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mHealth Business Model Framework for the Maternal and Baby Segment: A Design Science Research Approach

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Abstract mHealth applications are increasingly used to track, evaluate and store health data. Besides technological developments and acceptance of such mHealth services, a holistic understanding of the business model is required. A business model framework specific to the context of such mHealth services will support companies in developing holistic business models. In this research in progress, we present the development of a business model framework for mHealth services in the context of maternal and baby healthcare. The development of the framework is based on the design science research approach that supports the rigorous development of the framework. The initial business model framework as well as future steps are discussed. With the aid of the business model framework, companies will be able to design, evaluate and classify mHealth business models.

Keywords: • Business Model Framework • Mobile Health • Design Science Research • mHealth • Maternal and Baby Segment •

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1 Introduction

With technologies such as smartphones, wearables or mobile apps, digitization has made its way into the healthcare sector. EHealth and mobile Health (mHealth) applications and services can revolutionize the entire system of health and treatment. Young people are growing up with digital technologies and use apps for tracking and sharing information. This rising trend has led to 325,000 mHealth applications available in known App Stores in 2017 (Research2Guidance, 2017).

The World Health Organization (2011) classifies mHealth as sub-segment of eHealth and defines it as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices". A large market has emerged in the health and fitness segment. mHealth interventions are used to track, store and evaluate data such as weight or eating habits (Gentner *et al.*, 2017). With the aid of these services, the patient takes a participatory role in diagnosis and treatment.

Companies that offer mHealth services emerge from diverse areas - from the classic medical and health sector, but also companies operating in the consumer goods industry. The latter in particular are entering the market with products in the health, wellness and fitness sectors. For the development of mHealth services and business models it is necessary to consider the context in which the services are operating (van Limburg *et al.,* 2011). That is why we have decided to examine mHealth business models specifically in the maternal and baby healthcare segment as a fast-growing market. MHealth interventions support pregnant women and young mothers in handling and caring for their babies. They tend to use various applications like specific apps, blogs or social media (Wallwiener *et al.,* 2016) to gain information, record different data or track babies' vital functions with the aid of a wearable device. It provides parents and parents to be with a peace of mind. (Lupton, 2016).

In their study, Nikou and Bouwman (2017) argue that in order to gain economic as well as public health value from mHealth services, companies need to move from the exploration phase (investigation) to an exploitation phase (utilization). Also Cameron *et al.* (2017) revealed that research on mHealth is scattered around

topics like change in behavior, adoption of mobile applications in health or how mobile technologies can support prevention, diagnosis or patient care. But "the economic value of a technology remains latent until it is commercialized in some way" (Chesbrough, 2010, p. 354). Thus, more research on the business model of mHealth services is needed (Fielt *et al.*, 2008) in order to utilize such applications in a beneficial way (Nikou & Bouwman, 2017).

For the development of a business model, companies frequently use frameworks and patterns (Osterwalder & Pigneur, 2010; Gassmann *et al.,* 2014) providing a holistic view of the business model and supporting the development process. By now, research on business models of mHealth services neglects such a holistic view. Instead, the focus is on single aspects, like value creation or value capture. Furthermore, the actual value for the customer is also insufficiently emphasized – the value proposition of mHealth services needs to be presented more clearly. (Nikou & Bouwman, 2017). A business model framework with particular characteristics of mHealth services might overcome these issues.

Considering the request that a) more business model research is needed to utilize mHealth services in a beneficial way and b) to provide a holistic view on mHealth business models, the goal of our study is to *develop a business model framework for the design, evaluation and classification of mHealth business models* within the context of the maternal and baby healthcare. This research in progress paper presents the preliminary results of the developed business model framework based on the design science research approach.

2 Design Science Research as Research Method

Design science research (DSR) is increasingly used as a research method in management research (Sprenger & Mettler, 2016; Turber & Smiela, 2017). DSR seemed suitable for our research, as the goal is to develop a useful artefact to design, analyze or classify mHealth business models in the maternal and baby segment. Figure 1 provides an overview of our DSR approach, based on Pfeffers *et al.* (2007).

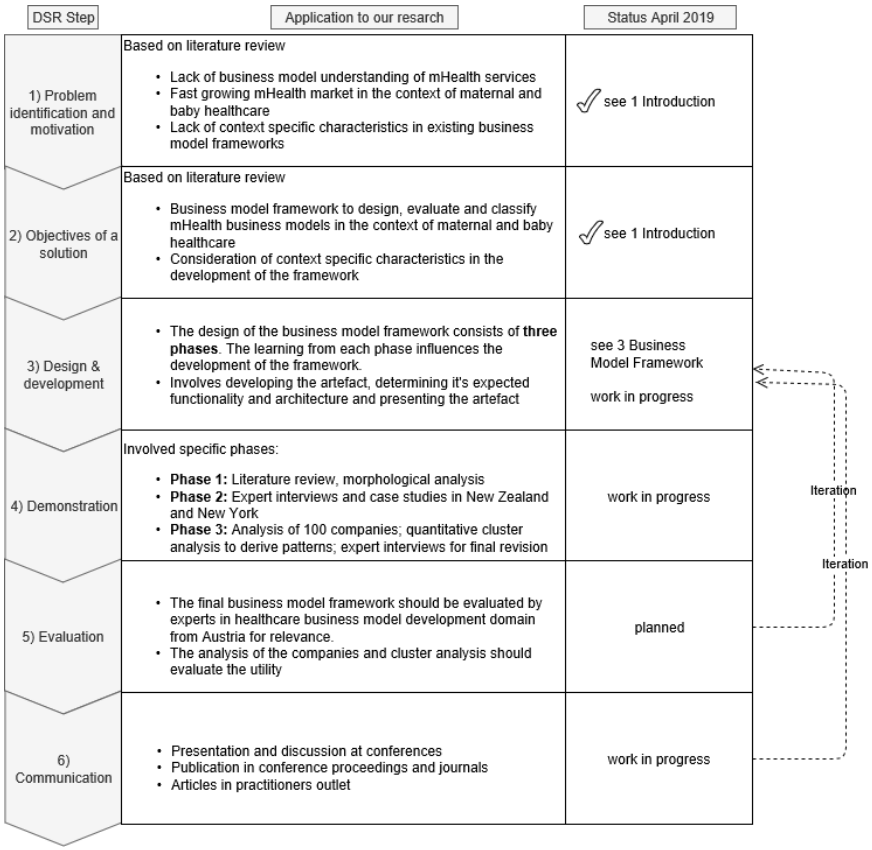

Figure 1: Design Science Research Process based on Pfeffers *et al.* (2007)

The steps one and two of the process were already discussed in the introduction. In the design and development phase, the business model framework is developed in three phases. In phase one, the business model framework, represented as a morphological box (the artefact), was iteratively developed based on literature research. For that reason, the morphological analysis is used as an overall method as it has proven as useful in developing a holistic understanding of business model elements in their specific contexts (e.g. Lee *et al.*, 2013; Peters *et al.*, 2015). The Framework is structured in dimensions consisting of several parameters and their specific characteristics. In phase two, case studies and expert interviews are used to review and adjust the framework if necessary. In phase three, the usability of the framework is demonstrated by applying the framework to 100 companies offering mHealth services in the maternal and baby healthcare

segment, drawn from the platform angellist.com. The data of these companies are collected based on secondary sources and analyzed by means of a qualitative content analysis. Based on the outcome of the qualitative content analysis, a quantitative cluster analysis is conducted in order to reveal different business model patterns. To evaluate the final business model, business professionals and researcher experienced in the development of mHealth services are interviewed in order to validate the framework for applicability and integrity. In addition, the framework is communicated continuously. New insights might lead to further revisions of the framework.

3 Business Model Framework for mHealth Services

Although there exists no uniform definition of the business model yet, there is a general consensus that business models are described by different elements (Baden-Fuller & Haefliger, 2013). In general, the business model explains "how the enterprise creates and delivers value to customers, and then converts payments received to profits" (Teece, 2010, p.173). For the development of our morphological box (see table 1), we adopted the business model dimensions proposed by Johnson *et al.*, (2008) as they represent the main dimensions of a business model – customer value proposition, value creation and value capture. Furthermore, we only considered specific business model parameters that characterize mHealth services in the maternal and baby segment.

We based our business model framework on three literature streams: 1) (Digital) business model frameworks and patterns (e.g. Osterwalder & Pigneur, 2010) that provide insights in characteristics of (digital) business models, 2) eHealth and mHealth business models in order to identify market specific characteristics, especially from the maternal and baby healthcare segment, and 3) platform business models, as mHealth services are often based on digital platforms that connect different users, for example to exchange information (Lupton, 2016). In the following, the main aspects of our business model framework are described.

Table 1: mHealth Business Model Framework

Dimension	Business Model Parameter	Characteristics									
Customer Value Proposition	Target Customer	B2B					B2C				
	Market Segment	Hardware			Software			Service			
	Service Offering	Physical product-based service				Digital product-based service				Pure digital service	
	Value Proposition	Functional Value			Emotional Value		Social Value			Epistemic Value	
	mHealth Category	Medical				Healthcare			Wellness/Fitness		
	Regulation	Yes					No				
Value Creation	mHealth Intervention Point	Conception			Pregnancy		Postnatal			Newborn/Baby	
	Digital Technology	Wearable Device	Mobile App		Social Media		Website			Video	Private Message
	Key Activities	Dissemination of information	Service Provision and Management			Education	Community Building			Data Management	Platform Management
Value Capture	Key Revenue Stream	Device Sales	Freemium		Advertising	Sponsorship	Service Sales	Subscription		Pay per download	Licensing
	Revenue Source	Health insurance			User/Patient		Third Party			Mixed	
	Price Mechanism	Fixed Price			Product Feature Dependent		Customer Segment Dependent			None/Other	

The *customer value proposition* explains how the company fulfills an important need or solves a customer problem (Johnson *et al.*, 2008). The parameter considered are the *target customer* segments; the operating *market segments* (Scheel *et al.,* 2013); the *mHealth categories* defining if the application can be designated as medical, healthcare or wellness/fitness (Kamel Boulus *et al.,* 2014; Rose *et al.*, 2017) and if the application is *regulated*; the kind of *service that is offered* as well as the *value* provided to the customer (Sheth *et al.,* 1991; Caridà *et al.*, 2014).

The *value creation* dimension is expressed by processes and resources in order to create the customer value proposition (Johnson *et al.*, 2008). In the case of mHealth services for maternity and baby healthcare, categories defining this dimension are *mHealth intervention points* in the continuum of maternal and baby care (Tamrat & Kachanowski, 2012); *digital technologies* used for these interventions (Free *et al.,* 2010; Lupton, 2016) and the *key activities* performed (Pagliari *et al.*, 2005; Osterwalder & Pigneur, 2010; Mettler & Eurich, 2012; Chen *et al.*, 2013).

The *value capture* dimension, also known as profit formula (Johnson *et al.*, 2008) explains how the company creates value for themselves when providing value to the customer. The parameters considered in are *revenue streams* (Parente, 2000; Mettler & Eurich, 2012); *price mechanism options* (Osterwalder & Pigneur, 2010) and *revenue sources* (Peters *et al.,* 2015).

4 Conclusion and Outlook

Existing business model frameworks predominantly do not consider the specific context of the operating business model, which is especially important in the area of healthcare. Our framework presented in this paper might overcome this lack and supports companies in developing mHealth business models especially in the context of maternal and baby healthcare. By doing so, our research contributes to the request by Nikou and Bouwman (2017) to investigate in mHealth business models in order to use technologies in a beneficial way (Chesbrough, 2010).

As this is a research in progress paper, we are currently entering phase two and conduct expert interviews and case studies. Although DSR is not commonly used in management research, it has proven as useful in developing the business model artefact in a structured way. Our research at its completion will provide a business model framework that can be used to design, evaluate or classify business models of mHealth services in the maternal and baby healthcare segment. It provides companies a holistic view of the business model. Moreover, we will contribute to the current business model research with a field-tested business model framework for mHealth services that can be used for more intensive research on business models in that field.

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