Creating Agility in Traffic Management by Collaborative Service-Dominant Business Engineering

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Abstract. Traffic management is a business domain characterized by an infrastructure-dominant approach to new developments: the focus is typically on innovating assets such as traffic detection systems, road signage and traffic information systems. This domain also has a large number of involved stakeholders, such as road authorities, municipalities, technology providers and road users of various kinds. Faster changing traffic management requirements and increasing complexity of the collaborative networks required to meet these requirements render traditional approaches to business design in traffic management too rigid. We have applied collaborative, service-dominant business engineering to prototype a basis for new levels of business agility in multi-stakeholder traffic management. Collaborative workshops have shown to be a useful means to quickly arrive at agile, customer-centric business models that allow decoupling from long-term infrastructure considerations. This paper demonstrates that service-dominant business engineering can be effective in an asset-dominant domain to increase business resilience in complex environments.

Keywords: Service-dominant business · Collaborative business network · Business model · Traffic management

1 Introduction

Like most large cities, Amsterdam is characterized by extensive road traffic problems. These traffic problems are bad during daily rush hours, but reach their worst peaks when large events are held that attract large volumes of traffic in a small window of time in a specific area of the city. Examples of these events are major soccer matches and large rock concerts – or even the combination of both. The southeast section of Amsterdam is a location where a number of large event locations is clustered and that consequently meets these traffic problems at a regular pace. To try and counter these problems collaboratively, the main involved stakeholders have joined in the PPA/ZO project: the practice trial for traffic management in the southeast of Amsterdam. A large

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variety of stakeholders is involved, both of the public, the private and the individual kind. The public kind includes the city of Amsterdam, the province of North-Holland and the Dutch road authority. The private kind includes several event locations in the city section, organizers of events at these locations, local retailers, parking providers and transport providers. The individual kind is formed by individual road users, both car drivers and other users influenced by car traffic.

Traffic management is a business domain that is traditionally characterized by an infrastructure-dominant approach to new developments. The focus in innovation is typically on developing and realizing new assets such as roads, traffic detection systems, road signage, and traffic management information systems. This asset-dominant orientation has two main drawbacks. Firstly, the assets are typically very costly to develop and deploy, which means that they must be designed for strategic, long-term use. This long-term approach is, however, hard to combine with much faster changing user requirements, which are strongly related to emerging transport patterns. Organizations developing or deploying the assets observe the situation from their own, isolated perspective. Secondly, the end users of traffic management solutions are not interested in the characteristics of the individual assets, but in the added value that the use of combinations of assets brings them. As an example, car drivers are not so much interested in algorithms that determine traffic information on roadside signage, but in travel time reduction that they may realize by any means of traffic management. The fact that there are multiple groups of end users (private drivers, professional drivers, institutions that need to remain accessible, the city that wants to uphold a good image) further complicates the situation. Consequently, there is a problem in the design of multi-stakeholder, collaborative business models in this traffic management context.

To try and counter this problem, we have introduced service-dominant business engineering as a new approach to collaborative business model design in the traffic management arena. To do so, we have applied part of the BASE/X approach that has been developed for service engineering in other business domains than traffic management [1]. Following the service-dominant line of thinking [2], BASE/X puts the added value for a specific group of service-based solutions at the center-point, called *value-in-use*. From this value-in-use, a collaborative network of organizations is designed that can realize this value-in-use and that has a realistic combination of costs and benefits for the involved organizations. The contributions of organizations to the value-in-use are mapped to their capabilities, which in turn are based on existing or future assets (infrastructures). Multiple combination of value-in-use and customer groups can co-exist, forming multiple collaborative business models that can be executed by *instant virtual enterprises* [3]. These business models use the same assets 'under the hood', thereby enabling an explicit decoupling of the strategic approach to asset management and the tactic approach to business model design.

This paper describes the application of BASE/X business model design in the PPA/ZO project. It demonstrates that a collaborative approach to business design can be efficient in a complex, multi-stakeholder context. On a higher level, it shows that a service-dominant approach to business engineering can be effective in asset-dominant domains, such as traffic management, to increase business resilience.

The remainder of the paper is structured as follows. In Sect. 2, we lay the basis for the paper by introducing service-dominant business engineering and the BASE/X

approach. In Sect. 3, we explain the collaborative approach to apply BASE/X in the practical context for the design of prototype business models. In Sect. 4, we discuss the execution of the approach and the realized results. We end the paper with conclusions in Sect. 5.

2 Service-Dominant Business Engineering and BASE/X

Business in many domains has transitioned towards a service-dominant setting where the provisioning of solution-oriented services to the customers is the focal point [4]. This can be compared to the traditional setting where the emphasis is on the delivery of products (assets) [5]. The services may require the deployment of products, but these products become part of the delivery channel of services, not the central point. This transition has shifted the emphasis from the value of the product to the value of the use of the product in an integrated context – the so-called *value-in-use* [6].

In a highly dynamic business environment, the customer expectations from solution-oriented services evolve faster than the capabilities of the underlying products. Customers expect coherent solutions (as opposed to stand-alone solution fragments), which require the integration of the capabilities of multiple service providers. This introduces the necessity of explicitly managed business networks [7].

For a solution-oriented service provider, however, it is not only about what services to offer, but also about how to get them delivered. Managing service complexity and business agility requires a tight integration between the business strategy and models on the one hand and the structure of business operation and information management on the other hand. Truly agile service provisioning business is not achievable if these elements are treated in isolation.

BASE/X is a business engineering framework that puts the service management at the forefront [1]. It adapts a holistic view and covers the entire spectrum from high-level business strategy definition to business information system architecture design, including elements, such as business strategy definition, business model conception, business service specification and business process modeling. It distinguishes between (i) business goals (the 'what' of business) and business operations (the 'how' of business), and (ii) the stable essence of an organization (i.e. business strategy and business services) and its agile market offerings (i.e. business models and service compositions). This leads to a model with four layers as shown in Fig. 1.

The top half of the pyramid covers business goal engineering, which contains two layers: the service-dominant business strategy and business models. The strategy describes the identity of an organization in a service-dominant market [8, 9]. The identity is relatively stable over time: the strategy evolves. A service-dominant business model describes a market offering in the form of an integrated, solution-oriented complex service: they describe a concrete value-in-use. Business models follow fluid market dynamics and are agile: they revolve – they are conceived, modified, and discarded as required. Business models are specialized from the strategy as they implement part of the strategy in a more specific way. They are operationalizations of the strategy as they are more concrete.

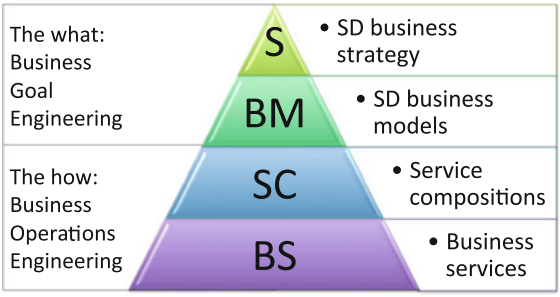

Fig. 1. BASE/X business pyramid

The bottom half of the pyramid covers business operations engineering, which contains business services and service composition. Each business service encloses a core service capability of the organization. As these capabilities are related to the resources (covering both personnel and large-scale technical infrastructures), they are relatively stable over time: they evolve. In the service compositions layer, business services are composed to realize the service functionality required by a business model: they implement a concrete value-in-use. The composition includes business services from the organization's own set, but also business services of partner organizations in a business network. As service combinations follow business models, they are agile: they revolve with their associated business models [1].

2.1 Service-Dominant Business Models

A business model describes the way in which an organization along with its providers and partners creates value for all its stakeholders [10]. Well-designed business models that ensure harmonization among business strategy, business processes, and information system are crucial for any business organization to survive and to succeed [11].

Business models can be designed using methods, such as the Business Model Canvas (BMC) [12], E3-value [13] or Service-Dominant Business Model Radar (SDBM/R) of BASE/X [1]. BMC is a visual chart with elements describing a company's or product's value proposition, customers, infrastructure -including its partnerships, and financial aspects. Although, it considers cross-organizational relations and the importance of partnerships, BMC is an organization-centric model that reasons mainly from the perspective of a *single* company. Unlike the BMC, the SDBM/R has a *network-centric* design at its core, allowing the composition of service design in multi-party business networks. It defines how the actors in the business ecosystem participate in value co-creation and what the cost–benefits distribution is.

Another network-centric approach to business model design is the E3-value e-business model, which describes the value exchanges among actors of a business network [13]. It focuses on the interactions between the actors of the network in terms of the value exchanges. However, contrasting the SDBM/R, E3-value does not consider the alignment between the business strategy, model, process and the information systems/technology as a harmonized package [10].

Figure 2 presents the elements of the SDBM/R. The co-created value-in-use constitutes the central point in SDBM/R, framed by three concentric circles. The 'actor value proposition' frame defines a value proposition to co-create value by an actor to the solution for the benefit of the same or other actor within the ecosystem. Co-production activity defines the activities that each actor performs in the business for achieving the co-creation of value. The third frame –actor cost/benefits defines the financial and non-financial expenses/gains of the co-creation actors. Finally, the 'pie slices' represent the co-creation actors including the focal organization, core and enriching partners, and the customer. The focal organization proposes the business model and participates actively in the solution - typically as an orchestrator. A core partner contributes actively to the essentials of the solution, while an enriching partner enhances solution's added value-in-use. SDBM/R accommodates an arbitrary number of actors, suiting the network-centric character of service-dominant business.

Each business model is operationalized by a service composition in the third level; i.e., it is implemented by composing a number of services from the business services layer of the BASE/X pyramid (refer to Fig. 1). The activities that take place in a service composition originate from or are tightly coupled with the 'actor coproduction activities' layer of the business model radar.

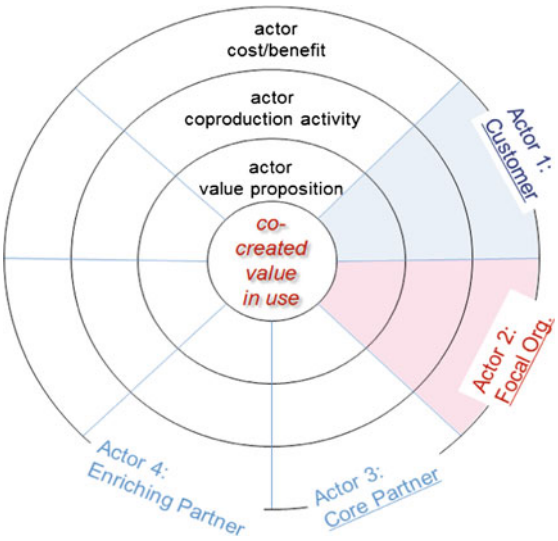

Fig. 2. Service dominant business model radar (SDBM/R) template.

3 Collaborative Approach to Agile Business Model Design

The infrastructure- and technology-dominant view and the diversity of stakeholders in traffic management pose challenges in designing multi-stakeholder, collaborative business models. Following an approach with a service-dominant line of thinking becomes essential for such initiatives. Therefore, we employ the SDBM/R in designing agile business models.

The BASE/X approach and its tools have been applied in diverse business domains (e.g. [1, 14]). However, effective application of tools in specific domains, such as traffic management, requires explicit guidelines to operationalize the concepts in practical business settings. We introduce the following steps in using SDBM/R for a collaborative design of business models:

i. *Stakeholder Field Analysis:* Business domains in contemporary markets, like traffic management, are characterized by a large number of stakeholders. Structuring the domain in terms of stakeholders through a field analysis helps significantly in understanding the dynamics and relationships in a particular business domain. It gives insight into the possible roles and their capabilities in potential business models in collaborative business networks.
ii. *Awareness Creation and Knowledge Transfer to Stakeholders:* Traditional asset-oriented mindset is still prevalent in many business domains. Creating awareness over the involved stakeholders on the service-dominant thinking, and on concepts such as value in-use, as well as on the use of relevant techniques and tools is essential before any attempt for a collaborative design of business models.
iii. *Workshops with Stakeholders for Collaborative Business Model Design:* The first two steps provide hints for business models and potential collaborators. The next step is to bring together selected stakeholders (typically 6 to 8 experts) to conduct workshops for interactive and collaborative business model design. The objective is to select a prospective business scenario, and design blueprint business models using the SDBM/R as a guiding template. The effectiveness of these workshop sessions depends heavily on the ability of the *moderator* in engaging the stakeholders in active communication and collaboration for innovative ideas.
The initial step in using the SDBM/R is to define and agree on the co-created 'value-in-use'. This goes in line with identifying the customer of the service and the focal organization that orchestrates its provisioning. Next, core and enriching partners that contribute to the proposed value-in-use are discussed and identified. These parties offer their 'actor value propositions' and 'co-production activities' to achieve the co-creation of value. As a final step, parties identify the costs and benefits (monetary or non-monetary) involved in the creation of value-in-use.
iv. *Business Model Refinement and Validation:* Workshop sessions typically result 'draft' business models on which the parties agree on the essential components. These models go through a round of refinements through offline/online discussions with involved parties. The finalized business models, which are represented using the SDBM/R, are validated by all stakeholders and act as a critical component of the agreement between the relevant parties.

4 Executing the Approach

The extensive number of prototypical technologies/services to be developed and tested, and the diversity of the stakeholders involved in their provisioning makes the PPA/ZO project a suitable context for applying the approach we introduced for collaborative design of business models.

As the first step, we performed a stakeholder analysis with domain experts in the field. We used two dimensions in classifying the parties: 'public vs. private' and 'service providers vs. consumers'. While the first dimension is mutually exclusive, the second category involves parties that play a dual role depending on a specific business model. Following this line, we defined main categories of stakeholders (such as governmental bodies, traffic service providers, technology suppliers, event organizers, etc.) and identified concrete parties under each category, which led to a set of over 30 parties. This analysis has not only brought a structure and a high level understanding of the market but also helped focal parties in identifying opportunities for collaboration with various parties in diverse business scenarios.

Based on the potential scenarios, a set of experts representing selected stakeholders were invited for a 2-h workshop organized in the Municipality of Amsterdam. We conducted 3 workshops for the design of 3 draft SDBM/R blueprints and were able to bring together around 20 stakeholders operating in this domain. Workshops constituted two phases. The first phase involved a tutorial on the concept of service-dominant business, BASE/X framework, and on the use of SDBM/R. The second phase comprised the core of the interactive design of a particular business model using the SDBM/R. Following a practical approach, large posters and 'post-its' were used to represent the SDBM/R blueprints and its specific elements (see Fig. 3).

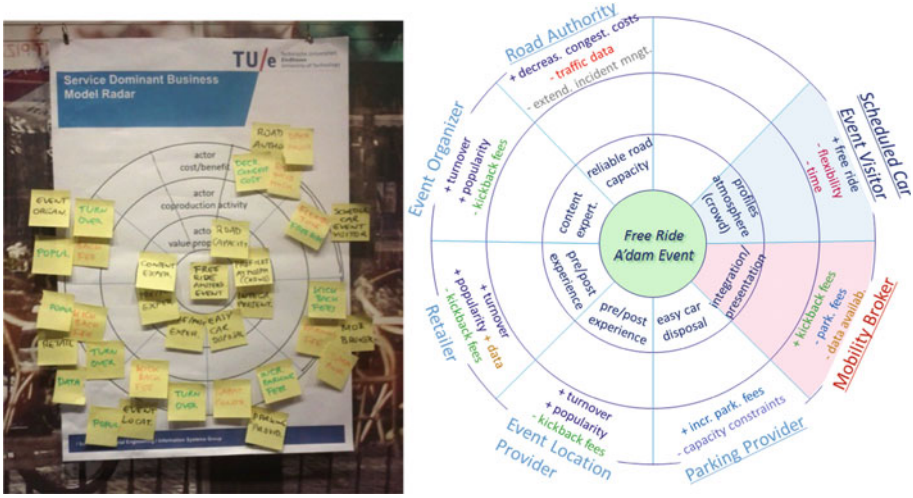

Fig. 3. The picture on the left shows the use of the SDBM/R poster and 'post-it's during the workshops. The figure on the right shows the first digital version of the *draft* business model.

The draft blueprints that were interactively designed in the workshops were later refined and communicated with involved parties for validation. Figure 4 presents an example of a completed SDBM/R blueprint for a business model. The *Free Ride Amsterdam Event* value-in-use contributes to the positive experience of event visitors who plan their arrival by car. The idea behind the model is to attract visitors at a much

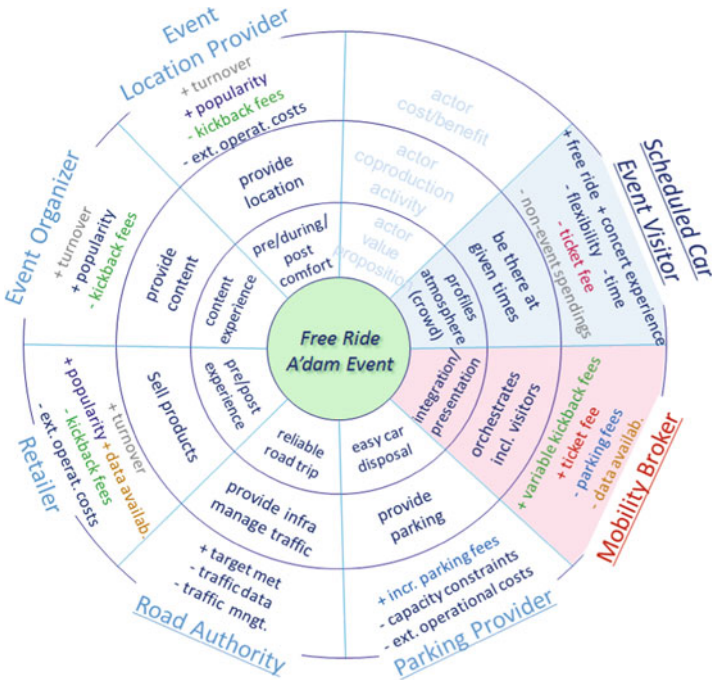

Fig. 4. A business model in SDBM/R: free ride Amsterdam event

earlier time than the beginning of the event, which helps reduce the traffic just before the event. This is facilitated by offering free parking, funded by parties benefiting from the early presence of the visitors (such as retailers). A number of stakeholders in the network contributes to this service. The Mobility Broker acts as the focal organization orchestrating the traffic-related parties. The Parking Provider provides parking services for an easy car disposal, while the Road Authority provides the road infrastructure and traffic management before and after the event for a reliable and safe trip. Retailers are also involved by contributing to customer's experience with pre- and post-event convenience (shopping, eating, etc.).

After each workshop session, we gathered feedback from the participants regarding the use of the approach and its effectiveness. All participants agreed that following an explicit approach that structures the interactive design of business models fostered the creation of innovative ideas. Participants indicated SDBM/R as an effective means for that purpose. They further agreed that it created awareness on the value of agile, service-dominant business thinking and provided inspiration for collaboration with different stakeholders. Feedback also included improvement suggestions regarding –for instance, the representation of cost-benefit flow between parties in the SDBM/R, which was incorporated in the new edition of the radar. Further details regarding the setup of the workshops, participants, and all three blueprints are available in [15].

5 Conclusions

Moving from an asset-oriented to a service-oriented mindset is a challenging yet essential step in today's highly dynamic business markets. This places an increasing demand on the agility of service providers operating in these markets. In many business domains, including traffic management, the providers' agility is heavily constrained by the business and IT platforms they use to deliver their services. The BASE/X approach can help in providing a basis for structural agility and in setting up a service-dominant business environment in this domain.

In this paper, we introduce a *part* of the BASE/X approach used for designing collaborative business models and report on its application in the traffic management domain. We brought together a diverse set of stakeholders and helped them in collaboratively designing innovative business models centered on customer-centric business solutions. Participants' positive feedback regarding the successful execution of the approach in the workshop sessions confirms the applicability of the SDBM/R in creating novel business models in the network of parties operating in the traffic management domain. This has also demonstrated that service-dominant business engineering can help in increasing business resilience in complex, asset-heavy domains.

Our future work will focus on further exploration of the use and applicability of service-dominant business thinking in diverse business domains. This includes the application of the SDBM/R as well as the other parts of the BASE/X framework in real-life settings. These applications will also accommodate evaluations on the perceived usability and ease of use of the method (through employing the techniques in the research field of technology acceptance [16]), and the benefits in terms of the degree in which the method fosters developing innovative and effective business models. Research and development on the tools and the guidelines to support the entire spectrum of the BASE/X pyramid is another key research direction.

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