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# ON THE UTILITY OF E-HEALTH BUSINESS MODEL DESIGN PATTERNS

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# ON THE UTILITY OF E-HEALTH BUSINESS MODEL DESIGN PATTERNS

*Research*

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## Abstract

*New information technologies are not only enabling new health services, but also innovative business models. As the business model defines how value is created, delivered, as well as captured by an e-health service, it is key to the service's economic success. However, business professionals responsible for developing e-health services often feel overwhelmed when it comes to the design of a corresponding business model because they lack the respective knowledge and experience. In this situation, design patterns can be of help as they document instantiated business model logics for reuse. Since existing business model design patterns are not specific to the e-health domain, they are not easily transferred to an e-health business model. In this paper, we introduce the concept of e-health business model design patterns by creating a corresponding template and by identifying as well as documenting 37 of them. The utility of these design patterns is evaluated in focus groups with business professionals from the e-health domain. We show that e-health design patterns are useful as they provide insights into business model logics, enhance the understanding regarding relevant actors and the respective value flows, foster discussions, support creativity in the design itself, and offer guidance in design decisions.*

*Keywords: Business model, Design pattern, Design science research, E-health.*

## 1 Introduction

The Cloud, Big Data, and the Internet of Things are just three examples of technological trends that enable new kinds of health services. Patients are increasingly shifting to the online sphere as they start using e-health services to discuss about their conditions, to manage their healthcare appointments, or to get medical advice from doctors (Biesdorf and Niedermann, 2014). However, these trends not only lead to completely new forms of health services, but also enable new business models for creating, delivering, and capturing value (McGrath, 2010, Osterwalder and Pigneur, 2010, Teece, 2010, Yang and Hsiao, 2009).

Despite the fact that there has been a recent increase of research interest in business models (Klang et al., 2014), the reality shows that many e-health services are prone to failure as they lack a thought-out business model with a compelling value proposition and an adequate revenue model (Mettler and Eurich, 2012a). As a consequence, many e-health services end up as “successful pilots” (Spil and Kijl, 2009).

In order to support business model design, extant literature proposes the use of business model design patterns that document existing business model logics for reuse (Abdelkafi et al., 2013, Gassmann et al., 2014, Mettler and Eurich, 2012b). However, these business model design patterns are not derived

from e-health businesses and therefore do not account for the special characteristics of the e-health environment. Other approaches that design based on reuse, for example in software development, are specific to one domain: with domain engineering the domain can be defined according to an industry and is the basis for engineering industry specific software artifacts that can be reused to design industry specific applications (Falbo et al., 2002, Harsu, 2002). Also data or process standards in healthcare are specific to the domain: For example, HL7 is a standard for exchanging, integrating, sharing, and retrieving e-health information (Health Level Seven International, 2015) and DICOM is the standard for the communication and management of medical imaging and related data (Dicom, 2015). As existing approaches for reuse in e-health are domain specific, we transfer this idea to the business model area by introducing e-health business model design patterns that are based on existing e-health businesses. These design patterns are evaluated according to their perceived utility in supporting business model design for e-health services.

The paper has theoretical as well as practical contributions as it (1) transfers insights from extant design pattern areas to the field of e-health business models, (2) proposes a template for the documentation of e-health business model design patterns, and (3) evaluates the utility of a pattern-based business model design approach for e-health services.

## **2 Background**

### **2.1 Business model design and e-health services**

Despite the growing amount of business model literature there is still no commonly accepted definition of the term business model. Many researchers have focused their work on understanding the components of a business model as well as their interrelations (Al-Debei and Avison, 2010, Brousseau and Penard, 2007, Hedman and Kalling, 2003). Others define the term from a value perspective and refer to business models as a description how companies create and capture value (Teece, 2010, Zott and Amit, 2009). Nevertheless, there are common elements among the various definitions of business models in extant literature, such as: a business model reflects the business's core logic; it consists of different, interrelated elements; it accounts for static as well as dynamic aspects; and the underlying concept is applicable to all kinds of businesses.

In the course of business model design, one has to deal with uncertainty as answers to basic questions have yet to be found; for example: "What is the business's value proposition? How is the value delivered to the customers? Which revenue mechanisms are suitable?" While these questions should be addressed by a business model expert, the reality shows that no person in the organization has the respective authority and capability to design a business model alone (Chesbrough, 2007). In practice, business model design is not performed by business model experts, but rather by people who usually deal with other topics in their job (Osterwalder and Pigneur, 2010). As a consequence, the business model is frequently a by-product of other tasks. Moreover, the lack of practical experience combined with the high degree of uncertainty often inhibits business professionals to predict the success of a potential new business model which makes it difficult to design an adequate business model straightaway (Sosna et al., 2010). This is even aggravated with regard to rather conservative businesses and industries with low innovation adoption rates. When adoption rates are low, relatively few services and their corresponding business models are designed and introduced to the market. Hence, in these industries, gaining experience in business model design is especially difficult. One example of these industries is healthcare as it, compared to other industries, adopts information technology and related e-health services slowly (Adler-Milstein and Bates, 2010, Menon et al., 2000). Here, the term e-health is understood according to Oh et al. (2005) who conducted a literature review in which they identified common elements in over 50 definitions, e.g. (1) e-health involves health activities as well as technology, (2) technology is both the enabling tool and the embodiment of e-health, and (3) e-health often involves a variety of stakeholders. These services are especially interesting regarding their business

model design because the technology as well as the different stakeholders would allow several business model options. By not opting for an adequate business model design alternative, e-health services often result in a failure as financial viability, relevant stakeholders, service consumption, and organizational issues are not considered (Fielt et al., 2008, Mettler, 2015). In this context, business model design can help as it accounts for all relevant parties as well as their interrelations to create, deliver, and capture value (van Limburg et al., 2011).

## **2.2 Design patterns in business modeling**

Business model design is a specific design process, which aims at developing a suitable business model for a product, service, or even an entire company (Zott and Amit, 2010). To understand how such a business model design process can be supported by methods, tools, or systematic approaches, other design processes might serve as a basis for inspiration. On a general level, the design process itself is the same whether it is designing a building or a business model. In all cases, a design process has the overall goal to create a solution to a specific design problem. This design problem is usually embedded in a context which a designer has limited control over (Alexander, 1964). From a business model point of view this context would be the environmental framing a business operates in (Osterwalder and Pigneur, 2010). Examples are legal requirements or existing technologies that can be seen as a given and have to be considered when designing a business model. Concrete design methods may help in clarifying the objectives of a design, in generating or evaluating design alternatives against the background of a certain context, or in improving the quality of detailed design decisions (Cross, 2008).

In our paper, we focus on the concept of design patterns that aims at supporting a design process through providing a specific solution to a recurring design problem in a domain specific context. The initial idea to communicate and encourage the reuse of proven design knowledge was first developed within the domain of architecture in the late 1970s by Alexander et al. (1977). According to them, a design pattern describes a recurring problem as well as a suitable solution, which can be reused whenever the problem occurs again. Hence, design patterns increase the efficiency of a design process as a former solution can be reused. Moreover, they enhance the effectiveness as the selected solution already proved to be useful in a similar context. Alexander et al. (1977) describe each design pattern in a consistent format to be more convenient and clear. First, a picture shows an archetypal example of the pattern. Second, an introductory paragraph describes the context for the pattern and sets it into relation with larger patterns. After that, there is the explanation of the problem including the empirical background of the pattern, the evidence for its validity, the range of different ways the pattern can be instantiated and so on. Then the solution as the main part of the pattern is presented. It specifies the field of physical and social relationships needed to solve the stated problem in the given context. This solution is always stated in the form of an instruction and is followed by a diagram, which indicates its main components. At the end, each design pattern is connected to all smaller patterns that are required to complete this pattern.

In the 1990s, the advantages of design patterns were acknowledged in the area of software engineering, where they refer to the archetypal solution for recurring programming problems (Buschmann et al., 1996). By reusing patterns, the software architect relies on proven solutions and thereby avoids pitfalls and mistakes in software design. As this results in an increase in quality of software products many current software systems embed instances of design patterns in their source code (Dong et al., 2009). The concept of design patterns has been especially used in object oriented programming (OOP) languages. Here, the objects, i.e. the entities combining the properties of procedures and data, are used in a unified way. Thereby, OOP languages are in contrast to the use of separate procedures and data in conventional programming (Stefik and Bobrow, 1985). Like architectural design, designing the objects in OOP is a complex process. To overcome this complexity, Beck and Cunningham (1987) transferred Alexander et al.'s concept of design patterns to the area of OOP. On that basis, Gamma et al. (1995) defined design patterns as "descriptions of communicating objects and classes that are customized to solve a general design problem in a particular context". They divided a pattern into four essential

parts: pattern name, problem, solution, and consequences. Overall, a design pattern captures design experience and provides a standard vocabulary among developers, which facilitates the communication between designers, programmers, and maintenance programmers (Cline, 1996).

Recently, design patterns were picked up by business model researchers to analyze the logic of a business model design and to communicate common archetypes (Osterwalder and Pigneur, 2010). As designing a business model is not a trivial task, the idea of using design patterns suggests itself. Moreover, the concept of (re-)using business model patterns seems to be extremely useful with regard to business model design as even 90 percent of business model innovations are just a recombination of existing business model patterns (Gassmann et al., 2014).

Literature dealing with design patterns for business models can especially be found in the e-business context. For example, Weill and Vitale (2001) present seven business model approaches to exploit and expend a business's core proposition, Sgriccia et al. (2007) identify four business model patterns in the Asian mobile business, and Rappa (2003) analyzes nine business model patterns of Internet businesses. Regarding business model design patterns with a general focus, Abdelkafi et al. (2013) provide a review of 49 existing business model design patterns. Besides the mere listing of the design patterns, they also analyze which business model components are addressed by the respective pattern, respectively which kind of value proposition, value creation, value communication, value delivery, and value capture are inherent in a business model. A similar approach is taken by Gassmann et al. (2014), who identify 55 business model design patterns and assign them to four dimensions of a business model. These four dimensions describe the business model by defining (1) who the customer is, (2) what is offered to the customer, (3) how value is generated, and (4) how value is captured. Besides the description of the business logic and the highlighting of the affected business model dimensions, each pattern is described by giving information on the origins of this pattern as well as by providing examples which businesses applied this pattern in an innovative way. Additionally, they provide pattern cards to support the process of business model design, which seem of special interest in a business model workshop context (BMI lab, 2014). These cards depict the pattern with a name, picture, description, addressed business model dimensions, and concrete examples.

Analogously to design patterns in architecture and software engineering, business model design patterns are a way to document established business model practices. The goal is to provide business model designers with a basis for (re-)designing their business model by imitating or recombining existing patterns.

### **2.3 Challenges of pattern-based business model design in e-health**

With regard to the healthcare industry, business model design patterns have been applied for analyzing different types of e-health business models, whereas the authors also elaborate on the elements needed to document a business model design pattern (Mettler and Eurich, 2012a, Mettler and Eurich, 2012b). These elements include the name as well as the purpose and scope of the pattern, the actors involved, an illustration of the pattern, as well as a reference to a company that adopted the respective pattern.

But even though e-health business models can be analyzed with existing business model design patterns, it is not trivial to actually design e-health business models with them. The reason is that the existing business model patterns are not domain specific. As a consequence, these business model design patterns do not reflect e-health specific problems like the access to patient data or the identification of a paying party for the e-health service (van Limburg et al., 2011). The existing patterns do not account for e-health specific stakeholders either, which, according to Mantzana et al. (2007), can be subdivided into four groups: the service acceptors (e.g. patients), providers (e.g. doctors), supporters (e.g. suppliers), and controllers (e.g. health authorities). Moreover, existing design patterns do not consider e-health specific goals that are pursued by the respective services: Websites providing health information promote the access of information for the patient, IT-supported administrative health services intent to reduce costs as they improve efficiency and workflow, and electronic medical records aim at

improving the quality of care by accounting for comorbidity and by reducing medication-related errors (Adler-Milstein and Bates, 2010, Hsia et al., 2006, Parente, 2000).

The value of general business model design patterns might be low for several reasons: With patterns coming from other industries, the problem-solution-fit can only be achieved on a rather abstract level and the e-health unrelated solution has to be transferred to the own specific case (Enkel and Mezger, 2013). However, the existing patterns do not offer any guidance on this adaption process. Against the background that business model design is often performed with a lack of experience in this field, the business professionals might struggle with the task of transferring and adapting abstract solutions to their own situation. Or, they might just not be convinced in the first place that a certain pattern could be implemented at all within their e-health domain.

Therefore, this paper introduces the idea of domain specific business model design patterns for e-health services that account for domain specific problems, goals, and stakeholders.

Analogously to design patterns in architecture, the idea is that business professionals can reuse existing knowledge to inform their business model design decisions. By providing domain specific design patterns, the business professional can better relate to the presented problems and examples. As a consequence, the time it takes to warm up with the patterns should be rather low and the transfer of the potential solution to the own case should not be that difficult as the design pattern describes how the potential solution has already been established in the own domain.

### 3 Method

In reference to our research goals, which are less focused on explanation and prediction, but rather on providing practice-oriented guidance during the business model design phase, this paper follows a design science research (DSR) approach. In this section, we therefore briefly introduce the notion of design science as alternative scientific approach for business research as well as describe our research procedure for the purpose of introducing domain specific business model design patterns for e-health services.

Despite the fact that more and more design-oriented research is conducted in the area of management (Dresch et al., 2015), there is still no dominant or all-embracing approach to perform DSR. Being aware of this limitation, we base our research on the six phases framework as suggested by Peffers et al. (2007), which is illustrated in Figure 1.

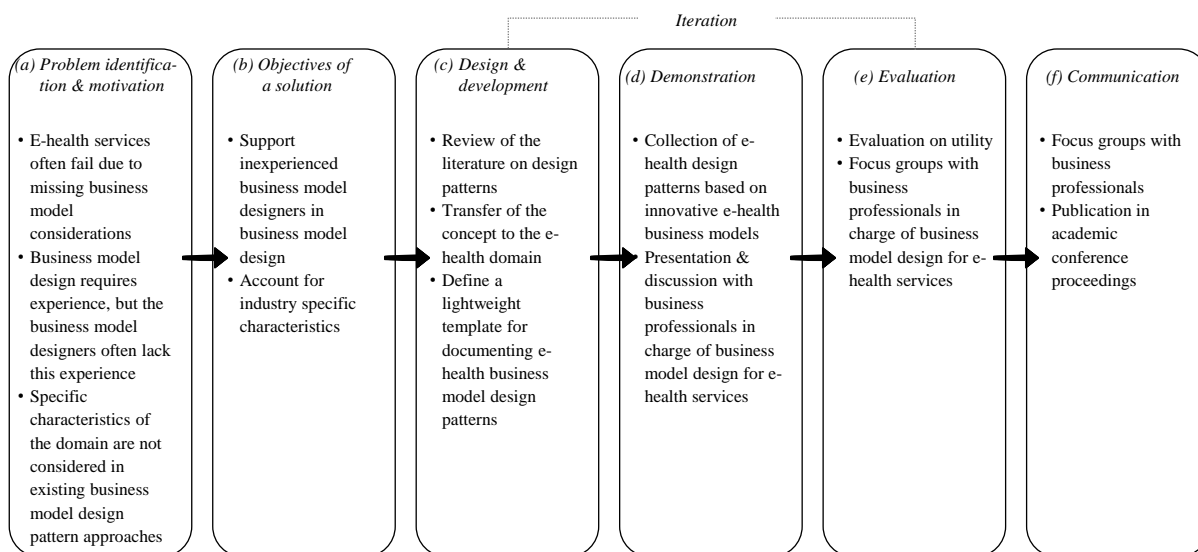


Figure 1. Adapted research approach from Peffers et al. (2007)

We first examined the literature on business model design by searching EBSCO and PubMed databases as we deemed them suitable to provide us with papers giving insights on the problems of business model design, especially for e-health services. The selected literature offers the background and motivation of our research and is therefore presented in the previous section (cf. Section 2). In a nutshell, the following problems are identified to be of major relevance regarding business model design for e-health services:

- (P<sub>1</sub>) E-health services often fail due to a lack of business model considerations.
- (P<sub>2</sub>) Business model design is highly experience-based. As such, it requires extensive knowledge about different business model designs. However, the possibilities to gain business model experience are limited (it is not a routine task!). As a result of the lacking experience, business professionals frequently feel overwhelmed when it comes to business model design.
- (P<sub>3</sub>) Existing design pattern approaches to support business model design are not domain specific and the business professionals are not guided in transferring the ideas from other industries to their own case.

On that basis, we then defined concrete objectives to inform the requirements of a possible solution to counteract the aforementioned problems:

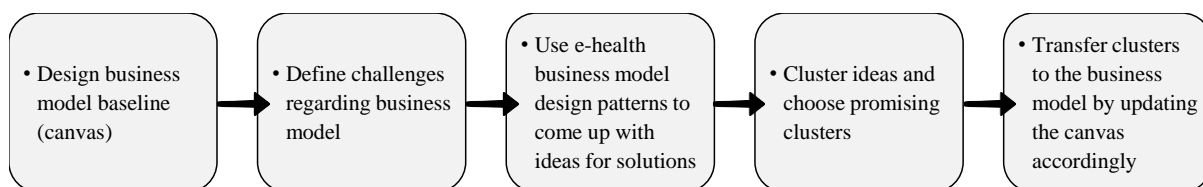
- (O<sub>1</sub>) The solution is particularly catered to inexperienced business model designers that lack experience and knowledge about different business model design alternatives.
- (O<sub>2</sub>) The solution should account for domain specific characteristics and problems. Therefore, the business model design patterns should be gathered from e-health cases.

We inferred further requirements for our solution by drawing on the extant literature on design patterns and business models. In the design phase, we transferred the concept of design patterns to the e-health domain and defined a lightweight template for documenting e-health business model design patterns. Here, we built on the existing ways of documenting design patterns in other areas, e.g. in architecture and general business modeling. A detailed description of the template's elements is given in Section 4.1.

To demonstrate that our template was able to document e-health business model design patterns, we studied innovative e-health cases (Harvard Business School Digital Initiative, 2015) to derive existing e-health business model design patterns and filled out the template accordingly. These cases were deemed suitable as their innovative nature was likely to uncover a large variety of viable business model design options to inform inexperienced business model designers of the possibilities within the e-health domain. To derive the e-health business model design patterns from the cases, each case was analyzed regarding how value was created, delivered, or captured for the e-health service at hand. Overall, we analyzed 33 cases, whereas most of the cases contained more than one e-health business model design pattern and one business model design pattern might be instantiated by several cases. The result of the demonstration phase was the description of 37 e-health business model design patterns which are presented in Section 4.2.

In order to evaluate the utility of the proposed e-health business model design patterns, we followed the recommendation of Tremblay et al. (2008) and opted for focus groups as evaluation technique: Focus groups were deemed suitable as they allowed us to get insights from a deployment perspective (Frank, 2007) by observing how the workshop participants applied the business model design patterns as well as to get rich data regarding if and for which aspects the design patterns were judged to be most useful. As our business model design patterns are specifically designed to be applied by practitioners, we opted for a naturalistic evaluation which explored the utility of our design patterns in its real environment (Venable et al., 2012). In our case, we worked with business professionals with extremely diverse backgrounds, such as people originating from medicine, software engineering, and management that were all involved in designing a business model for an e-health service. Overall, we

conducted four focus groups each consisting of six – as recommended by Stewart et al. (2007) – business professionals recruited via email from German companies. Each company replied by nominating employees that were in charge of designing a business model for an e-health service. Overall, four employees were nominated and each one of them was asked to appoint five additional participants that were familiar with the respective e-health service. All focus group sessions had the same structure (Doll and Eisert, 2014), whereas Figure 2 illustrates the main steps.



*Figure 2. Steps of the focus group sessions*

At first, we started with the business model baseline: Here, the participants were asked to illustrate the current idea for their business model in form of the business model canvas (Osterwalder and Pigneur, 2010). After the participants agreed on the business model canvas, they got the task to formulate their two biggest challenges regarding their outlined business model. These challenges could be internal ones (e.g. the lack of important key resources) or external ones (e.g. a change in customer preferences, inadequate revenue mechanisms to capture value for the company). After a consensus was reached concerning which two challenges were deemed the most important ones, we introduced the e-health business model design patterns. As the workshop participants were not familiar with the pattern concept, we first presented the general idea and the structure of the design patterns. Each participant got all 37 patterns in form of cards (one pattern per card in our template structure). Their task was to go through the patterns, judge if the pattern could be a solution to their challenges and, if applicable, transfer and adapt the design pattern idea to their own business model. These ideas were put on sticky notes, whereas each participant presented his or her ideas to the others. Afterwards, the ideas were clustered and the participants could vote on clusters they intended to implement. The chosen clusters were then transferred to the business model canvas to illustrate how the business model could look like in future. At the end, participants were asked to provide us with feedback regarding their attitudes, beliefs, and perceptions of our design patterns. All sessions were conducted by three researchers, in which one moderated and guided the sessions and the others collected verbal and non-verbal observational field notes. These notes were afterwards independently coded by the three researchers with regard to the research interest, i.e. if the patterns were perceived as useful and, if yes, for which aspects they proved to be most useful. Here, we applied open coding to identify common concepts in the data (Strauss and Corbin, 1998). In case the researchers assigned different codes, they discussed until a consensus for the respective code was reached. The evaluation results are discussed in detail in Section 5.

## **4 E-Health Business Model Design Patterns**

Although design patterns already found their way into business model design, the existing approaches have certain limitations as they do not account for domain specific characteristics and are often hard to transfer to the e-health domain (cf. Section 2.3). Therefore, we introduce e-health specific business model design patterns, whereas we specify a template for these patterns and document instantiated patterns found in existing business models of e-health services.



## 4.1 Template for e-health business model design patterns

Analogously to design patterns in other domains, an e-health business model design pattern should facilitate the documentation and reuse of e-health business model logics existing in practice. With regard to our target group, i.e. business professionals lacking experience in business model design, it should as well be easy to understand and to apply. As the existing design pattern approaches have a similar high-level structure, we took the documentation of design patterns in the original fields as a basis to identify meaningful elements for a design pattern template. Additionally, we based the development of our template on the e-health specific goals and actors.

The e-health business model design pattern has a title that is followed by a short description of a problem specific to e-health. Based on this problem the goal of the pattern is highlighted. As e-health services pursue various goals by promoting different values (Adler-Milstein and Bates, 2010, Hsia et al., 2006, Parente, 2000, Valeri et al., 2010), the pattern differentiates among five types: information quality, health outcome, efficiency, access and capability, as well as trust (Fitterer et al., 2011). As Alexander et al. (1977) suggest, the solution is presented in form of a statement. The actors involved can be derived from the solution and are highlighted afterwards, whereas we group the relevant health actors according to Mantzana et al. (2007) into health providers, supporters, acceptors, and controllers. As proposed by other design pattern approaches the e-health business model design pattern also provides an example of a business that instantiated the pattern (Gassmann et al., 2014) as well as an illustration of the pattern that depicts the involved actors as well as the value flows (e.g. money, data) between them (Mettler and Eurich, 2012a).

By building on design pattern templates from other areas, e.g. architecture and general business modeling, a template is derived that serves as a tool to document e-health business model design patterns in a structured way and to facilitate their reuse for business model designers.

## 4.2 Exemplary e-health business model design patterns

In order to demonstrate our solution, i.e. the e-health business model design patterns, we opted for innovative e-health cases to identify and document existing business model design patterns. These cases were drawn from the digital business models presented on the open forum of the Harvard Business School Digital Initiative (2015) as this forum presents various interesting and innovative business model examples for e-health services.

01 24/7 Telehealth	14 Franchising	27 Partnership for trust
02 Access to healthcare abroad	15 Freemium	28 Patient engagement system
03 Automation	16 Full healthcare service provider	29 Patient network
04 Collective intelligence	17 Gamification	30 Pay-per-use
05 Commission-based revenue	18 Health wearables	31 Razor and blade
06 Crowdsourcing	19 Healthcare bartering	32 Reverse auction
07 Data-based customization	20 Healthcare crowdfunding	33 Secure platform
08 Data-based pricing	21 Healthcare data selling	34 Subscription-based revenue
09 Data for trust	22 Digital connectivity	35 Targeting new segments
10 Direct-to-consumer tests	23 Lock-in	36 Third-party channels
11 Expert platform	24 Marketplace for clinical data	37 Verified cost transparency
12 Fee for health	25 Open healthcare ecosystem	
13 Flatrate for health	26 Partnership for customization	

*Table 1. List of identified e-health business model design patterns*

It is important to mention that our goal was not to identify new business model design patterns, but rather to detect which business model design patterns are relevant for e-health services in which specific problem contexts. Hence, by studying the e-health cases we also looked for already known business model design patterns and identified how they were instantiated in the e-health domain as well as which domain specific problems, goals, and actors were addressed. Overall, we derived 37 e-health business model design patterns in our proposed structure. These patterns address different parts of the business model and thereby also different elements of the business model canvas (Osterwalder and Pigneur, 2010): Some patterns, e.g. “partnership for trust”, focus on how value is created (left side of the canvas), some patterns, e.g. “third-party channels”, focus on how value is delivered (right side of the canvas), some of them, e.g. “fee for health” concentrate on how value is captured (bottom part of the canvas), and some patterns, e.g. “razor and blade”, might affect a combination of the aforementioned aspects. The design patterns can now serve as a tool to learn about existing business logics in e-health and as a basis to design a business model for an e-health service. Table 1 lists all identified e-health business model design patterns whereas two of them are presented in detail in the following.

#### 4.2.1 Marketplace for clinical data

The pattern „marketplace for clinical data” addresses the problem of scattered healthcare data. Healthcare providers often struggle to collect the information needed to treat the patient in the best way possible. The same holds true for research centers that need access to patient data to gain insights for treatment strategies or drug development. The pattern would suggest a marketplace where healthcare providers as well as researchers and other supporters would get access to the clinical data they need in order to enhance the information quality for their healthcare service in an efficient way.

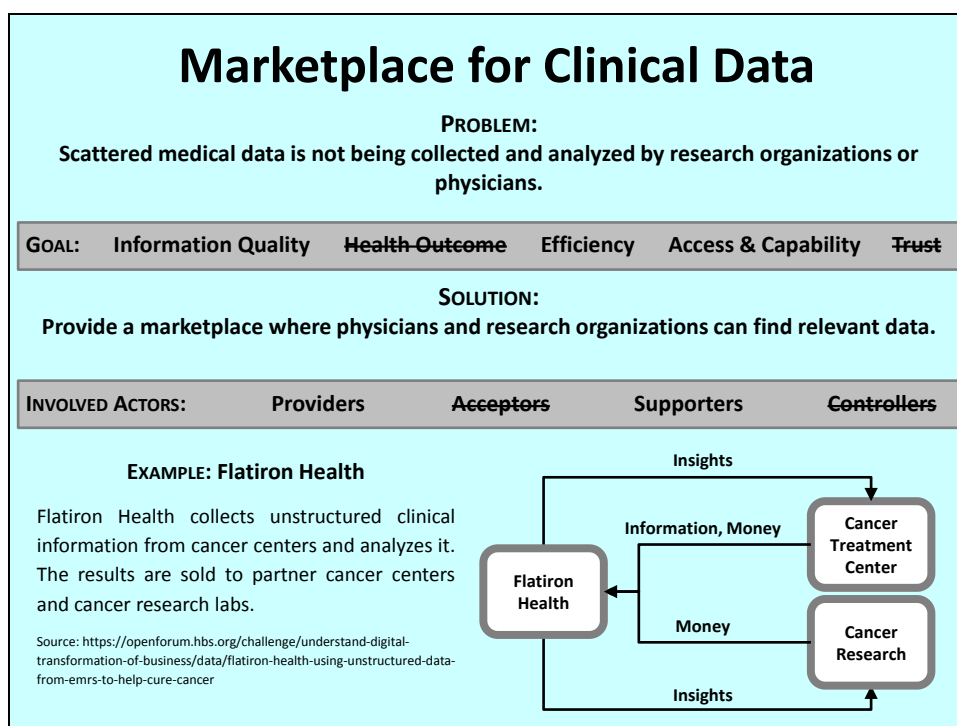


Figure 3. “Marketplace for clinical data” pattern

An exemplary instantiation of this pattern can be found at Flatiron Health (Desperado, 2015). This company collects unstructured data from cancer treatment centers (e.g. from electronic medical records, billing systems, etc.), analyzes it, and provides the resulting insights on its marketplace. These insights are then accessed by treatment centers as well as research organizations. By consolidating rel-

evant information and by providing one single access point to their data-based insights, Flatiron Health supports cancer related research and treatment discovery.

Figure 3 provides an illustration of the “marketplace for clinical data” pattern.

#### 4.2.2 Direct-to-consumer tests

Patient data from samples (e.g. blood, saliva, etc.) is often only collected when the patient visits a doctor or a hospital. The pattern “direct-to-consumer tests” offers a way how patients are able to get insights on their sample data in an easy and efficient way: Testing companies can send test kits directly to consumers and analyze the returned samples. The resulting insights are provided to the consumer as well as sold to interested parties.

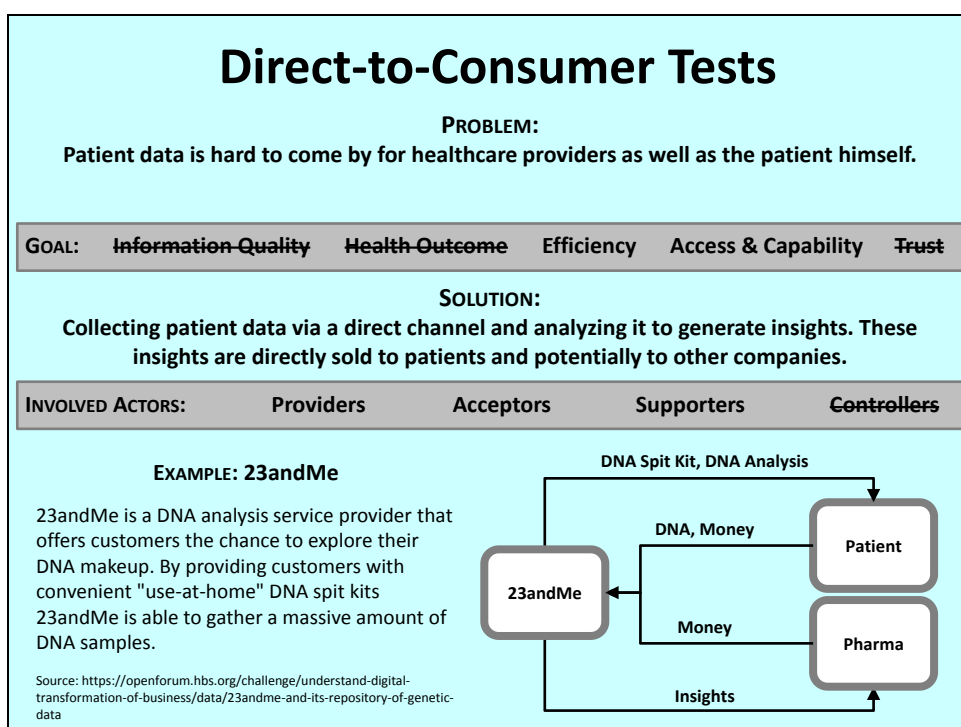


Figure 4. “Direct-to-consumer tests” pattern

The genetic testing company 23andMe is an instantiation of this pattern. This company sends its customers convenient use-at-home spit kits, whereas the returned DNA samples are analyzed regarding predispositions to diseases or genetic variations (Ting, 2015). The thereby created human genomic database contains information that can be sold to pharma companies and research centers. Hence, on the one hand, 23andMe empowers the consumer by giving him a fast and direct access to his DNA data. On the other hand, the company provides valuable data and insights for research.

Figure 4 illustrates the “direct-to-consumer tests” pattern.

## 5 Evaluating the Utility of E-Health Business Model Design Patterns

As stated in Section 3, we conducted four focus groups to determine the perceived utility of e-health business model design patterns and to understand for which aspects these patterns are most useful. The coding of the participants’ comments revealed that all focus group members were convinced of the utility of the e-health business model design patterns, whereas we will elaborate on the identified utili-

ty aspects in the following. Moreover, the focus groups gave us an indication regarding the limits of the design patterns' utility.

## 5.1 Utility of e-health business model design patterns

### 5.1.1 Providing an overview

The participants especially appreciated that the business model design patterns summarized business logics that were already instantiated. As the examples were all derived from e-health cases, the focus group members could relate to them and had an idea which business model design patterns were established for other e-health services. In this context, the business model design patterns served as a means to overcome their lack of experience. One participant of the first focus group stated:

*"I liked that the design patterns were based on real e-health examples. Until now, I didn't know that so many interesting business model ideas are implemented for e-health services. [...] The design patterns gave me an overview what is already out there."*

### 5.1.2 Enhancing understanding

The design patterns not only gave an overview regarding the instantiated business model logics but also regarding the interdependencies of involved actors and the respective value flows. Here, the illustrations on the design patterns were seen as crucial for the overall understanding of the design pattern. A member of the fourth focus group explained:

*"For me, the design patterns are a necessary tool to complement the business model canvas: When filling out the canvas it was often not clear, which part of the value proposition is provided to which customer segment. This gets even more complicated when different customer segments have different revenue models. [...] The patterns nicely describe the main rationale and even illustrate which party is providing which value and what they get in return."*

### 5.1.3 Supporting discussions

In all focus groups, the pattern cards acted as a trigger for discussions. The participants showed each other the cards they found relevant for their own business model and discussed how they might adapt it to their context. A member of the first focus group mentioned:

*"When I saw a pattern I liked, I had the urge to immediately explain my ideas to the others which sometimes led to long discussions about the different options to implement it for our service."*

A participant from the second focus group felt that the pattern cards helped him articulate his ideas:

*"Some patterns illustrated ideas I already had before but couldn't articulate because they were usually pretty vague. With the design pattern in my hand I could put the idea into a nutshell and start discussing with my colleagues."*

### 5.1.4 Fostering creativity

One of the main advantages of the design patterns were seen in fostering creative thinking. By giving the focus group participants innovative examples regarding business model logics from other e-health services, they saw the design patterns as a source of inspiration. A participant from the third focus group commented:

*"While looking at the design patterns many ideas came to my mind which I had not thought of before. In our company we are often not able to think outside the box, because we take the ex-*

*isting business logics as a given. [...] For me, the design patterns were a catalyzer for creativity.”*

The fact that the patterns were domain specific seemed to support the creativity as well. In this context, a member of the second focus group mentioned:

*“If the patterns were based on Amazon, Ebay, or other non-e-health examples, I would have been more hesitant to consider the patterns for my own e-health service. [...] With the domain specific design patterns I felt assured that it is possible to implement this pattern in my industry context and that gave me room for creativity.”*

### 5.1.5 Offering guidance

In addition to the above mentioned utility aspects, the participants of the focus groups felt guided by the design patterns. As the design patterns offered solutions for problems they could relate to, they saw the business model design patterns as decision support. A participant of the fourth focus group explained:

*“I think that business model design is very fuzzy. These design patterns, at least partly, resolved this fuzziness by telling me how I could adapt the design of my business model when I have a specific problem. [...] The patterns gave me the good feeling that my business model design decision would be suitable in my problem-context.”*

## 5.2 The limits of e-health business model design patterns

Although our focus groups judged e-health business model design patterns to be useful, they also revealed that the design patterns' utility is limited. This is especially true regarding their ability to foster creativity and to offer guidance. Regarding the former, the design patterns foster creativity by being a source of inspiration, however, they also limit the creativity to those ideas that are covered by the design patterns. With regard to the latter, the design patterns offer guidance to a certain extent, but the business model designer still has to transfer the idea to the own e-health service. When observing the focus groups it became evident that this transfer was not always trivial for the workshop participants. For example, when choosing the design pattern “marketplace for clinical data” (cf. Section 4.2.1) they still had to define which parties would provide the data and who might be interested in buying it. Moreover, the design patterns are not entire business models. Hence, the business model designer still has to complete the business model either on his own or by combining different business model design patterns. For example, regarding the “marketplace for clinical data” pattern, the business model designer still has to define the revenue streams for his healthcare service. As – at least in theory – all patterns can be combined with each other, the business model designer has to decide on his own which set of business model design patterns he would like to integrate in his business model.

The result of the evaluation can be summarized by the following statement of a participant from the fourth focus group:

*“The design patterns are a great support when designing business models. But, of course, they are not the silver bullet that solves everything.”*

## 6 Conclusion and Future Research

Our paper transfers the concept of business model design patterns to the domain of e-health. In this context, we introduce e-health business model design patterns that are identified based on existing e-health services and account for domain specific problems, goals, as well as stakeholders. The patterns were developed following a design science research approach which not only guided the design of our solution, i.e. the e-health business model design patterns, but also evaluated its utility to verify the validity of our research.

Our paper offers contributions for research as well as for practice. It contributes to research by transferring the insights of existing design pattern approaches to the area of e-health business models. We not only present existing business model patterns, but also offer a structured approach of documenting these patterns by providing a template. This template can be applied to further document e-health business model design patterns and serves as a common basis to communicate these patterns to facilitate their reuse. As our patterns give insights on how value is created, delivered, or captured as well as illustrates the corresponding value flows among the relevant actors, it contributes to the value-focused business model research that is identified as one core theme of business model studies (Zott et al., 2011). Moreover, our approach might inform the adaptation of business model design patterns to other domains and hence might act as a guideline for researches to develop other domain specific business model design patterns.

The contribution for practice roots in the pattern-based support for the design of e-health business models. According to the evaluation of our design patterns, they are a source of inspiration for business model design. For business professionals with a lack of business model experience the design patterns act as a catalyst by giving an overview of possible e-health business model patterns in practice and by fostering discussions and creativity regarding one's own business model. In this context, design patterns can be seen as a starting point for learning from other e-health businesses. This is especially true when the design patterns are derived from innovative e-health examples as the confrontation with cutting-edge business practices leads to an even higher degree of creativity during business model design. As design patterns might also limit the creativity, business model designers should try to come up with their own ideas (e.g. with brainstorming sessions or other creativity methods) before they have a look at the design patterns. Moreover, there should be a high number of business model design patterns to increase the level of inspiration (although even a large set of design patterns will not have the claim to be complete). According to our evaluation, the design patterns also offer a structured approach to e-health business model design. Thereby, the business professionals' uncertainty regarding how to proceed during business model design is reduced as the design patterns constitute a form of guidance. However, design patterns are only a starting point for business model design. As they provide generic information of a business model logic instantiated in practice they always have to be adapted to the own business. As the business model designers seem to value guidance in business model design, the domain specific design patterns seem to be a step in the right direction: By focusing on e-health services, the transfer to the own e-health service is not such a far stretch compared to business model design patterns that are instantiated by eBay, Airbnb, etc.

Analogously to the concept of design patterns itself, our paper has certain limitations. Although we introduce an approach that seems to ease business model design, there is no guarantee for business success. Another limitation is the lack of a formalized language for the business model design patterns. Although we provide a structured template, there is no specification how to document the respective elements in a formalized way. Especially with regard to the illustrations, we deliberately leave it open to those who are interested in defining their business model design patterns to specify the business model blueprints using their most preferred visualization technique. This can be a more formalized modelling notation such as e3-value and i\* (Gordijn et al., 2006), or completely different approaches such as iconic images or pictures.

Future research could be directed towards increasing consistency and user-friendliness, for instance, by developing a tool that supports this language specification. This would also assist in the collection, maintenance, and retrieval of existing design patterns. By allocating patterns to specific categories (e.g. linking them to different goals or problems), the tool could even provide a matching function that could list patterns that seem most promising for a specific issue. For example, if an organization would need an alternative revenue source, the tool could display a list of patterns that document various revenue mechanisms.

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