this section, we apply the 6-V model to characterize the 15 ODBMs highlighted in Section 2.2. We do not include Value Management in the analysis because it is related to all other elements of the model. For each model we identify value propositions, core activities of the value adding process, the value network required to collaboratively deliver the value, value in return which is the value produced and value capture which is how the produced value is captured. The resulting information is presented in Table 5 and highlighted below.

Cost Avoidance offers sustainable publishing solution, cost avoidance, and improved meaning of data and data integration as value in return. *Sponsorship* offers free and useful data to the public using resources provided by sponsors. *Freemium* offers free but limited data and high quality data at some cost and provides limited availability of useful free data to public and perceived value of data as value in return. *Premium* offers specific customer need and provides perceived value of data as value in return. *Dual-Licensing* offers free data for non-commercial uses and high quality data for commercial use. It also provides limited availability of useful free data to public. *Support and services* offers high value adding data services and provides perceived value of data as value in return. *Charging for changes* offers free but limited data services and high quality data at some cost and provides limited availability of useful free data to public and perceived value of data as value in return. *Increasing quality through participation* offers higher quality of data and provides higher data quality as value in return. *Supporting primary business* offers strategic support to the business objective and provides improved in business results as value in return. *Open source* offers free data for non-corporate use and quality data for corporate use and provides limited availability of useful free data to public and perceived value of data as value in return. *Infrastructural razor and blades* model offers incomplete data at discount price while the complementary parts are provided at some cost. It provides perceived value of data as value in return. *Demand-oriented platform* offers high quality and reliable data at some cost and provides commoditization and democratization of data as value in return. *Supply oriented platform* offers efficient and scalable infrastructure and provides perceived value of data as value in return. *Free as branded advertising* offers useful data for public and provides perceived value of data as value in return. *White-label development* offers useful data services and Apps and provides saving in development time and budget as value in return.

6. Analysis

This section analyses the business models described in Section 5. The analysis here seeks to determine commonalities in the 15 ODBMs based on the 6-V framework. This will provide some insight into what are the core or inherent ODBM patterns and related value disciplines. The

Table 3 Method mix.

		Research activities			
		Build	Evaluate	Theorize	Justify
Research output	Constructs	Library search, speculation, conceptual research, tool application (NVivo)	Model comparison	BS	BS
	Models/patterns	Conceptual research, library research, literature analysis, tool application (NVivo)	Literature analysis	BS	BS
	Methods	BS	BS	BS	BS
	Instantiations	BS	BS	BS	BS

Table 4
6-V model's top-level and low-level components.

6-V model components	Second-level components	Third-level components
Value proposition	Offer Channel Value	Product, service; information Delivery method Price/value for money
Value adding process	Operational Strategic	Activities and processes; technologies and systems; resources and assets Market segment/position/geographical expansion; logistic systems; competencies and capabilities; profit model/stream/formula; revenue model/sources/stream/mechanisms; financial model; pricing mechanisms; competitors and competitive outcomes; internal value chain structure; cost structure and pricing; branding and marketing; networking and resource leveraging; differentiation; legal issues; mission Innovation (Incremental and Disruptive); R&D
Value in return	Knowledge management Volume of sale Income Future income opportunities	Volume of product sale Revenue; rent and commission Advertising space; future contract
Value capture	Market size Profit/margin model	Product cost and quality Profit/margin; financial performance
Value network	Actors Supporting infrastructure	Customer; partner businesses Customer relationship/interface; product, service, information and resource flow; supplier/supply chain; logistical stream
Value management	Discipline Governance Structure Administration	Mind-set and dynamic consistency Governance Organizational structure (Organization Entity and Arrangement); Administrative processes

categorization and identification of value disciplines will provide open data businesses concrete model options for generating revenue for open data. Business model categories and value disciplines are described below.

6.1. Business model categories

The first part of our analysis identifies the major categories of business models focusing on value propositions; a central element of the

business model which are directly associated with customers and external entities. The centrality of value proposition in the design of business models is clearly reflected in our conceptual model in Section 4. Business model categories are determined from the 15 models (see Table 5) by examining the similarities between value propositions of the models as well as careful comparison of what each model offers, tries to achieve and how. Our analysis resulted in five major business model categories including *Freemium*, *Premium*, *Cost Saving*, *Indirect Benefits* and *Parts of Tools* categories (see Table 6). In Table 6, we

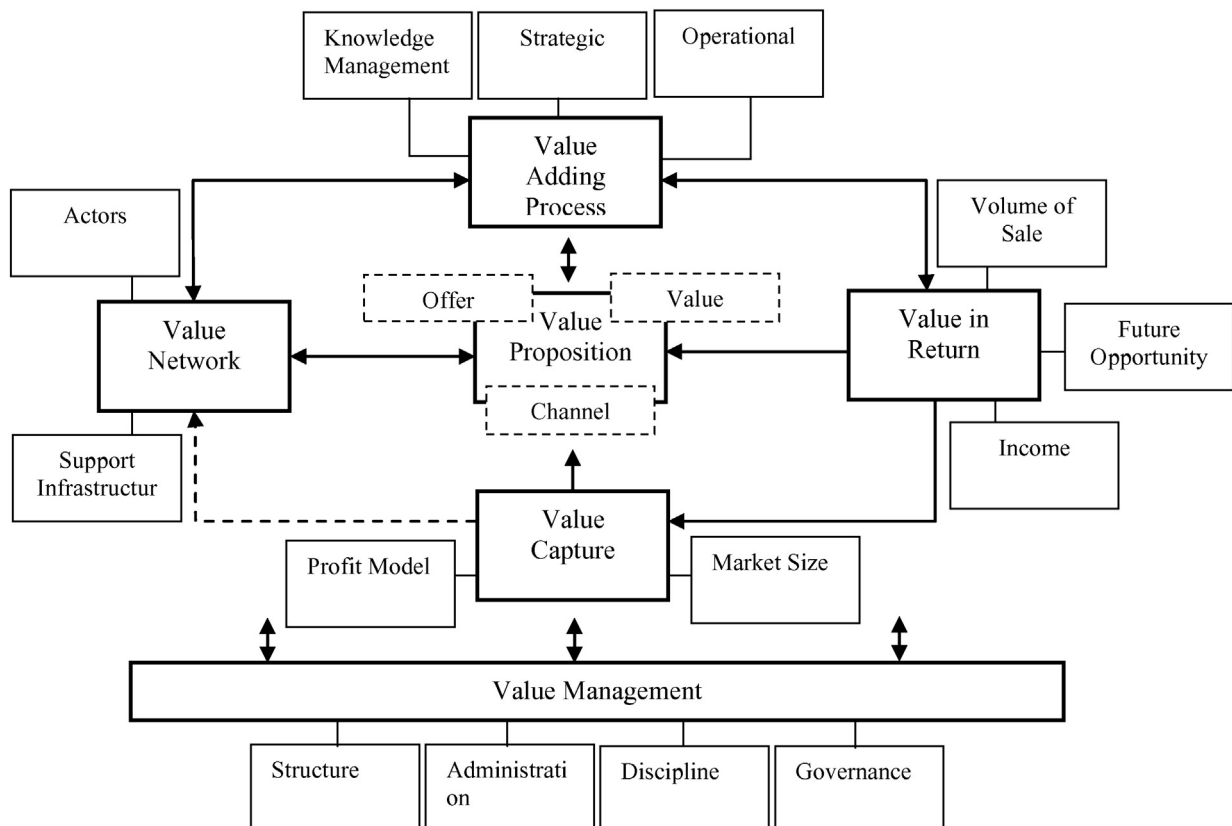


Fig. 7. The 6-V business model conceptual framework.

Table 5
 ODBMs elaboration based on the 6-V model.

	Value proposition	Value adding process	Value network	Value in return	Value capture
Premium	<ul style="list-style-type: none"> Meeting specific customer data need 	<ul style="list-style-type: none"> Publishing Data maintenance 	<ul style="list-style-type: none"> Mostly business clients 	<ul style="list-style-type: none"> Perceived value of data 	<ul style="list-style-type: none"> Revenue received
Freemium	<ul style="list-style-type: none"> Free, but limited data services High quality data at some cost 	<ul style="list-style-type: none"> Availability of different machine-readable formats Unconstrained numbers of API calls More sophisticated querying, Access to data dumps rather than through an API (or vice versa) Provision of feeds of changes to the data Enhancement of the data with additional information Early access to data Provision of data on DVDs or hard disks rather than over the net 	<ul style="list-style-type: none"> Clients (mostly consumers B2C) 	<ul style="list-style-type: none"> Perceived value of data not freely provided 	<ul style="list-style-type: none"> Revenue from the small % of the free users Charges for additional data or advanced features
Open source	<ul style="list-style-type: none"> Free data for non-corporate use High quality data for corporate use 	<ul style="list-style-type: none"> Publishing data Data maintenance 	<ul style="list-style-type: none"> Mixed clients (B2B,B2G, B2C) 	<ul style="list-style-type: none"> Recognition and attribution from data made freely available 	<ul style="list-style-type: none"> Revenue from added value services
Infrastructural razor & blades	<ul style="list-style-type: none"> Incomplete data at low cost Complete data at higher cost 	<ul style="list-style-type: none"> Update data Maintenance Refining Datasets Collecting and cataloging data Harmonizing data in terms of formats and exposed through APIs 	<ul style="list-style-type: none"> Developers Clients Developers 	<ul style="list-style-type: none"> Perceived value of data Commoditization and democratization of data 	<ul style="list-style-type: none"> Revenue from data Revenues in exchange for advanced services and refined datasets or data flows
Demand-oriented platform	<ul style="list-style-type: none"> High quality and reliable data at some cost 	<ul style="list-style-type: none"> Data retrieval Standardization of formats Automated external exposure of data via APIs and GUI Data visualization 	<ul style="list-style-type: none"> Technology companies Publisher (who is selling) 	<ul style="list-style-type: none"> Perceived value of data 	<ul style="list-style-type: none"> Revenue from potential advertisers
Supply-oriented platform	<ul style="list-style-type: none"> Efficiency Scalable infrastructure 	<ul style="list-style-type: none"> Data retrieval Standardization of formats Automated external exposure of data via APIs and GUI Data visualization 	<ul style="list-style-type: none"> Software development Companies Developers Mostly Business Clients Developers 	<ul style="list-style-type: none"> Perceived value of data Savings in development time and budget Costs savings 	<ul style="list-style-type: none"> Revenue from Adverts Lump sum Revenue
Free, as branded advertising	<ul style="list-style-type: none"> Useful data for the public 	<ul style="list-style-type: none"> App making App upgrading 	<ul style="list-style-type: none"> EU, parliaments Government department People Sponsors Clients Developers Clients 	<ul style="list-style-type: none"> Perceived value of data Availability of data to public Perceived value of additional data services 	<ul style="list-style-type: none"> Revenue from Adverts Proactive data release Revenue from sponsors
White-label development	<ul style="list-style-type: none"> Useful data services and Apps 	<ul style="list-style-type: none"> Publishing data as Linked Data Data retrieval Publishing process 	<ul style="list-style-type: none"> EU, parliaments Government department People Sponsors Clients Developers Clients 	<ul style="list-style-type: none"> Savings in development time and budget Costs savings Availability of data to public Perceived value of additional data services 	<ul style="list-style-type: none"> Lump sum Revenue Sustainable publishing practice Proactive data release Revenue from sponsors
Cost avoidance	<ul style="list-style-type: none"> Sustainable publishing solution Cost avoidance 	<ul style="list-style-type: none"> Publishing data as Linked Data Data retrieval Publishing process 	<ul style="list-style-type: none"> EU, parliaments Government department People Sponsors Clients Developers Clients 	<ul style="list-style-type: none"> Savings in development time and budget Costs savings Availability of data to public Perceived value of additional data services 	<ul style="list-style-type: none"> Lump sum Revenue Sustainable publishing practice Proactive data release Revenue from sponsors
Sponsorship	<ul style="list-style-type: none"> Free data and useful for public 	<ul style="list-style-type: none"> Publishing data Data maintenance 	<ul style="list-style-type: none"> EU, parliaments Government department People Sponsors Clients Developers Clients 	<ul style="list-style-type: none"> Savings in development time and budget Costs savings Availability of data to public Perceived value of additional data services 	<ul style="list-style-type: none"> Lump sum Revenue Sustainable publishing practice Proactive data release Revenue from sponsors
Dual licensing	<ul style="list-style-type: none"> Free data for non-commercial use High quality data for commercial use 	<ul style="list-style-type: none"> Publishing data Data maintenance 	<ul style="list-style-type: none"> EU, parliaments Government department People Sponsors Clients Developers Clients 	<ul style="list-style-type: none"> Savings in development time and budget Costs savings Availability of data to public Perceived value of additional data services 	<ul style="list-style-type: none"> Lump sum Revenue Sustainable publishing practice Proactive data release Revenue from sponsors
Support and services	<ul style="list-style-type: none"> High value adding data service 	<ul style="list-style-type: none"> Guarantees on data availability Prioritization on bug fixes (both in data and its provision) for paying customers Timely help for customers using the data Services around data visualization Analysis and mashing with other data 	<ul style="list-style-type: none"> Mostly business clients 	<ul style="list-style-type: none"> Perceived value of data 	<ul style="list-style-type: none"> Revenue Presence in the service market
Charging for changes	<ul style="list-style-type: none"> Free, but limited data services High quality data at some cost 	<ul style="list-style-type: none"> Update data Availability of different machine-readable formats Unconstrained numbers of API calls More sophisticated querying Access to data dumps rather than through an API (or vice versa) Provision of feeds of changes to the data Enhancement of the data with additional information Early access to data 	<ul style="list-style-type: none"> Mostly business clients 	<ul style="list-style-type: none"> Perceived value of additional data services 	<ul style="list-style-type: none"> Revenue from added value services

Table 5 (continued)

	Value proposition	Value adding process	Value network	Value in return	Value capture
Increasing quality through participation	<ul style="list-style-type: none"> • Availability of higher quality data 	<ul style="list-style-type: none"> • Update data • Cleansed data • Feedback 	<ul style="list-style-type: none"> • Developers • Lawyers • Academics and government • Clients as an active player 	<ul style="list-style-type: none"> • Higher quality data with increased value 	<ul style="list-style-type: none"> • Revenue • Client satisfaction
Supporting primary business	<ul style="list-style-type: none"> • Open data supporting strategic business objective 	<ul style="list-style-type: none"> • Publishing data • Providing APIs 	<ul style="list-style-type: none"> • Developers • Clients 	<ul style="list-style-type: none"> • Improved business outcomes 	<ul style="list-style-type: none"> • Revenue • Customer satisfaction

describe specific ODBM comprising each category, identify what each category as a whole offers and also indicate associated channels for delivering value and how value is captured in the category of models.

We briefly describe the categories of open data business models below:

- *Freemium* – includes *Freemium*, *Dual-Licensing*, *Charging for Changes*, *Open Source*, and *Free as Branded Advertising* models. All the models in this category offer limited data free of charge and apply fees for additional request for complete and higher quality datasets.
- *Premium* – includes *Sponsorship*, *Support and Services*, *Demand-Oriented Platform*, *Supply-Oriented Platform*, *White-Label Development* and *Premium* models. Data in this category is not offered free of charge. However, data are offered in high quality and complete form at some cost.
- *Cost Saving* – includes *Increase Quality through Participation* and *Cost Avoidance* models. Models in this category do not entirely cover the cost, but reduce cost of opening and releasing data by engaging participants and publishing data as Linked Data. Data user or re-user participants play a vital role in this category as by active participation publishing data can happen at lower cost.
- *Indirect Benefit* – includes *Supporting Primary Business* model. Opening up data in this category is strategic and releasing open data naturally supports the primary goal of the business. Model in this category allows the business to develop its own data and data infrastructure by using the third-party infrastructures that are created because the data is open and available.
- *The Parts of Tools* – includes *Infrastructural Razor and Blades* model. The business strategy in this category is to offer first set of data at a discount, while offering complementary or dependent data at a considerable higher price.

As can be seen from Table 5, most of the 15 ODBMs belong to *Freemium* and *Premium* categories. Consequently, in open data business community, more emphasize is given to *Freemium* and *Premium* models than the other three categories.

6.2. Value disciplines

A business model and value proposition in particular, is shaped by the business's underlying value discipline which describes different ways a business can differentiate itself from competitors. It is a strategic focus that enables a business to set its vision and objectives. Value discipline helps a business to tailor value disciplines to exactly match the need.

Our approach to identifying the implicit value disciplines for model categories is based on the analysis of the model attributes such as value proposition and value in return. Determination of the value disciplines enables analysis of the required capabilities to guarantee the attainment overall business objectives. A Delphi-like process involving the three co-authors of the research was adopted in the analysis of Table 5, resulting in four types of value disciplines for open data businesses. The identified value disciplines converged on *Usefulness*, *Process Improvement*, *Performance* and *Customer Loyalty*, which are explained below:

- *Usefulness*, tailors value proposition to directly support the needs of consumers in one way or another. Business strategic focus, corporate vision and business objectives should be defined to meet usefulness of the offer. *Usefulness* is associated with the *Freemium*, *Dual-Licensing*, *Charging for Changes*, *Open Source* and *Free as Branded Advertising*. These models all somewhat focus on the usefulness of the data offered to the clients as the business value disciplines.

Table 6 ODBM categories.

	Offer	Channel	Price/Value for money
Freemium category Freemium, dual-licensing, charging for changes, open source, and free as branded advertising	Limited data services, quality data, useful data	Data portals, data visualization platforms or display advertising	Limited dataset for free of charge, quality dataset at some costs
Premium category Sponsorship, support and services, demand-oriented platform, supply-oriented platform, white-label development and premium	Data services, quality data, efficient and scalable infrastructure, useful data	Data portals, data publishing platforms, APIs, and graphical user interfaces	Quality data provided at a fee
Cost saving category Increase quality through participation and cost avoidance	Quality data, sustainable publishing solution, cost reduction	Data portals, linked data	Reduce cost of opening and releasing data
Indirect benefit category Supporting primary business	Quality data for supporting business strategic objectives	Data portals, apps, marketplace of created tools and apps by other organizations	Releasing organization's data for free that can be used by others to make tools that improves the releasing organization
Parts of tools category Infrastructural razor and blades	Incomplete data, complete data	Cloud computing platforms, API	Incomplete data for lower cost and complementary or dependent data at higher cost.

Table 7
ODBMs and value proposition categories.

		Value disciplines			
		Usefulness	Process improvement	Performance	Customer loyalty
Categories	Parts of tools	NA	NA	NA	Infrastructural razor and blades
	Indirect benefit	NA	NA	Support primary business	NA
	Cost saving	Increasing quality through participation		Cost avoidance	NA
	Premium	Sponsorship, support and services, demand-oriented platform, supply-oriented platform, white-label development		NA	Premium
	Freemium	Freemium, dual-licensing, charging for changes, open source, free as branded-advertising		NA	NA

- *Process Improvement*, tailors value proposition to match to the needs of the customer specifically for improving processes. *Process improvement* is associated with *Cost Avoidance* model. A business oriented on *Process Improvement*, aim at greater efficiency to reduce cost by optimizing its processes. Open data published based on this discipline targets improving of business processes. The third value discipline type
- *Performance*, tailors value proposition for a better performance. Performance is associated with *Support Primary Business* model. Businesses with this orientation aim to release data which support their primary business objectives.
- *Customer Loyalty*, tailors value proposition to target customer loyalty. This is associated with *Premium* and *Infrastructural Razor and Blades*. A business with *Customer Loyalty* value discipline should apply *Premium* or *Infrastructural Razor and Blades* model to adjust their processes to meet the clients' satisfaction and build customer loyalty.

Table 8 shows that *Usefulness* value discipline is the most popular value discipline in the open data industry followed by the *Customer Loyalty*.

6.3. Summary

In summary, we have organized existing ODBMs in terms of their inherent value disciplines and their respective categories as shown in Table 7. For instance, an open data business which aims to focus on customer loyalty can have two choices for their business model which are *Infrastructural Razor and Blades* and *Premium*. Business could choose one depending on business model category they aim to target. Open data businesses aiming at increasing performance as their value discipline can have one opt for the business model “*Support Primary Business*”. Similarly, for open data businesses aiming at improving processes as their value discipline could adopt the “*Cost Avoidance*” model. Our observation is that most of the business existing models target “*Usefulness*” implicitly as their value discipline. However, the specific nature of useful value being targeted varies from one customer segment to another. *Increasing Quality through Participation, Sponsorship, Support and Services, Demand-Oriented Platform, Supply-Oriented Platform, White-Label Development, Freemium, Dual-Licensing, Charging for Changes, Open Source and Free as Branded-Advertising* belong to this value discipline. Table 7 shows how existing models could be described based on the elicited patterns and value disciplines.

7. Evaluation

As highlighted in the Section 3.1, Design Science must include some form of validation of the research outputs. Evaluation here comprises a process for determining how well the research outputs compares with the state of the art knowledge. Our research output includes constructs, models, methods and instantiations that could be evaluated. In our case,

there is an obligation to evaluate the developed constructs and models/patterns. According to March & Smith (1995), the evaluation of constructs tends to involve completeness, simplicity, elegance, understandability and ease of use. The evaluation of models should be done in terms of their conformity with real world phenomena, completeness, level of detail, robustness, and internal consistency. Furthermore, to inform researchers in the field, the new model must be positioned with respect to existing literature on (open data) business models.

Thus, we concentrate on evaluating the 6 business model components and business model patterns and value disciplines produced as core outputs. Our research outputs are evaluated for completeness, understandability and level of details. Constructs (i.e. the 6 business model components) are evaluated for completeness and understandability and model or patterns (i.e. the 6-V model and business model patterns) are evaluated for completeness and level of details.

Evaluating the constructs and model can be done qualitatively by comparing and positioning the constructs and models or patterns to the existing business model literature in order to be able to show which domains are covered and which are not and this is an indicator of completeness. This is achieved by identifying similarities and differences and arguing why the developed constructs and model or patterns advances business model research. We could argue that our thorough literature review as illustrated previously in Sections 2 and 4 (Table 4) show that our research outputs are complete compared to all the

Table 8
Business model literature compared.

Literature	6-V model	Osterwalder model	Shafer model	Hamel model	BM4LOGD
Value network	✓	✓	✓	✓	
Actors	✓	✓	✓	✓	✓
Supporting infrastructure	✓	✓	✓	✓	✓
Value proposition	✓	✓			
Offer	✓	✓	✓	✓	✓
Channel	✓	✓			✓
Value	✓	✓			
Value adding process	✓		✓		
Operational	✓	✓	✓	✓	✓
Strategic planning	✓	✓	✓	✓	✓
Knowledge mngt.	✓				
Value in return	✓				
Volume of sale	✓				
Income	✓	✓			✓
Future income opportunities	✓	✓			
Value capture	✓		✓		
Market size	✓		✓		✓
Profit/margin model	✓		✓		
Value mngt. model	✓				
Discipline	✓				
Governance	✓				
Structure	✓				
Administration	✓				

existing literature in the domain area. In addition, it also shows its uniqueness in covering all the business relevant issues/components. Table 4 as well as existing business models (Hamel's business model and Osterwalder's business model) presented in Section 2 of this study illustrate that the developed constructs and the 6-V business model components are all covered in existing literature. For example, Hamel's business model (Hamel, 2000) covers main components and but stays relatively ambiguous on their description. Osterwalder's business model presents the nine main blocks of a business model however it does not cover other main components and lower-level components. In addition, Osterwalder's model did not cover relationships between components. The 6-V business model described here consolidates constructs across existing models. Thus the 6-V model subsumes existing ones. Its main improvement compared to other models is that it cover all the relevant components of a business model and provides the relationships between the main components through a modeling approach. With respect to the business model patterns and value disciplines as one of our research output presented in Table 7, no literature exist that covers business model patterns and open data business value disciplines therefore, comparison of patterns and value disciplines with existing literature on open data business models is essentially not possible however, our in-depth analysis of the existing literature on both domains can validate completeness and level of details of the patterns and value disciplines.

Table 8 shows comparison between 6-V model components and second-level sub-components with the highly-cited models such as Osterwalder model, Shafer model, Hamel model and BM4LOGD (Archer, Dekkers, Goedertier, & Loutas, 2013) model. We use '√' to indicate what components and sub-components of 6-V model are covered by these models.

8. Discussion

Several authors have attempted to represent business models in different ways. While some of the components of these business models are similar, a few are peculiar to the different models. For example, the existing models such as Hamel (2000) and Shafer et al. (2005) models captured some core components. Consequently, the conceptual model (6-V) we have developed which is the consolidation of existing business models captures all the components of business models in a relatively complete sense. It enables businesses to have a complete understanding of business model components and their relations. While some may argue that the 6-V model and Osterwalder and Pigneur (2009) are very similar, our 6-V model shows the dependencies and relations between components which are not available in the other models.

Furthermore, there is significant paucity of scientific literature on the data industry and ODBMs, making it an emerging domain. Existing models were not discussed in terms of the model components. In our opinion, there are also a number of ambiguities in the semantics of open data business models. For example few literatures claim that the notion of ODBMs are synonymous to revenue model, pricing strategy, distribution model, marketing techniques and architectural model (Bekkelund, 2011; Mai & Zhang, 2011). A careful review of definitions, meanings and use of these terminologies suggest that they are different. We have attempted to reduce these ambiguities by providing concrete definitions for these related terms.

We have successfully characterized each of the existing models using the 6-V model components (see Table 5). Our contribution here is in elaboration and complete description of otherwise incomplete specification of revenue models to produce 15 ODBMs. In addition, our findings also include five categories of ODBMs. This finding is particularly based on the analysis of the characteristics of each ODBMs (see Table 5). Our categorization shows that *Freemium* and *Premium* categories are the richest in terms of the number of

ODBMs they accommodate. This is mainly due to the simplicity of these models supported by significant experience in other domains. Besides, the revenue model of these two categories are similar when the product is offered free of charge and extended when product is offered under *Premium*.

Our ODBM Categories assist open data businesses to determine their choices of business model. For example, supposing a Business X is willing to adopt the *Premium* model, our categorization offers different value disciplines to drive the model (five from *Usefulness* and one from *Customer Loyalty*) to select from (see Table 7).

Given the centrality of value disciplines in any business, we have also identified four value disciplines for open data business: *Usefulness*, *Process Improvement*, *Performance* and *Customer Loyalty*, which can assist them to achieve these objectives. These value disciplines complement well-known ones in traditional businesses – *Operational excellence*, *Product leadership* and *Customer intimacy*. ODBMs categories in conjunction with the value discipline categories assist businesses to come up with the right model for their business.

However, to successfully develop an open data industry, Government plays a major role. Apart from providing the main input (open government data) for this industry, government is expected like in other industries to develop sound policies to support its growth. To enable the growth, governments need to develop capabilities, strategies and regulations to support businesses. Government capabilities such as 1) technical infrastructure for providing high quality data (via models such as Demand-Oriented and Supply-Oriented Platforms); 2) regulation supporting use and re-use of data and monitoring pricing of data; and 3) the provision of data in formats that can be allow re-used to facilitate independent analysis and identifying government policies to enhance the transparency and confidence in government.

In addition, according to the Resource-Based View, it is very essential for a business to lie primarily in the application of a bundle of valuable tangible or intangible resources and this can be divided into resources and capabilities. In open data industry where open data is the rich and very fundamental resource, governments must reduce supplier power and support to ensure availability, accessibility and quality of open data at very low or at no cost. In order to support this, government can provide a framework to support fare negotiation for providing open data to businesses. Governments can also provide participatory approach to engage communities to assist in providing and improving the data. In addition, according to the Theory of Competition, government can play a significant role in success of open data startups and small businesses by providing required guidelines, recommendations, infrastructures and free quality data.

Despite the fact that there is more than enough literature in open data and generic business model and our attempt to rigorously present and objectively organize the received literature on business models and open data, this review comes with several limitations. First, very limited articles exist covering ODBMs. Second, contributions in ODBM are yet to appear in major conferences and journals. Third, researchers claimed that the existing ODBMs are not ODBMs but revenue models, pricing strategy, distribution model, marketing techniques and architectural model (Bekkelund, 2011; Doligalski, 2010; Mai & Zhang, 2011). Fourth, most business models discussed in the business model literature are the outcome of the researchers' perception. Fifth, application of ODBM varies from country to country due to the different business environment, for instance with respect to available resources. Sixth, ODBM contributions/Impact for emerging new open data businesses/start-ups. Seventh, ODBM main components specifications for new open data businesses/start-ups/entrepreneurship. Future research should seek to overcome these limitations. More specifically, we should be able to establish clarity and give answer to the fourth and fifth. However,

there is a need to study and develop the theoretical foundations of the business model and/or ODBMs as well.

9. Conclusion

All businesses, either explicitly or implicitly should employ a particular business model. Similarly, open data businesses must utilize ODBMs. The first and foremost activity of emerging businesses is to identify the value discipline before identifying a particular business model. This particular research field; open data business value disciplines; is missing and literature on ODBMs is also very limited to some number of websites and presentation files. Besides, in regard to business models, various scholars present generic business model differently.

Our research findings clearly answered to the aforementioned problems both at the research and business levels. We also confess that the conceptual business model (6-V), core ODBMs patterns – *Freemium, Premium, Cost Saving, Indirect Benefit and Parts of Tools* – and new open data business value disciplines – *Usefulness, Process Improvement, Performance and Customer Loyalty* – contribute significantly to business model and ODBMs literatures and assist not only start-ups and SMEs but also big businesses to deliver full value to their stakeholders.

This study provides insight to governments and government authorities by providing knowledge of importance of availability and accessibility of open data for innovation and transparency. This allows more businesses and development of open data products like APIs. For example, with a focus on realistic local solutions, initiatives like CitySDK are working with pilot cities to create uniform APIs that have standard approaches to how APIs expose local government data. Therefore, governments have a new way of saving and making money by becoming a provider for the city. By opening the data, governments let city (businesses and developers) to create products. Governments can also establish partnership with private sectors to benefit. Therefore, governments should seek to identify how publishing open data can be done in a way provides value to general public and facilitates the development of both free and commercial products.

Appendix A

A.1. Premium

In the premium business model, the offering is high end products and services. The customer willing to use the product or service has to pay. Brand image is an important factor in the premium business model, as quality is often a subjective matter. This business model seeks a higher profit margin on a lower sales volume (Ferro & Osella, 2013; Huber, 2011). The use of this model in the open data industry entails publishing data in a complete form for a fee (Ferro & Osella, 2013; Howard, 2014; van der Aalst, 1992; Zeleti & Ojo, 2014).

A.2. Freemium

In this business model, the product (i.e. data) is given away for free (MAHLER, 2015). The main idea is that customers are hooked on the free product and then subsequently converted into paying customers (Teece, 2010). In the open data industry, data is published in a basic form; data with some limitations on formats; and offer advanced access to data to those who are willing to pay. For those who pay the freemium price will receive enhanced data (e.g. data in different format, unconstrained numbers of API calls, more sophisticated querying, and early access to data). In addition, loyalty is important to maintain the free users who understand the value of the service and are therefore willing to opt for the paid version (Edogbanya, Sule, & Sule, 2013; Email, 2012; Ferro & Osella, 2013;

Howard, 2014; Huber, 2011; Musings, 2012; Mai & Zhang, 2011; Objectives; Segal, 2003; Tjia, 2003).

A.3. Open source

This model is inspired by the open source model in software industry, where a product is developed by programmers who create freely distributed source code by collaborating and communicating over the Internet (Välimäki, 2003; Wilson & Appiah-Kubi, 2002). This business model takes place on top of products, services, or simple unpackaged data that are provided for free and in an open format (Ferro & Osella, 2013). Data is provided in a totally open format that allows free elaboration, usage and redistribution without any technical barrier (Ferro & Osella, 2013). The distribution of data is governed by an “open source”-like license (Wilson & Appiah-Kubi, 2002). By exposing company data to the public, this model implicitly improves the quality of the data collected by regulatory bodies (Ferro & Osella, 2013; Howard, 2014; Spencer, 2009; van der Aalst, 1992).

A.4. Infrastructural razor & blades

A razor-blade business model is about selling a product for a low price in order to generate revenues from the complementary products (Nelson, 1999; Pietersz, 2013; Spence, 1976). In the open data industry, datasets are stored for free on cloud computing platforms being accessible by everyone via APIs (“razor”) while re-users are charged only for the computing power that they employ on-demand in as-a-service mode (“blades”). This business model exhibits another case of cross-subsidization whereby profits accrued from the provision of on-demand computing capacity cover costs attributable to the storage and maintenance of data. However, application of this model is limited to contexts and domains in which the computational costs are significant (Anderson, Britt, & Favre, 2007; Bacidore, Boquist, Milbourn, & Thakor, 1997; Ferro & Osella, 2013; Howard, 2014).

A.5. Demand-oriented platform

This model involves charging data consumers (e.g. developers) the added value such as advanced services and refined datasets or data flows provided upon the original raw open data. Platforms owners enable easier access to the data resources stored on proprietary servers having high reliability. Once collected from source, “datasets are then cataloged using metadata, harmonized in terms of formats and exposed through APIs, making it easier to dynamically retrieve data in meaningful way. This approach commoditizes and democratizes data. In addition, the business may reap the benefits given by the “one stop shopping” nature of such platforms: they may resort to one supplier and access a variety of information resources through standardized APIs – even beyond the borders of the PSI – without having to worry about interfaces connecting to each original source. This “procurement” approach is crucial to minimize search costs and, by consequence, transaction costs. To sum up, re-users are charged according to a freemium pricing model that sets the boundary between free and premium in light of feature limitations” (Ferro & Osella, 2013; Howard, 2014).

A.6. Supply-oriented platform

This business model entails the presence of an intermediary business actor having an infrastructural role. Contrary to the previous case, according to this logic data holders or suppliers are charged in lieu of developers. In fact, the enabler, following the golden rules of two-sided market, fixes the price according to the degree of positive externality that each side is able to exert on the other one. Consequently, this approach is beneficial for both sides of the resulting arena: from

developers' perspective, their barriers are wiped out (i.e., they can retrieve data without incurring cost) while, from the governmental angle, public sector information or data holders become platform owners taking advantage of some handy features such as cloud storage, rapid upload of brand-new datasets by public employees, standardization of formats, tagging with metadata and, above all, automated external exposure of data via application programming interface (APIs) and GUI. Public agencies engaging in such programs establish long term relationships with providers and are required to pay a periodic fee that depends on the degree of sophistication characterizing the solutions purchased and on some technical parameters" (Ferro & Osella, 2013; Howard, 2014).

A.7. Free, as branded advertising

The main aim of this model is to encourage an audience towards a brand or a company. Businesses applying this model deliver commercial messages through visualized data which is also called "display advertising". This model will provide the customers with the services of general usefulness. Services offered in this way have a positive effect on economy. The rationale fuelling this "enlightened" business model is twofold. Firstly, it may be based on a powerful advertising boost that leads the company to consider the cost as a promotional investment in the marketing mix. Secondly, it seems to be very convenient in the presence of zero marginal costs, a situation that occurs when the costs of distribution and usage are not significant (Ferro & Osella, 2013; Howard, 2014).

A.8. White-label development

A white-label product is a new product or service developed by one company but acquired and rebranded by another as theirs. This model enables the opportunity for the business to use its capabilities and competencies to build a new product or service for acquisition by another. In this model the company or business has the control over how much to charge (Hill, 2013). Moreover, White Label Apps save development time, budget or offer chance to make money (Ferro & Osella, 2013; Howard, 2014).

A.9. Cost avoidance

This model reduces the cost of data publishing by having a sustainable publishing solution. It is common for the same data to be published a number of times and in different formats meeting the needs of different customers. Publishing as open data enables "Publish once, use many times". The model reduces the overall burden of publication therefore, choosing to publish the data as linked data can significantly reduce the overall data publishing costs (Epimorphics Ltd, 2012; Musings, 2012). Finding sponsor for publishing open data is the reverse of cost avoidance (Musings, 2012).

A.10. Sponsorship

This model entails giving the product for free to customers and obtaining revenue from some sponsors. To attract sponsors, business needs to convince its customers to provide something to the sponsors in return (Casadesus-masanell & Zhu, 2011; Teece, 2010). In the data industry, sponsoring entities to set up an open data publishing program is more essential than sponsoring people to publish a snapshot of their data. This provides them the financial resources they need and the process that is cheaper to run than their current process. The data that is published as open data is exactly the same data that is used internally within the department, thus there is no additional task (Epimorphics Ltd, 2012). If there are people who strongly believe that a particular dataset should be open they may want to sponsor its publication.

They can pay for the data to be made open, for their own reasons (Musings, 2012).

A.11. Dual licensing

Dual licensing is based on the idea of simultaneous use of both open source and proprietary licenses (Välämäki, 2003; Wilson & Appiah-Kubi, 2002). This means that data are published in an open license for certain purposes and under a closed license for others. This technique has worked for some open source products. The 'certain purposes' might not be simply 'non-commercial'; publishers could still encourage start-up use of the data by charging based on the size or revenue of the organization. Alternatively, the license could state that the data can be used in products but cannot be used in further "added value" data feeds without being licensed (Musings, 2012; van der Aalst, 1992).

A.12. Support and services

In the open data industry, data publishers could offer paid packages with guarantees on data availability; prioritization on bug fixes (both in data and its provision) for paying customers; timely help for customers using the data; services around data visualization, analysis and mashing with other data. These kinds of services tend to be coupled with licenses in the data world, whereas in open source they have been successfully disentangled (Abiodun, 2011; Musings, 2012).

A.13. Charging for changes

In this model, individuals or organizations are obliged to provide information to public bodies so that the information is available within government and in society. Public bodies who receive the information can charge the providers of the information 'administration costs'. An example of this is VAT registration. In such cases, those who supply the information to the register are bound to by law, so it would be possible to charge them whatever it took to support the provision of the data as open data. Indeed, supplying the data as open data is likely to increase its usage (both within government and more widely), and therefore the political pressure to retain the registry and thereby maintain its longevity (Musings, 2012).

A.14. Increasing quality through participation

This model involves increasing participation and satisfaction of the customer with the goal of generating higher margins, either by increasing revenues or by reducing costs. In the model, customers are considered as the producers of the network externalities to enhance the value proposition without being involved in the value adding process (Angot, 2010). In addition, this model involves engaging other parties who would benefit from having up-to-date data to participate towards increasing the quality of the data published. There are any number of potential contributors, including publishers, lawyers, academics, and government itself.

A.15. Supporting primary business

This model is used when releasing open data naturally supports the primary goal of a business or organization. For instance releasing open data can heavily contribute to the development of value-adding apps by other businesses or developers (Musings, 2012). Organizations that publish the data can also use the data to improve its own use of its data by using the third-party tools that are created. There is a great opportunity for the public sector to create a market place for tools that enable it to work more efficiently, by opening up its data.

Appendix B

B.1. Components of business model

Context	Lambert, 2008	Shafer et al., 2005	Hamel, 2000	Sandberg, 2013	IBM Bus. Cons., 2005	Goelbals, 2009	Casadesus & Ricart 2010	Boons & Ludeke, 2013	Chesbrough & Rosenbloom, 2002	Klievink & Janssen, 2012	Demil & Lecocq, 2010	Chesbrough & Rosenbloom, 2000	Tece, 2010	Brettel et al., 2012	Massa, Zott, & Amit, 2010	Osterwalder, 2004	Wikström et al., 2010	Klievink & Janssen, 2012	Morris et al., 2--5	Callia et al., 2007	Lambert and Davidson, 2013	Boons and Ludeke-Freund, 2012	Casadesus and Ricart, 2009	Casadesus and Zhu, 2011	Bonina, 2013	Ludeke-Freund, 2009	Pfe et al., 2008	Janssen and Züderwijk, 2014		
Value Network																														
Customer	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Customer Relationship/Interface	x													x						x								x		
Information Flow	x						x		x									x	x											
Product Flow	x				x		x												x											
Resource Flow																														
Service Flow		x	x					x												x										
Supplier (Supply Chain)	x	x	x					x	x		x	x			x	x	x		x		x	x			x				x	
Logistical Stream															x														x	
Partner Businesses	x		x					x			x	x			x	x	x		x	x							x	x	x	
Value Proposition																														
Product	x	x						x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Service	x	x			x			x	x	x	x	x			x	x	x													
Channel/Delivery method	x	x		x	x				x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Information	x	x	x								x																			
Price/Money for the Value	x	x			x				x	x		x			x	x	x	x												
Value Adding Process																														
Activities	x			x	x					x					x	x	x												x	
Technologies/Systems	x	x	x					x	x						x	x													x	
Resources/Assets	x	x	x		x	x				x					x	x													x	x
Market/Segment/Positionin	x	x	x						x			x	x		x	x													x	
Geographical Expansion				x																										
Logistic Systems				x																										
Competencies	x	x	x	x					x		x				x		x												x	
Capabilities	x	x		x					x						x	x	x												x	
Capabilities	x	x		x					x						x	x	x												x	
Profit Formula									x						x															
Profit model/stream																														
Financial Model	x								x																					
Revenue Model	x		x	x	x				x	x					x	x	x	x											x	
Renvenue Sources, Stream and Mechanisms	x														x	x													x	
Pricing mechanisms																														
Competitors	x																													
Internal Value Chain Structure																														
Cost Structure and Pricing	x		x						x		x	x	x	x	x														x	
Branding	x																													
Networking/Resource Leveraging																														
Marketing																														
Differentiation	x	x	x																											
Legal issues																														
Mission	x	x																												
Innovation (Incremental/Disruptive)																														
R&D																														
Value in Return																														
Volume of sale																														
Revenue	x								x		x				x														x	
Advertising Space	x																													
Future Contracts	x																													
Rent	x																													
Commission	x																													
Value Capturing																														
Product Cost and Quality	x																													
Profit/Margin	x		x																											
Financial Performance																														
Value Management																														
Mind-Set and Dynamic Consistency																														
Organizational Structure																														
Governance																														
Administrative Processes																														

Appendix C

C.1. Logistic system

Logistics system is part of the supply chain. The aim is to plan, implement, and control the flow and storage of products, services, and information between the point of origin and the point of consumption in order to meet customer requirements (van der Aalst, 1992).

C.2. Competencies and capabilities

The ability of both individuals and business facilities and instruments to handle and carry out a responsibility or a task (Zeleti & Ojo, 2014).

C.3. Profit model

Profit model is an algebraic model used to structure modeling cost elements such as materials, losses, multi-products, learning, depreciation etc. Starting with, profit equals sales minus costs (MAHLER, 2015).

C.4. Revenue model

Revenue model is a framework that represents how revenue can be generated in a business. It identifies which revenue source to pursue, what value to offer, how to price the value, and who pays for the value (Teece, 2010).

C.5. Financial model

Financial model is a mathematical representation of key financial and operational relationships. It is used in analyzing how business will react to different economic situations. The model is usually characterized by performing calculations, and makes recommendations based on that information. The outcomes are all action-related: deciding, reporting, analyzing, valuing and risk assessing — these are just some of the outcomes of financial modeling (Tjia, 2003).

C.6. Revenue or income

Revenue or income is an increase in net worth resulting from a transaction. There are different ways to generate revenue. One is the sales of products and services (Edogbanya et al., 2013).

C.7. Profit

Profit is the income the business has received from its trading activities. Another word, profit is a financial benefit that is realized when the amount of revenue exceeds the expenses, costs and taxes needed to carry out the activity. Profit acts as an incentive mechanism for business investment. Higher profits provide incentives for business growth.

C.8. Pricing mechanisms

Price mechanism refers to the price mechanism is a system of determination of prices and resource allocation. It is the buyers and sellers who actually determine the price of a product or service (Segal, 2003).

C.9. Value chain

Value chain includes a set of activities business must undergo to generate value for their customers (Zeleti & Ojo, 2014).

C.10. Cost structure and pricing

Cost Structure refers to the types and relative proportions of fixed and variable costs that a business incurs to operate a business model. Emerging BM for OD Industry (Objectives; Segal, 2003).

C.11. Branding and marketing

There is a difference between Marketing and Branding. Branding is strategic but, Marketing is tactical. Brand, is ultimately what determines if a customer will become a loyal customer or not while Marketing is a practice to convince potential customer to buy a particular product or service (Email, 2012).

C.12. Networking and resource leveraging

Recourse leveraging via different networks is the process of creating or seizing an opportunity and pursuing it by the use of networks to access external resources and pursue competitive advantage (Wilson & Appiah-Kubi, 2002).

C.13. Differentiation

Differentiation is one of the functions of the market system. Product and service differentiation involves a set of real economic choices because there are increasing returns or declining average costs in the development, production, marketing and distribution activities of the firm (Spencer, 2009; Spence, 1976).

C.14. Advertising space

Advertising is defined as any form of communication to current or potential customers. Adequate method of advertising will increase the number of customers and eventually, volume of sales increases (Nelson, 1999).

C.15. Product cost

Product cost refers to the costs used to create a product. Product cost also includes direct and indirect costs of making the product. These costs include direct labor, direct materials, consumable production supplies, and factory overhead (Objectives).

C.16. Financial performance

The ability to perform and evaluate the financial position of a firm. This includes number of activities such as choosing a supplier or partner organization, knowing how much capital to be invested, considering a strategic partnership and trying to work out how much credit to extend to a customer (Bacidore et al., 1997).

C.17. Supply chain

The sequence of processes, people, activities, information and resources involved in the designing, making, and distribution of a product and service to customers (Anderson et al., 2007).

C.18. Mind-set and dynamic consistency

Dynamic consistency demands that a decision maker's preferences over contingent plans agree with his preferences in the planned-for contingency (Hill, 2013).

C.19. Volume of sale

This is used to measure the amount of the product being sold at a given point in time. This is commonly used as well with products but it could be as used within a service company (Abiodun, 2011).

C.20. Future income opportunities

Various ways business can have additional income. Examples are advertising space and contracts with new customer and supplier.

C.21. Supporting infrastructure

There is no unique definition of this term in business literature. We define it as network relationship, services and supplies needed to sustain a business in its day to day operations. This may include communication and relationship with customers and suppliers, supply chain, and logistic system.

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