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Design of B2B E-Commerce Business Models: A Configuration and Design-Science Perspective

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Abstract

This paper investigates how configuration theory and design-science approaches inform the design of B2B e-commerce business models. The approaches were believed to provide new insights on the relationship between the business model dimensions and their configuration. The design-science methodology involved conceptualising a business model artefact (i.e. a framework) based on literature, which was refined using an in-depth case study of a pharmaceutical firm that recently went through a B2B e-commerce business model re-design process. Through integration and validation of the artefact's dimensions using the case study, it was found that a pharmaceutical firm's business model can be expressed in terms of four dimensions (value creation, value delivery, value capture, and customer) and that these are linked via a dynamic value proposition that is defined in terms of tangible, intangible, and their respective monetary value flows. It was further found that each business model dimension possess capabilities that influence the configuration of each of the value proposition's flows in terms of five properties (volume, velocity, veracity, variety, value). These insights address the knowledge gap related to classification of value exchanges and their interdependencies within pharmaceutical businesses through a business model perspective. They further provide a foundation for exploring the relationship between the individual business model dimensions and contribute to e-commerce business model literature by highlighting its reconfigurable elements in a detailed and coherent way. For practitioners, the findings provide a set of properties for the (re-)design of the value proposition and facilitate the identification of opportunities for improved value generation by the overall business model based on a binary (configured/not-configured) approach. To the author's best knowledge, this is the first study to view the value proposition concept as a dynamic mechanism that links, and is influenced by, the individual dimensions of a business model.

Keywords: Business Model(s); Configuration; Design-Science; B2B; E-Commerce

1 Introduction

Business model domain is an exciting area for research in both, academia and practice (Wirtz et al., 2016). This is because the relative newness of the field (e.g. vs more established fields like business strategy), and the lack of consensus on the definitions and applications of the concept, still leaves a lot of room for unexplored knowledge (Teece, 2010). One such area for further exploration was identified to be how alternative academic lenses, such as configuration thinking and design-science, could improve our understanding of business models and their design.

2 Research question and knowledge gaps identification

The question to be addressed by this paper was established to be as follows: how might configuration theory and design-science approaches inform the design of B2B e-commerce business models? The problem of "business models" was first recognised during a series of "Business Model" research workshops at the University of Cambridge. During the workshops it was established that there was still a disagreement on the definition of the concept, and that *"there is a need for firms to better understand their current business models through business model mapping/design frameworks"*. Another participant suggested that *"such business model design frameworks could help identify hidden value in firms, for example by mapping and revealing the flow of money within the business models"*. To confirm the relevance of pursuing research in the business model domain, additional systematic literature review was conducted. In that process, two additional questions (a, b) emerged based on the identified knowledge gaps: (a) *What are the dimensions of a business model (from a design-science perspective)?* The literature review process has shown that there remains a wide range of definitions and interpretations of the business model concept (e.g. DaSilva and Trkman, 2014). With this in mind, this research identified Massa's et al. (2017) proposition as relevant, which involves the need to define an interpretation of the concept (and its dimensions) that is applicable and relevant to the given research context. (b) *What is the mechanism through which the business model dimensions interact with each other?* The literature review has also shown that the way the dimensions of a business model interact with each other was not understood (Foss and Saebi, 2017). Moreover, among the common academically-derived dimensions that can constitute a business model, the "value proposition"

dimension has not been examined in detail; and this research hypothesized that it is that dimension that could potentially explain how the other business model dimensions interact with each other.
In the process of identifying the above sub-questions, relevant context for addressing the problem of "business models" was also established. Reviewing Lin et al. (2011), as well as having further discussions with academics, have suggested to explore (from a business model perspective) how healthcare organisations adopt e-commerce platforms and interact with each other (as business-to-business or B2B). The relevance of conducting this research in the healthcare context was further supported by Narayana et al. (2014), who found that there was a need to understand the elements of (value) exchanges within pharma businesses, in terms of information, materials, and finances, and how they interact with each other. At the same time, configuration theory (Miller, 1996) was confirmed as relevant to inform this research, due to the theory's successful application in the context of operations (e.g. Srai and Gregory, 2008), which would potentially help explain how certain dimensions interact with each other, and the theory's emerging application in business model research (e.g. Kulins et al., 2016).

3 Solution artefact conceptualisation

A design-science approach (Dresch et al., 2015) was utilised to conceptualise a solution artefact (i.e. a framework) to address the identified questions. First, the artefact's core dimensions were established based on literature, which suggested that a business model can be defined as the logic behind creating, delivering, and capturing value through a specific value proposition being offered by an organisation (or an individual) to a customer (e.g. Richardson, 2008). Following this, the artefact's core dimensions were established as shown in Table 1.

Table 1. Business model dimensions adapted from literature.

(1) Value creation	Capabilities/configuration of the organisation to create a value proposition using its resources
(2) Value delivery	Ability to deliver the value proposition, while meeting and supporting customer's requirements
(3) Value capture	How the firm captures (and distributes) its revenue and profit
(4) Customer	The intended customer or user of the value proposition
(5) Value proposition	What the organisation delivers to its customers (products/services); why they pay for it

The second stage of the artefact conceptualisation was concerned with understanding how its core dimensions can be linked together in a logical way. Following a review of configuration and network theory, it was found that "value networks" exhibit parallels to business models in a sense that they also generate value for particular stakeholders (De Reuver, 2009). Value networks do so by exchanging "value flows" among its "nodes". This logic was applied to link the previously identified dimensions (1-4) through the flow of the value proposition (5) to create a first version of the artefact. The initial visualisation of the proposed artefact was derived from Browne and Zhang's (1999) visualisation of an "Extended Enterprise", in which material, information, and technical flows link various actors responsible for value delivery (e.g. manufacturer, supplier). Browne and Zhang's visualisation has also prompted to view the "value proposition" more granularly, and that instead of it being a single flow, it could be broken down to tangible (physical products), intangible (services), and monetary (finance) flows[1]. The reviewed literature also implied that for the "nodes" of networks to generate value flows, "value-generating" capabilities must be in place (Håkansson and Johanson, 1992). But, given the wide range of possible capabilities that could enable value generation, it was deemed unfeasible to identify all of them. Instead, it was found that such capabilities could be expressed more simply, using the supply-chain logic, in which value is created by processing inputs into outputs (Chan and Ngai, 2011). This logic led to grouping the capabilities within each of the four business model dimensions into three categories: input, processing, and output capabilities ("IPO" capabilities), which in return generate the value proposition flows. Further building on the hypothesis that capabilities bestow certain "properties" on the value flows as they move from one dimension to the next, these properties also needed to be defined. Given the novelty of viewing a value proposition as a flow, no business model literature was found to assist with definition of such properties. However, expanding the scope to IS literature[2] (e.g. Grover et al., 2018) has led to adapting five value flow properties: volume, velocity, variety, veracity and value. The above led to the conceptualisation of an artefact shown in Figure 1, with the proposed properties captured below the figure.
The theoretically-derived conceptual solution artefact helped answer sub-question (a), providing a view of the key dimensions of a business model. The artefact also visually offered an initial understanding of the mechanism through which the business model dimensions interact with each other (i.e. the value proposition flow), thereby also providing a partial response to sub-question (b). However, the relevance of the conceptual artefact in answering the main research question needed to be understood and validated further. This was chosen to be done using an in-depth case study from the pharma sector. Additionally, the case would also help answer emerged "unknowns" related to the artefact, which are: (i) *how does the solution artefact help explain the aspects of value*

[1] Which has previously also been considered in other non-business model literature (e.g. Mentzer et al., 2001)
[2] Information systems literature was deemed relevant in this context, as business model research originally emerged from information systems research (e.g. Mahadevan, 2000; Timmers, 1998)

(proposition) flows and their interrelationship with the business model dimensions?; (ii) *how can a business model be configured while accounting for the interaction among its dimensions (using the solution artefact)?*; and (iii) *what is the method for utilizing the solution artefact in a practical context?*

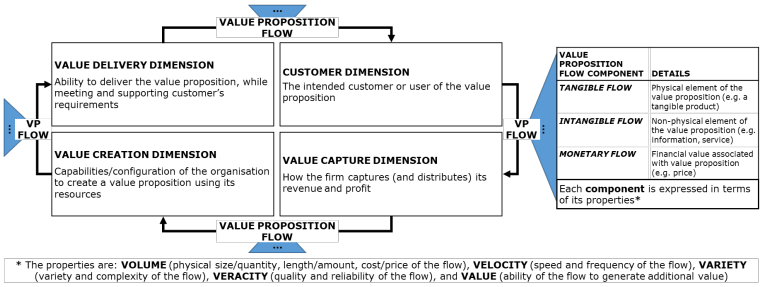

Figure 1. Visualisation of the conceptualised solution artefact.

4 Case selection and data collection/analysis methodology

In order to answer the research question and better understand the unknowns, while identifying ways to refine the artefact, a single-case study approach was utilised. Single-case approach, although often criticised for a lack of rigour, and its inability to provide sufficient evidence to make robust generalisations (Miles and Huberman, 1994), has recently seen support from researchers (e.g. Easterby-Smith et al., 2009). This is because in reality, even the minimum of eight cases to justify generalising a theory, as suggested by Eisenhardt (1989), cannot be statistically significant to achieve generalisation (Dubois and Gadde, 2002). In business model context specifically, single cases have been successfully used to generate high-quality research (e.g. Demil and Lecocq, 2010; Doganova and Eyquem-Renault, 2009). Nevertheless, selecting a case study organisation is still a critical step in ensuring quality of case research (Yin, 2009). This research aimed to find a solution to the problem of "business-to-business e-commerce business model design in the pharma sector", and to solve for it, a number of criteria[3] were considered. At the time of writing the paper, the selected organisation was the second-largest flu vaccine manufacturer globally. It was established as a result of a merger of assets from two other pharma firms, and will be called FluCo in this paper. FluCo now runs global operations in more than 20 countries with manufacturing plants in the US, UK, and Australia, and employs 1,900+ people. At the time of this research, FluCo was going through the process of introducing an e-commerce platform for its US business, intended to reach more of its customers, such as pharma distributors, hospitals, or healthcare professionals (i.e. doctors) in clinics. Having selected a suitable case study, the solution artefact was discussed and evaluated with stakeholders in FluCo, which resulted in additional refinements and questions for the artefact. Data collection involved interviewing 11 senior commercial and operations employees at FluCo for a total of 35 hours. The primary form of data collection method was with hand-written notes, while utilizing an interview protocol and a data gathering instrument (Figure 2a). The instrument included the key identified business model dimensions, and the five properties of the value flows. It was used to systematically capture the inputs from interviews that describe the properties of the flows as they move from one dimension to the next.

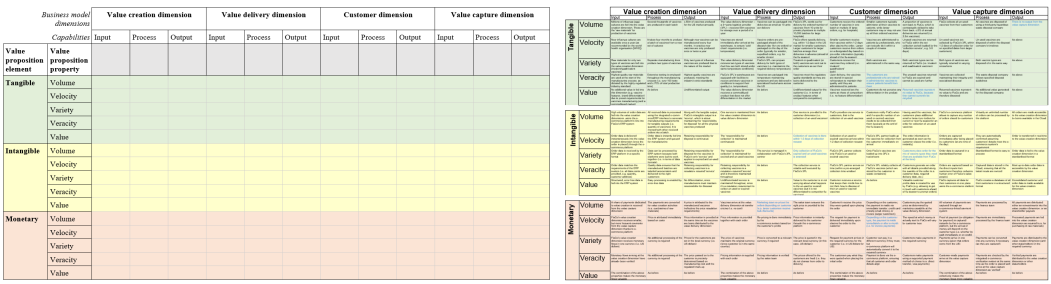

Figure 2. (a) Data gathering instrument; (b) completed master sheet with opps for re-configuration in blue text.

Main data analysis consisted of comparing and synthesising the 11 completed data gathering instrument sheets and summarizing the content on one master sheet (Figure 2b), which was then sent back to the interviewees for verification, along with questions that emerged during the data analysis stage. At the same time as the master sheet was shared with the interviewees for verification, the last five interviewees[4] were also asked to identify

[3] (1) the case organisation has to be primarily operating in the pharmaceutical sector; (2) it has to interact with other businesses/organisations (i.e. B2B), not with consumers; (3) it has to be mature, displaying experience in the sector to collect meaningful inputs; (4) it has to have an e-commerce platform in place at the centre of its "business model"; and (5) it has to be accessible to get sufficient info about the organisation's business model

[4] The five interviewees were picked due to their seniority (offering input that is grounded in more experience) and due to their availability

opportunities for "re-configuration" of the various value flows, i.e. identify those properties (e.g. velocity) that could be improved from a business model perspective. The data that was returned was then cross-referenced for patterns and those "re-configuration opportunities" that were mentioned by at least two of the interviewees were highlighted on the master sheet (in blue in Figure 2b).

5 Data presentation

The synthesised data of FluCo's business model is presented here along with additional questions that emerged from the interviews. Firstly, a synthesised view of FluCo's business model dimensions is expressed using the artefact in Figure 3. In the process of doing that, an additional question emerged as proposed by the interviewees: (I) *how does one account for value exchanges with external stakeholders within the proposed artefact?* Secondly, FluCo's value proposition was captured as an output of each of its business model dimensions by flow type (tangible, intangible, monetary) in Table 2. In the process of doing so, another question emerged: (II) *What is the monetary element associated with the intangible flow (e.g. what is the cost of collecting unused vaccines)?* Thirdly and finally, each flow type was captured at properties-level to provide full detail, as shown in Figure 2b. However, given the quantity of data captured, only a selected fragment is shown in this paper in Table 3. In the process of capturing that data, two additional questions emerged as proposed by the interviewees: (III) *Is the 'value' property of the monetary flow still meaningful in the context of business model configuration?*; and (IV) *What does each property tell us about its configuration*[5]*?*

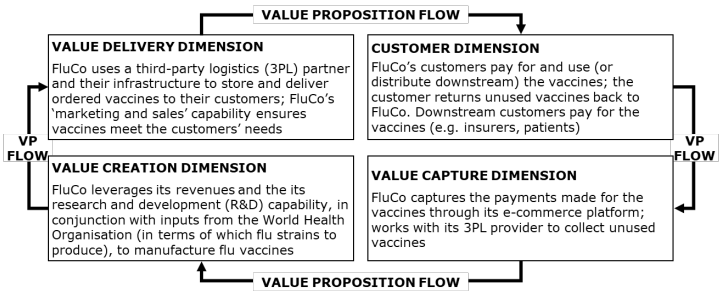

Figure 3. FluCo's business model expressed using the proposed solution artefact.

Table 2. FluCo's value proposition expressed using the proposed "value flows" view (as an output).

Flow type	Value creation	Value delivery	Customer	Value capture
Tangible flow output	A range of flu vaccines (e.g. quadrivalent vaccines, trivalent vaccines)	Flu vaccines that meet the customers' requirements (e.g. vaccine type)	Vaccines that have not been used by the customer, or those that expired	N/A, since returned vaccines cannot currently be recycled
Intangible flow output	FluCo remains responsible for disposal of unused or expired vaccines	FluCo remains responsible for disposal of unused or expired vaccines	Customer places orders for more vaccines (i.e. generating data)	The order data is forwarded to the value creation dimension
Monetary flow output	Specific price associated with each vaccine type (based on R&D, mfg costs)	Price that meets specific customer's requirements (w/ discounts)	Full-, part-, or invoice-(e.g. 1 month) payments for their vaccines ordered	Payments, reinvested into e.g. R&D or dividends

Table 3. Output of FluCo's customer as tangible, intangible, and monetary flows, broken down by property

Output	Volume	Velocity	Variety	Veracity	Value
Expired or unused vaccines	5% of vaccines (2.5 m) sent back to FluCo each year	Unused vaccines are returned to FluCo by the 'collection service' (3-5 days)	Both vaccines types can be returned to FluCo (i.e. trivalent and quadrivalent)	The unused vaccines returned to FluCo are expired and cannot be used any further	Returned vaccines represent no value to FluCo, because they cannot be recycled
Customer places orders for more vaccines (as information)	Customers place orders for current/ next flu season/or an order for collection of un-used vaccines	The order information is generated as soon as the customer places the order (instantly)	Customers place order for the mix of vaccine types they need (available from FluCo)	Customers generate an order with details provided (e.g. delivery date, etc.)	Valuable customer profile data is created for use by FluCo
Full- or part-payment for the order	Quoted price set by marketing capability at value delivery	Velocity of payment to FluCo will vary by customer type	Customers make payments in the required currency	Customers pay using a method of choice (e.g. transfer, card)	N/A

[5] How can we capture whether a property of an output flow is configured to meet the requirements of the input capability of the next dimension?

6 Discussion and solution artefact refinement

The collected data has suggested that the proposed solution artefact is capable of adequately expressing the business model of FluCo. It also prompted a number of questions (I-IV) to be considered for refining the solution artefact and helped uncover answers to the "unknowns" (i-iii) identified during artefact conceptualisation.

6.1 Discussion on the emerging questions identified during data collection

Emerging question (I): It was found that the artefact (as captured in Figure 3) did not consider FluCo's external elements, which each of the four dimensions exchanged value with in order to operate properly, such as those related to the inputs for the value creation dimension (e.g. World Health Organisation providing research inputs) or external value exchanges with the value capture dimension (e.g. 3PL collecting unused vaccines from customers and returning to FluCo). Based on that, it was suggested by the interviewees that the artefact could benefit from adding external dimensions to the extended visualisation.
Emerging question (II): Based on discussions with the interviewees, it was found that expressing the components of the value proposition flow in terms of only tangible, intangible, and monetary outputs was not sufficient (Table 2). Specifically, because when both tangible and intangible values are exchanged between the dimensions, each of the flows could be associated with its own monetary flow, as opposed to just one monetary flow accounting for both. This suggested that the value proposition should be a combination of four, instead of just three flow types.
Emerging question (III): Working through the properties of each value proposition flow type with the interviewees (in Figure 2b) suggested that the "value" property of monetary flows was redundant, as the "value" of the monetary components could arguably be expressed as the sum of their other properties.
Emerging question (IV): Having the interviewees review the properties captured using the artefact (Figure 2b) from a configuration perspective (i.e. viewing the properties as arrangements of elements that create efficient systems), allowed to uncover opportunities for business model reconfiguration. These were uncovered, because the artefact presented a comprehensive view with unprecedented visibility of the flows properties to identify flows that could be deemed "un-configured" (i.e. those flows that did not fully fit the requirements dictated by the business model dimension on the receiving end of the flow). An "un-configured" velocity property of a value flow, for example, could be a flow that reaches a dimension at a speed and frequency that is not suitable, as it would not be able to process the flow, because it flows too quickly. Within FluCo, a number of flows' properties were deemed "un-configured" by the interviewees, and as such, several opportunities for reconfiguration of the value flows were identified, for example to: (1) reduce the velocity (i.e. speed in term of days) of vaccine collection to reduce costs; and to (2) start collecting other medical waste products from customers for extra charge (related to the variety property). This has suggested that the proposed artefact offers a valuable approach to quickly identify opportunities for reconfiguration of a business model (specifically based on configuration rather than for example cost), as long as the properties of the value flows are considered from a "binary" configuration perspective (i.e. as either configured or un-configured properties).

6.2 Discussion on the "unknowns" identified during the conceptualisation of the solution artefact

Having identified potential refinements for the artefact based on questions emerged during data collection, it was necessary to understand how the "unknowns" identified during the conceptualisation stage could also be addressed.
Unknown (i): It has been shown that the proposed artefact can help explain the aspects of business model value flows at multiple levels. Firstly, validation of the artefact has demonstrated that a business model can be captured and expressed using four dimensions, all of which are interlinked by a value (proposition) flow. Secondly, the FluCo case has demonstrated that a value proposition flow can be captured as a combination of tangible, intangible, and their associated monetary flow types, which move from one business model dimension to the next. Thirdly and finally, the artefact offered a more granular perspective on each value flow type (vs existing academic frameworks) by establishing a set of properties that define these flows. Collectively, the above supports the hypothesis that a value proposition is a dynamic concept, which changes in terms of its flow types and properties as it moves from one dimension to the next, implying that there is a direct relationship between the value flow and the dimensions. This relationship and the value proposition's dynamic nature is in return facilitated by the various input-process-output resources/capabilities found within each of the dimensions, which define the properties of the flows. Unknown (ii): This unknown was answered as part of the emerging question (IV). Unknown (iii): In design-science terms, the proposed solution artefact could be defined as a model, which is a simplified representation of reality documented through a formal notation or language (Peffers et al., 2007). A model is typically supplemented by a method, which represents conceptual, yet actionable instructions for utilizing the model (Dresch et al., 2015). For this research, there was no formal design-science method in place for utilizing the artefact in the interviews, and it was simply guided by the interview protocol. However, a method was still developed (see Appendix) to support the model, based on reviewing the steps engaged in during the interviews.

6.3 Refined solution artefact and its dimensions

Inputs from the interviews generated refined definitions of each dimension (Table 4) and provided refinements for the initial concept of the artefact (Figure 1). The refined version (Figure 4) consists of four dimensions that are linked via a value proposition flow. It flows from one dimension to the next, and it can be expressed as a combination of tangible, intangible, and respective monetary flows, each of which can be defined in terms of five properties. These properties can be configured to fit the requirements of capabilities of each dimension.

Table 4. Updated definitions of the business model dimensions.

(1) Value creation: a set of input-process-output capabilities that work together to recombine the value flows received from the value capture dimension (e.g. recycled materials, usage data, money) in a way so as to generate value flows that fit the requirements[6] of the value delivery dimension that then prepares them for the customer, while accounting for the requirements[6] of the external nodes relevant to the value creation dimension (e.g. suppliers, data providers, fin. services)
(2) Value delivery: a set of input-process-output capabilities that work together to recombine the value flows received from the value creation dimension (e.g. product, service, price) in a way so as to generate value flows that fit the requirements[6] of the customer dimension, while accounting for the requirements[6] of external nodes relevant to the value delivery dimension (e.g. physical infrastructure)
(3) Value capture: a set of input-process-output capabilities that work together to recombine the value flows received from the customer (e.g. returned materials, demand/usage data, payments) in a way so as to generate value flows that fit the requirements[6] of the value creation dimension, while accounting for the requirements[6] of external nodes relevant to the value capture dimension (e.g. shareholders)
(4) Customer: a set of input-process-output capabilities that benefit from the value flows received from the value delivery dimension of the business model (e.g. a product/service at a particular price), as well as the flows from external nodes (e.g. additional product/service features not provided by the main business model) for which the customer then provides value flows in return (e.g. returned materials, demand/usage data, payments), to be captured by the value capture dimension
(5) Value proposition: the value proposition is a dynamic concept that changes as it flows through each dimension of the business model. The artefact expresses the value proposition as a combination of tangible, intangible, and their respective monetary flows, which can be configured in terms of five properties: volume, velocity, variety, veracity, and value. Each property can be either configured (C) or un-configured (U) to fit the capabilities of each dimension

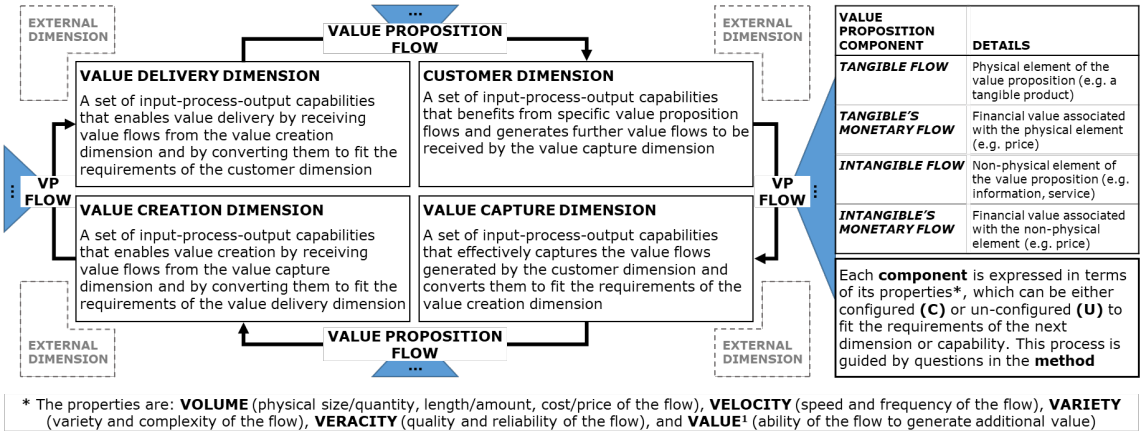

Figure 4. Refined solution artefact [Note (1): does not apply to monetary flows].

7 Conclusions

This paper set out to explore how configuration theory and design-science approaches might inform the design of B2B e-commerce business models. Interestingly enough, in the process of attempting to answer this question, a novel concept was developed that was not anticipated to play a major part in this research: a new view of the value proposition has unexpectedly taken a central role within this work, despite it having been taken for granted in its original ill-defined form in the existing business model-related literature for some time now. However, this deviation from the original research expectations was not entirely surprising, as it is an integral part of design-science's abductive method, which drives the generation of more creative propositions during the research process (Dresch et al., 2015). As such, the design-science approach has played a successful role in shining new light on what was asked in the main research question. Similarly, configuration thinking has also led to defining new elements of a business model that have previously not been considered in the business model literature. In answering the main research question, this paper also successfully tackled sub-questions (a) and (b) answers to both of which were defined in Table 4.

[6] i.e. requirements based on properties of the flows

7.1 Implications, limitations, and future research

Firstly, validation of the solution artefact's dimensions using the case study showed that a pharma firm's business model can indeed be expressed in terms of four dimensions, and that these can be linked via a dynamic value proposition that is defined in terms of tangible, intangible, and their respective monetary value flows. Secondly, the study showed that each business model dimension possess capabilities that influence the configuration of each of the value proposition's flows in terms of five properties (volume, velocity, veracity, variety, value) at each dimension. Thirdly, the findings address the knowledge gap related to classification of value exchanges and their interdependencies within pharma businesses (Narayana et al., 2014) through a business model perspective. Fourthly, the insights provide a foundation to explore the relationship between the individual business model dimensions and contribute to the pharma-related e-commerce business model literature by highlighting reconfigurable elements of a business model in a detailed and coherent way. And finally, the artefact enables comparisons to be made across different types of business models/propositions.

From a practical perspective, this research provides practitioners with a set of properties for the (re-)design of the value proposition (and as such, of the business model). In doing so, the artefact facilitates the identification of opportunities for potentially improved value generation based on a binary (configured/un-configured) approach.

The artefact does a satisfactory job of exploring the relationships between the dimensions of a business model, and how a change in one dimension can affect the other. However, where properties of the value proposition flows are considered, this research has not explored in detail the impact of change in individual properties on each other (e.g. how a change in velocity of the intangible value flow affects volume of its monetary flow). Future research could also develop specific configurational archetypes, following Miller (1996)'s view on configuration, by understanding the patterns those configurations of properties could fall into, and thus identify business model and value proposition archetypes, such as Srai and Gregory (2008) have done for supply network configuration archetypes. Finally, more cases would have improved the validity of the proposed artefact, and using cases from beyond pharma B2B e-commerce would have improved the research' generalisability to wider context.

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Appendix

Design-science method for utilizing the proposed artefact

1. Define the value proposition in terms of its value creation, delivery and capture activities, as well as who it is intended for (i.e. the customer)
2. Express the activities related to the defined value proposition at each of the four business model dimensions
3. Express the value proposition in terms of the four value flow types (i.e. tangible, intangible, and their respective monetary flows) at each dimension
4. Break up each value flow type (i.e. tangible, intangible, etc.) and express it in terms of its five properties at each dimension as they flow through the input, process, and output capabilities of the dimension; note down the key input, process, and output capabilities required to enable the value flows (four properties for the monetary flows)
5. Review the information captured in the tables and identify areas where the value proposition flows are un-configured – that is where a flow's property does not fit the requirements of the receiving capability (i.e. the input capability of the next dimension). Next, consider options to reconfigure them (e.g. change the underlying capability to make a 'fitting' flow, or remove the flow entirely). Questions to ask at each dimension to test this could include:
    a. *Does the value proposition (i.e. product, service) flow in the right quantity and at the right cost/price?*
    b. *Does the value proposition (i.e. physical product, service, payment) flow at right speed/frequency?*
    c. *Does the value proposition (i.e. physical product, service, payment) flow in right composition/type/format?*
    d. *Do the value proposition flows meet the quality and reliability requirements of the receiving dimension?*
    e. *Do the value proposition flows meet the value expectations of the receiving dimension?*