

# ICT-enabled Value Creation in Community Pharmacies: An Applied Design Science Research Approach

*Completed Research Paper*

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## Abstract

*Pharmacist-patient communication is currently limited to infrequent encounters in pharmacies, which limits the delivery of and value created by pharmacy services. We seek to better understand how ICT can enable value creation by extending pharmacist-patient communication beyond these encounters. In an applied design science research study with 21 Swiss community pharmacies, we designed an artifact that unleashes the provision of pharmacy services from personal encounters. We investigate (1) strategic intent for extending the communication, (2) business model requirements that are generated, (3) ICT capabilities that need to be developed, and (4) value that is created by the artifact instantiation. The findings can help healthcare practitioners to gain a better understanding of their current and future value proposition and policy-makers can (re-)consider the role of pharmacies and ICT-enablement in healthcare reforms. The presented process and artifact evaluation can contribute to the scientific dialog on co-evolution of artifact design and value creation.*

**Keywords:** Design Science Research, Business Model, Community Pharmacy, Information System Design, Information and Communication Technology, Innovation Management, Service Innovation, Value Creation.

## Introduction

Community pharmacies serve people directly in the local area and are the health professionals most accessible to the public (World Health Organization 1994). Currently, community pharmacists' major task is to check and dispense prescription drugs. As a response to increased economic pressure, e.g. due to emerging Internet pharmacies, changes in the regulatory environment, and lower margins in the sale of prescription drugs, community pharmacies aim to become more service-oriented. They are therefore rethinking their position in the healthcare value chain: the goal is to make a move from merely dispensing prescription drugs to providing professional pharmacy services (Feletto et al. 2010; Gebauer 2008; Heinsohn and Flessa 2013). Professional pharmacy services are defined as "an action or set of actions undertaken in or organized by a pharmacy - delivered by a pharmacist or other health practitioner, who applies their specialized health knowledge personally or via an intermediary, with a patient/client, population or other health professional, to optimize the process of care, with the aim to improve health outcomes and the value of healthcare" (Moullin et al. 2013, p. 990). An expanded role of community pharmacies is being considered by policy makers in a number of countries (Mossialos et al. 2013).

However, in practice, the process of dispensing medications to providing more advanced pharmacy services has been slow, which is caused by a "cycle of dysfunction" (Schommer and Gaither 2014 p. 523); patients do not acknowledge pharmacists as health service providers and pharmacists do not position healthcare services more prominently in their value proposition, which reinforces dysfunctional behaviors from both parties. We propose that a precondition to provide more advanced pharmacy services is the elimination of pharmacists' limited contribution to the process of healthcare: while face-to-face encounters still represent the standard of communication between health professionals and patients, the execution of primary care is currently restricted to the event when a patient comes into a community pharmacy, i.e., there are limitations regarding the timeframe and location where the communication takes place. The absence of a continuous communication process (as an integral component of the therapeutic process) limits the potential value that could be created.

Extending pharmacist-patient communication beyond face-to-face encounters is motivated by benefits not only for the community pharmacies, but also for the patient and the overall healthcare system. Benefits of an extended pharmacist-patient communication include, but are not limited to:

First, access to idle capacities: community pharmacies are the most accessible, the most frequently visited, and, in many situations, the most cost-efficient healthcare provider (Chisholm-Burns et al. 2010). However, much of pharmacists' knowledge and education are still idle capabilities, especially in the management of chronic diseases (George et al. 2010). The extension of the pharmacist-patient communication accesses these idle capabilities and thus creates additional value for the patient, while it enables pharmacies to realize the business opportunity to provide advanced pharmacy services (Brown et al. 2014).

Second, continued support: patients' tendency of non-adherence to therapy plans along with unstructured and infrequent encounters with therapists negatively impact their healing process (DiMatteo et al. 2002). For many diseases, advanced pharmacy services can improve the healing or the disease management process by providing continuous support and a communication channel to advise in case of drug-related problems or when therapy-related questions arise (Bellone et al. 2012; Schnipper et al. 2006).

Third, effectivity and cost-efficiency: the treatment of chronic diseases accounts for three-quarters of total healthcare costs (Christensen et al. 2008), which are even expected to increase in the future (Zhuo et al. 2013). These diseases are often rooted in lifestyle behaviors and habits that are related to, e.g. nutrition, fitness, smoking, or a patient's non-adherence to therapeutic plans (DiMatteo et al. 2002; Sabaté 2003). Against the background of rising healthcare costs in nearly every economy in the world (Regalado 2013; World Bank 2014), the fundamental asymmetry between highly organized health professionals on the one side and patients, who, once outside the physical boundaries of healthcare institutions, cannot be efficiently accessed, guided, and supported on the other side, is a major challenge for current healthcare systems. It is widely acknowledged that the overall "healthcare [system] as it is organized today is not sustainable" (Mohrman and Shani 2012 p. 2) and that the management of chronic diseases and, in particular, therapy adherence have become priorities for healthcare reforms (Cutler and Everett 2010). Physicians alone will not be able to meet the future demand for providing disease management to patients

(e.g. Petterson et al. 2013). In this regard, the provision of advanced pharmacy services can be a first step towards a more effective and cost-efficient treatment of chronic diseases.

Information Systems (IS) have the potential to contribute to a more accessible and efficient healthcare service provision (Agarwal et al. 2010; Martin et al. 2010; Mohr et al. 2013; Romanow et al. 2012). As described before, extending the communication between pharmacist and patient beyond the face-to-face encounter is considered a viable approach to provide pharmacists and patients with new opportunities to create value. In this endeavor, information and communication technology (ICT) can contribute to unleash the provision of pharmacy services from their current temporal and spatial limitations (Evans and Wurster 2000).

The shift towards providing advanced pharmacy services means nothing more than a transformation of community pharmacists' business model. A business model refers to an organization's design or structure of creating, proposing, delivering, and capturing value (McGrath 2010; Osterwalder and Pigneur 2010; Teece 2010). It can be understood as a reasonable means of aligning the relation between business strategy and IS (Hedman and Kalling 2003). The architecture of the IS should go hand in hand with the design of the business model (Chesbrough and Rosenbloom 2002; Chesbrough 2010). Venkatraman (1994) argues that the "range of potential benefits" and the "degree of business transformation" are correlated and are enabled by advances of the IS infrastructure. Heinzl and Güttler (2000) draw upon Venkatraman's framework to suggest an IT-induced healthcare reconfiguration. According to their framework, the provision of advanced pharmacy services represents a "business process redesign," which is considered a "revolutionary" endeavor (Heinzl and Güttler 2000; Venkatraman 1994).

Comprehensive business model innovations are not an easy task in the healthcare sector: there are typically only incremental business model changes because of policy and safety boundaries. Revolutionary business model innovations have to excel in providing a clear value proposition and in generating sustainable profits for all stakeholders to provoke policy changes (Valeri et al. 2010). The role of the pharmacist is highly ritualized; it is not only influenced by legal requirements and economics, but also by routines in interaction between pharmacists and patients that have evolved over decades and that are hard to change (Guirguis 2011, Guirguis and Chewing 2005). While market regulations do not pose an immediate obstacle to the development and deployment of new ICT, they can account for the low effort that is put into business model innovation endeavors in healthcare (Breitenmoser et al. 2013; Mettler and Eurich 2012).

Existing strategies for healthcare reforms (Hwang and Christensen 2008; Porter and Teisberg 2004; Porter 2009) mostly adopt a top-down approach on required changes; changes shall be enforced by policy makers that speak with one voice. However, bottom-up approaches are equally important, but they are thus far rarely addressed in the literature (e.g. Eason et al. 2012). In this regard, it is important to better understand how community pharmacies can benefit from ICT to facilitate a transformation of their business model (Lehoux et al. 2014; Schneider and Spieth 2013). A problem is the scarcity of rigorous research that considers both the ICT artifact design and the business model design. Petrakaki et al. (2012) investigate how ICT shapes the pharmacists' work practices, jurisdictions, roles, values, power, and boundaries and propose a framework to analyze ICT possibilities and corresponding features of change (Petrakaki et al. 2012). Lehoux et al. (2014) investigate the dyadic relationship between business model and health technology, and they conclude that there "is no single inherent value in a given innovation; if the technology 'were to be developed in different ways, it would likely accrue different value' (Chesbrough and Rosenbloom 2002 p. 534)" (Lehoux et al. 2014).

To our best knowledge, there is no study that systematically explores the potential of advanced pharmacy services by the means of a co-evolutionary approach that combines ICT artifact design with value creation considerations. A review of the literature on this kind of co-evolution revealed a lack of knowledge on how ICT can facilitate value creation by means of advanced pharmacy services. Because of the scarcity of successfully applied co-evolution in IS research, there is a lack of understanding of how research on ICT-enabled innovation and business value can support the design and evaluation of artifacts in healthcare settings.

We aim to fill these gaps by presenting an applied design science research (DSR) project that investigated the role of ICT in enabling value creation for community pharmacies. For that purpose, we designed and evaluated an ICT artifact that extends the communication between pharmacist and patient beyond the

face-to-face encounter to provide advanced pharmacy services. This represents a situated implementation of an artifact (artifact instantiation), but also facilitates the formulation of design principles and the understanding of the process of ICT-enablement (Gregor and Hevner 2013). We used an adapted framework for "technology-enabled business models" by Rai and Tang (2014) to investigate the ICT enablement over the artifact design process. To this end, the research questions are twofold: first, with regard to the community pharmacies' challenge to apply a bottom-up approach and to demonstrate their capability to provide advanced pharmacy services, the research questions are:

- RQ 1. *What are the key objectives for freeing pharmacist-patient communication from its current temporal and spatial limitations?*
- RQ 2. *How should the value creation and appropriation be designed?*

Second, we investigated the following two research questions on how community pharmacies can benefit from innovative ICT that enable a transformation of their business model:

- RQ 3. *What are the design requirements for community pharmacies' business model transformation?*
- RQ 4. *What ICT capabilities are needed to enable this business model transformation?*

The remainder of the paper is organized as follows: First, we describe our research design. Second, our results are structured around the four research questions and are presented in dedicated sections: (1) objectives that pharmacies have for the strategic intent, (2) the business model requirements that are generated, (3) the ICT capabilities that need to be developed and the prototype that we implemented to meet and support these capabilities, and (4) the value that is created and appropriated. Finally, the paper concludes with a discussion of practical and theoretical implications of the findings.

## Research Design

We investigate the research questions by reflecting on a project with 21 Swiss pharmacies, in which the authors were involved, which started in Q1/2012. The pharmacies are located in the German-speaking part of Switzerland, both in major cities and in the countryside. The sample includes mostly family-owned businesses and a few pharmacies that are subsidiaries of larger organizations. Most are independent pharmacies that join collaborations to coalesce in order to gain a better bargaining power or to jointly organize marketing activities. Their organizational structure includes a general manager, pharmacists, and pharmacy assistants. Pharmacies have between one and seven pharmacists and between four and nine pharmacy assistants. They have between 50 and 500 pharmacist-patient interactions per day. Most of the pharmacies are highly dependent on regular customer visits with an average of more than 70% of repeat customers. Highly profitable customers are typically older than 50 years.

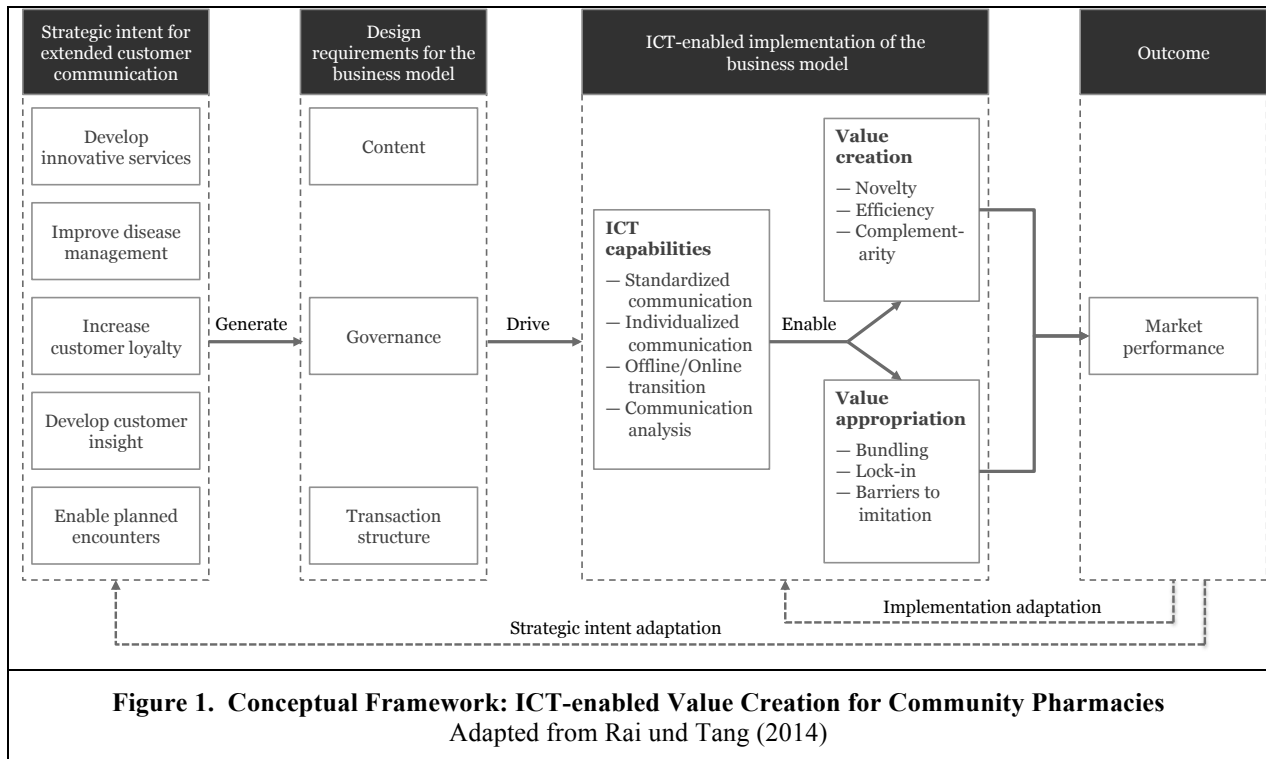
As the current research aims to develop an artifact that extends communication between pharmacists and patients in everyday practices, it is important to acknowledge that the technology cannot be investigated in isolation. ICT artifacts can be defined as "bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (Orlikowski and Iacono 2001 p. 121). The implementation and use of the technology influences the social and organizational context (Orlikowski 1992, 2000). It is important to acknowledge the recursive interaction between people and technologies over time; relations and boundaries between humans and technologies are not pre-given or fixed, but enacted in ongoing situated practices that may either reproduce existing structural conditions or produce changes that may lead to structural transformation (Orlikowski 2000). This circumstance applies especially to the introduction of ICT that goes beyond automation of existing processes and that introduces new processes and social interactions that alter the social system of the organization (Harrison et al. 2007, Hopp et al. 2005). This represents a "wicked problem" (Hevner et al. 2004) and favors a DSR approach that is concerned with "the systematic creation of knowledge about, and with, design" (Baskerville 2008 p. 441) and "not with how things are but with how they might be" (Simon 1996 p. xii). DSR supports researching aspects related to the development and organizational implementation of new systems (Rossi et al. 2013).

In the project, the strong collaboration between researchers and pharmacists was characterized by changing requirements and solution configurations; this necessitated flexibility to continuously address and integrate changes in the artifact development and synchronize with business transformations. We take a retrospective view on this project that followed the DSR paradigm (Gregor and Hevner 2013;

Gregor and Jones 2007; Hevner et al. 2004; Sein et al. 2011) and reflect on the design process that involved multiple build and evaluation cycles. Eventually, an artifact instantiation has been developed in the pharmacies that extends the communication between pharmacist and patient beyond the face-to-face encounter.

Several artifact instantiations were continuously demonstrated to the pharmacists and evaluated through interviews, focus workshops, surveys, and pilot tests. All design phases involved close collaboration between researchers and pharmacists and direct observations of existing workflows and ICT artifact's usage in the pharmacies. In the beginning of the project, we conducted personal, semi-structured interviews in the 21 pharmacies. The interviews addressed the current and future situation of pharmacies, aspects of pharmacist-patient communication, the existence of after-care operations, methods to control, support, or identify adherence, and requirements for an artifact to support patients subsequently to a pharmacy visit. Interviews lasted between 30 and 90 minutes. Subsequent to the interview, a questionnaire was returned by 19 of the pharmacies. The questionnaire aimed to quantify aspects that were discussed in and emerged through the interviews. The evaluation of several demonstrable artifact instantiations incrementally informed the research questions and the design process: from mockups in the first stages to fully working prototypes in the later stages of the project. There were three major versions of the prototype: the initial prototype was informed by insights from the first round of interviews and questionnaires and was theoretically grounded in research on (a) pharmacist-patient communication and relationship (e.g. Chesser et al. 2011; DiMatteo et al. 2012; Guirguis 2011; Katz et al. 2004; Worley-Louis et al. 2007) and (b) relationship marketing (Grönroos 2004). This prototype was then evaluated in focus group workshops inside the pharmacies, at which the focus was on identifying the critical requirements and functions of the system and to identify specific deployment scenarios. Based on the insights from this first prototype, a second prototype was developed that was used in the same manner by the pharmacies. 20 pharmacies returned a follow-up survey on their evaluation of the second prototype. Finally, based on the feedback and personal interviews with pharmacists, a third version of the prototype was developed and tested. In this way, our DSR project focussed on a "systematic creation of knowledge about, and with (artificial) design" (Baskerville 2008 p. 441). So far three pharmacies started using the system in their daily work routine with patients.

In line with the concept of business models (Chesbrough 2010; Hedman and Kalling 2003) and against the background of the specific challenges that apply to innovation in healthcare (see Introduction), we investigate both the IS design and the business model design with iterative feedback loops. In this regard, an adaptation of the recently suggested framework from Rai and Tang (2014) for creating "business value from IT-enabled business model[s]" seems suitable. We use this framework as an analytic lens to reflect on the design process that addresses the co-creation of knowledge and design of the IS and the business model. The framework guides researchers from the strategic intent over the design requirements for the business model to its technical implementation. In its generic use, "strategic intent" can refer to a variety of management goals, of which "develop innovative products/services", "develop market and customer relationships", and "generate complementarities" are most important to our project (ibid.). The framework also features two feedback loops in order to iteratively adjust the strategic intent and the implementation of the business model. This conceptual framework is too generic to be applied to the specific case of co-creation and co-innovation of an IS and business model that have the objective to provide community pharmacies with ICT-enabled pharmacy services. Therefore, the generic framework is adapted to the class of applied DSR projects that address ICT-enabled value creation such as our case in a community pharmacy setting (see Figure 1). While the feedback loops of strategic intent and implementation adaptation match the iterative nature of the applied DSR approach, the different phases of the framework match our research questions and are informed by the DSR process as described above: (1) the key objectives for the strategic intent (RQ1), (2) the business model requirements (RQ3), (3) ICT capabilities and value generation mechanisms (RQ2, RQ4). Finally, the surveys and observations from the customer pilot and additional interviews with the pharmacists provided first insights into the (4) market performance and, therefore, into the value created by the instantiated ICT artifact.



## Strategic Intent for Extending the Communication

A prerequisite for the strategic intent is that patients need to be perceived as customers and service consumers especially if they do not suffer from chronic disease but voluntarily want to consume services like nutrition-counseling. By means of the DSR process, we identified five key objectives for freeing pharmacist-patient communication from its current temporal and spatial limitations:

1. *Develop innovative services.* It is widely agreed upon among participating community pharmacists that they need to become more service-oriented and increase the revenue generated by and profitability of provided services. Pharmacies reported that pharmacy services currently account for less than 10% of their workload and for an even lower share of revenues. The regulatory environment is seen as a major reason for this situation. Often reimbursement models for pharmacy services are missing. Provision of nutrition-counseling is an example of the potential development of an innovative pharmacy service that is provided by some of the pharmacists in our project. Traditionally, the existing service consists of an initial 45-minute meeting inside the pharmacy, in which the specific situation is discussed and several recommendations for nutrition intake and behavior are agreed upon with the patient. In a second meeting a week later, it is discussed how well the patient followed the recommendations of the pharmacist and their progress is then evaluated. However, pharmacists' support is limited to the time and place of the personal interaction and does not comprise any action between the meetings when the actual nutrition intake and dietary changes take place. An innovative and advanced pharmacy service aims to extend this support to the time when patients have left the pharmacy and requests them, e.g., to take photos of their nutrition intake. New interaction points would be generated that may enable a higher quality of service and allow patients to provide feedback and ask questions, to which the pharmacist can give advice or adjust recommendations accordingly. For example, it is well known that antibiotics can harm the gut flora. The ability to identify patients that are troubled by these kinds of side effects provides opportunities to offer pharmacy services like nutrition-counseling that can address the particular problem of the patient during the therapeutic process outside the pharmacy.

2. *Improve disease management and adherence.* Due to the substantial costs that patients' non-adherence behaviors generate, medication and treatment adherence are a priority for healthcare reforms (Cutler and Everett 2010). Specific pharmacy services such as medication therapy management are

already reimbursed by health insurances in some countries (Bernsten et al. 2010). While research has supported the positive effects of pharmacists on patients' adherence (Morgado et al. 2011), the reach and richness of pharmacists' support and information is mostly limited to the personal encounter with the patient. However, drug-related problems and support requirements often emerge during the therapeutic process (Eichenberger et al. 2011) and after the encounter. The currently poor assistance to deal with these problems results in a substantial economic burden for the healthcare system (Christensen et al. 2008; Zhuo et al. 2013). In most situations today, the pharmacist does not even know if the patient adheres to the therapy recommendations, if adverse drug-related side effects exist, or if the patient has actually recovered as expected. From a patient perspective, no structured channel exists to ask the pharmacist for further support or advice as situations emerge. In rare cases, pharmacists ask the patient to return to the pharmacy or they may call the patient by phone to check therapeutic progress or outcome. Tools for facilitating adherence to therapy plans are scarce and those that are available tend to be very specific to particular situations. Accordingly, measures for the support and effectiveness of pharmacists are missing. However, this would present a solid argument for pharmacists to argue for expanded reimbursement schemes with health insurance providers or provide enough added value for patients to make them pay for their disease management support. Damage to the gut flora that may occur during antibiotic therapies also provides a good example here. If the gut flora is harmed, a healthy intestinal flora should be restored for an effective future immune response to various viral or bacterial germs (Ganal et al. 2012). Pharmacists could provide additional advice and support in restoring the immune system.

*3. Increase customer loyalty.* Customer loyalty is a vital aspect in the environment of community pharmacies. The current situation is characterized by emerging Internet pharmacies, supermarkets that sell over-the-counter products, self-dispensing physicians, and rival pharmacies (Heinsohn and Flessa 2013). In the highly regulated environment of pharmacies, differentiation is mainly limited to the quality of the counseling process and to the provisioning of additional services. Participating pharmacies are highly dependent on repeat customers. An expansion of the value and extent of counseling services beyond the personal encounter can increase customer satisfaction, create new touch points, and eventually pave the way to lead customers back to the pharmacy and build customer loyalty.

*4. Develop customer insight.* While pharmacies are the most accessible healthcare providers, their insights into patients' needs are still limited to the personal encounter. There are many situations that only emerge after the patient has left the pharmacy. This provides vast potential for pharmacies to create innovative pharmacy services and to improve their counseling processes (Urban and Hauser 2004). Extended communication supports the gathering of insights into the behavior of patients. The systematic creation of knowledge, about the concerns, needs, and attitudes of patients can be directly addressed or used in future counseling and selling processes. Situation as explained above, in which patients experience problems with side effects, can be systematically explored to support patients and provide additional services.

*5. Enable planned encounters.* In contrast to visiting the physician, most visits to pharmacies are random and are not planned ahead. While participating pharmacists agree that this open door policy is one of the central value propositions of a pharmacy, it also poses limitations to the quality of their personal interaction. As it is not known when a patient with a specific problem approaches a specific pharmacist, pharmacists must be equally trained, which makes it hard for general managers to specialize their staff. The development of personal relationships between pharmacist and patient subsequent to their face-to-face encounter is not possible because there is no way to lead the patient back to this particular pharmacist whenever required throughout the patient's recover process. Particularly, pharmacies that provide services like travel-counseling, nutrition-counseling, or checking of blood pressure and cholesterol levels would benefit from planned encounters. First, the pharmacy could allocate resources better if they were able to book appointments with patients for services that require specialized staff or hinder the pharmacist from serving other patients in the meantime. Second, the patient could be prepared for the encounter, e.g., by documenting nutrition intake for a week to be able to interpret blood pressure testing or cholesterol levels better. This could increase the quality of the personal encounter.

## **Design Requirements for the Business Model**

The five key objectives for extending pharmacists' communication with patients generate distinct design requirements for an advanced value creation. In accordance with the conceptual framework introduced

above (Figure 1), we identify for each of the objectives its influence on (a) transaction content (“the goods or information being exchanged and the resources and capabilities that are required”), (b) transaction structure (“the parties that participate in the exchange and the ways they are linked”), and (c) transaction governance (“the ways in which flows of information, resources or goods are controlled by the relevant parties”) (Amit and Zott 2001 p. 511; Rai and Tang 2014). The development of healthcare ICT comprises a large number of general ICT requirements like security or privacy requirements (Zhang and Liu 2010). While general requirements were considered in and influenced the design of the artifact, the following assessment focuses on the specific requirements that emerged in the context of the presented DSR project.

*1. Develop innovative services.* (a) The transaction content and the structure of the *sequencing* of service interactions between pharmacist and patient (both for the encounter in the pharmacy and thereafter), need to be defined, e.g., when a pharmacist offers a service for treating tick bites. During the personal meeting, the pharmacist can remove the tick and disinfect the bite area. The pharmacist then needs to tutor the patient about the value proposition of the extended service such as monitoring specific signs or symptoms for a month, to ensure timely identification of tick-borne diseases. This is particularly important because there is little awareness of a pharmacy’s competences among patients and most pharmacists are not comfortable in selling services (Schommer and Gaither 2014). Consequently, *service triggers* are required, which request pharmacists to provide a specific follow-up service to the patient in a predefined situation. Appropriate *pricing mechanisms* need to be identified that suit the extended service provisioning like one-time payments, usage-based pricing, outcome-based pricing, or subscriptions. Revenues for extended services must be enforced because according to participating pharmacists, pharmacies already provide too many services for free. The provisioning of the extended service should be automated as much as possible, but at the same time provides the flexibility of individualized and spontaneous support in case of irregularities. For example, the information on how to monitor symptoms after a tick bite can be standardized and delivered automatically. However, when specific symptoms occur on the patient side, patient and pharmacist must be able to communicate spontaneously in order to address the problem in an individualized manner. This pattern holds true for all services that were discussed throughout the project such as the treatment of tick bites, the management of diabetes, or the provisioning of nutrition-counseling. (b) With regard to the transaction structure, it needs to be defined who participates in the communication (pharmacist, pharmacy assistant, patient, or caregiver). The staff for the provision of services must be available when the patient communicates remotely or returns to the pharmacy (*resource allocation*). This is particularly challenging as many pharmacists have part-time contracts. It would be best if the very pharmacist that provided the service to the patient inside the pharmacy also provided the service when the patient has left the pharmacy. However, this might not be possible in certain situations and *handover processes* need to be in place in order to ensure timely responses to patients’ requests. (c) With regard to the *transaction governance*, the remote service provisioning must meet health industry’s standards regarding quality, reliability, and confidentiality (*quality attributes*). Moreover, both the pharmacist and the patient must have *incentives* to participate in the extended exchange. That means that while pharmacists need incentives to provide good and timely counseling with remote services, patients need to appreciate the value that is created for them. This also applies to cases, in which an individual intervention of the pharmacist was not required because the recovery transpired as expected.

*2. Improve disease management and adherence.* (a) Specific to our project are requirements that define *evidence-based contents* of interaction to support patients throughout their therapies. Guidelines for the face-to-face encounter exist (Greenhill et al. 2011), but need to be redefined for extended communication. Patients need the information, the motivation, and a strategy to follow recommendations of adherence (DiMatteo et al. 2012). (b) Patients need to have the possibility to report specified adherence measures to the pharmacist. These measures need to be interpreted by the pharmacist to advise the patient accordingly. *Thresholds and signals* must be in place that support pharmacists in their decision-making and indicate which interventions are needed. For example, if patients indicate that they are doing worse than before or are experiencing side effects, the pharmacist must be able to provide timely advice on the basis of predefined and easily accessible guidelines. (c) Patients need to understand the value of entering this extended process of communication in the context of their particular problem. As patients are unlikely to pay for disease management or adherence programs, reimbursement schemes must be established, which may require *data storage and processing* by third parties.



3. *Increase customer loyalty.* (a) *Continuous analysis of customer loyalty* is required. Communication frequencies and patterns should be measured for different groups of patients and different kinds of follow-ups; not all activities may have positive effects on all patients. (b) Mechanisms must ensure that the transitioning from the personal encounter to the online encounter and vice versa is as coherent and as easy as possible and that patients can be served by the *same pharmacist* in subsequent encounters. (c) Contents and structure of communication must build trust between patient and pharmacist. *Incentive schemes* can increase customer loyalty, e.g., when encouraging and rewarding certain behaviors when patients are outside the pharmacy.

4. *Develop customer insight.* (a) The data of interest needs to be identified, integrated into the communication, and analyzed. (b) Patients should be automatically requested to provide feedback at the end of each follow-up. (c) They need to be informed about and agree on the data that is shared with and analyzed by the pharmacist. Data mining mechanisms can be applied to analyze data patterns and create knowledge for new or improved pharmacy services. For example, with the nutrition-counseling service that requires patients to document their meals for a week, we discovered that participants preferred taking photos of their meals over documenting them by writing. This generates requirements with regard to the information shared with patients and the mechanisms for analyzing nutrition intake. For example, the pharmacist needs to advise patients on how to best document their nutrition intake with the smartphone camera.

5. *Enable planned encounters.* (a) *Situations* should be defined that are suitable for planned encounters. For example, nutrition-counseling requires a dedicated pharmacist for about 45 minutes. (b) Patients and pharmacists must be able to agree on and prepare *appointments*. This includes the activities that pharmacist and patient need to do when *preparing* the personal encounter. It needs to be ensured that the specific pharmacist is available for the face-to-face encounter, i.e., the pharmacist cannot serve incoming patients meanwhile. (c) Furthermore, collected data from the preparation phase (the data that was documented by the patient before the face-to-face encounter) must be *available* to the pharmacist shortly before and during the personal encounter. Table 1 provides an overview of introduced design requirements for business model transformation to address the key objectives as derived above.

Strategic intent for extending communication	Business model design requirements		
	(a) Content	(b) Transaction Structure	(c) Governance
Develop innovative healthcare services	<ul style="list-style-type: none"> <li>- Service sequencing</li> <li>- Service triggers</li> <li>- Pricing mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>- Resource allocation</li> <li>- Handover processes</li> </ul>	<ul style="list-style-type: none"> <li>- Incentives</li> <li>- Quality attributes</li> </ul>
Improve disease management and adherence	<ul style="list-style-type: none"> <li>- Evidence-based contents of extended communication</li> <li>- Service triggers</li> </ul>	<ul style="list-style-type: none"> <li>- Resource allocation</li> <li>- Handover processes</li> <li>- Thresholds and signals</li> </ul>	<ul style="list-style-type: none"> <li>- Incentives</li> <li>- Quality attributes</li> <li>- Data processing</li> </ul>
Increase customer loyalty	<ul style="list-style-type: none"> <li>- Analysis of loyalty generating mechanisms</li> <li>- Sequencing</li> </ul>	<ul style="list-style-type: none"> <li>- Easy transitioning between online/offline</li> <li>- Personal pharmacist</li> </ul>	<ul style="list-style-type: none"> <li>- Incentives</li> <li>- Trust building</li> </ul>
Develop customer insight	<ul style="list-style-type: none"> <li>- Data analysis</li> </ul>	<ul style="list-style-type: none"> <li>- Automated feedback requests</li> </ul>	<ul style="list-style-type: none"> <li>- Transparency of collected data from patient side</li> <li>- Mechanisms to translate data to market knowledge</li> </ul>
Enable planned encounters	<ul style="list-style-type: none"> <li>- Planned encounter definition</li> </ul>	<ul style="list-style-type: none"> <li>- Resource allocation</li> <li>- Appointment booking</li> <li>- Preparation phase</li> </ul>	<ul style="list-style-type: none"> <li>- Availability of planned encounter preparation data</li> </ul>

## ICT Capabilities and Prototype System

Pharmacies need to invest in four distinct but complementary ICT capabilities to enable the business model transformation as described above. The pharmacy needs to be able to:

1. plan the communication with the patient in advance and standardize the communication process,
2. customize the communication to a specific patient's need, which we refer to as "individualized communication,"
3. manage the offline/online transition from the personal encounter in the pharmacy to the remote communication and vice versa, and
4. analyze emerging communication patterns to continuously adjust and improve standardized and individualized communication, and to improve the offline/online transition.

### **Standardized Communication**

The communication process and the emerging relationship between pharmacist and patient needs to be planned in advance (Grönroos 2004). It would not be feasible for a pharmacist to plan and structure a communication process completely and individually for a specific patient during the face-to-face encounter. We introduce the notion of interaction-templates (Volland et al. 2014), which consist of a number of communication elements at specific points of reference to the time of the personal encounter. These support and enable the patient in making specific health decisions or behavior changes (Chesser et al. 2011). Interaction-templates can be created for specific situations depending on the particular situation of the patient and allow the automatic delivery of communication elements at specified times. Examples include interaction-templates for head lice, tick bites, skin related problems, pain therapy, diabetes management, or nutrition-counseling. They guide both, pharmacist and patient, through a predefined communication process. Table 2 shows an extract of the interaction-template for a tick bite that enables specific types of communication such as text information, a photo-function to enable patients to report their status, and a final success feedback after 28 days to determine the patient's recovery.

In addition to the interaction-templates, which relate to a specific indication or drug, there can also be interaction-templates that inform the patient about the availability of specific services, e.g., templates including triggers for travel counseling at the beginning of the holiday season or for allergy checks in spring that patients receive complementary to their situation-specific content.

### **Individualized Communication**

While the standardized interaction-templates provide the structure for a communication process, individualized communication complements this whenever required. This can be triggered from the patient's side, e.g., when additional information is required that was initially not included in the interaction-template. It can also be triggered from the pharmacist's side, e.g., when a status report from the patient requires personal advice, when an upcoming personal encounter needs to be arranged, or when an individual service provision should be offered to the patient.

<b>Time</b>	<b>Type</b>	<b>Communication text that is displayed to the patient</b>
Directly	Text information	Dear patient, you had a tick bite. Please note the date and location of the bite. In the coming days, you will receive notifications that will remind you to check the bite. This is important for the early recognition of a potential infection.
Day 3 9:00	Photo feedback	Dear patient, please send me a photo of the bite so that I can check if the healing is progressing as intended.
Day 4 9:00	Text information	Dear patient, over the next 10 days please check if you have any symptoms of the flu such as fever, headaches, or fatigue. This could be an indication of an infection caused by the tick bite.
Day 28 9:00	Success feedback	Dear patient, your tick bite occurred weeks ago. Is the bite completely healed?

## Offline/Online Transition

The transition from personal encounters to online communication and vice versa is crucial because if it does not meet the patient's expectations, the patient may never join into the extended communication. The pharmacist must be technically supported in demonstrating to the patient how and why their communication should be extended during the personal encounter.

## Communication Analysis

Pharmacies need the capability to analyze emerging communication for patterns and inconsistencies. The findings can be used to incrementally improve the interaction-templates. For example, when specific individualized communication repeatedly occurs in certain situations, it can be included into an interaction-template and therefore reduce the individual workload of the pharmacist in future interactions. Analysis of information and feature usage directly influences interaction-templates and the structure and content of offline/online transitioning.

## Final Prototype System

We developed a prototype system (Volland et al. 2013, 2014), which consists of (1) a tablet PC application that enables communication and monitoring of patients by pharmacists, (2) a smartphone application used by patients that guides them along the defined interaction-template as configured by the pharmacist and allows for communication with the guiding pharmacists, and (3) a mobile back-end service to synchronize the usage data of the different clients. Furthermore, (4) a web-interface supports the creation of interaction-templates and the analysis of communication by pharmacists or third party editors. Figure 2 provides a high-level overview of the architecture and the key functions. We chose a tablet PC device for the pharmacist as it cannot only be integrated into existing workflows and the personal and often brief encounters (van Hulst et al. 2011) with patients at the front desk, but also be used in the back office and can even be taken home by the pharmacists. While the introduced prototype addresses the above-derived requirements and enables the development and execution of presented ICT capabilities, the focus in the following description is on the introduction of the functionality and workflow of the system. General ICT requirements such as requirements for service-oriented architectures (Papazoglou and Heuvel 2007) or for security and data privacy (Zhang and Liu 2010), particularly in the context of the mobile cloud context, were considered and implemented in the final prototype.

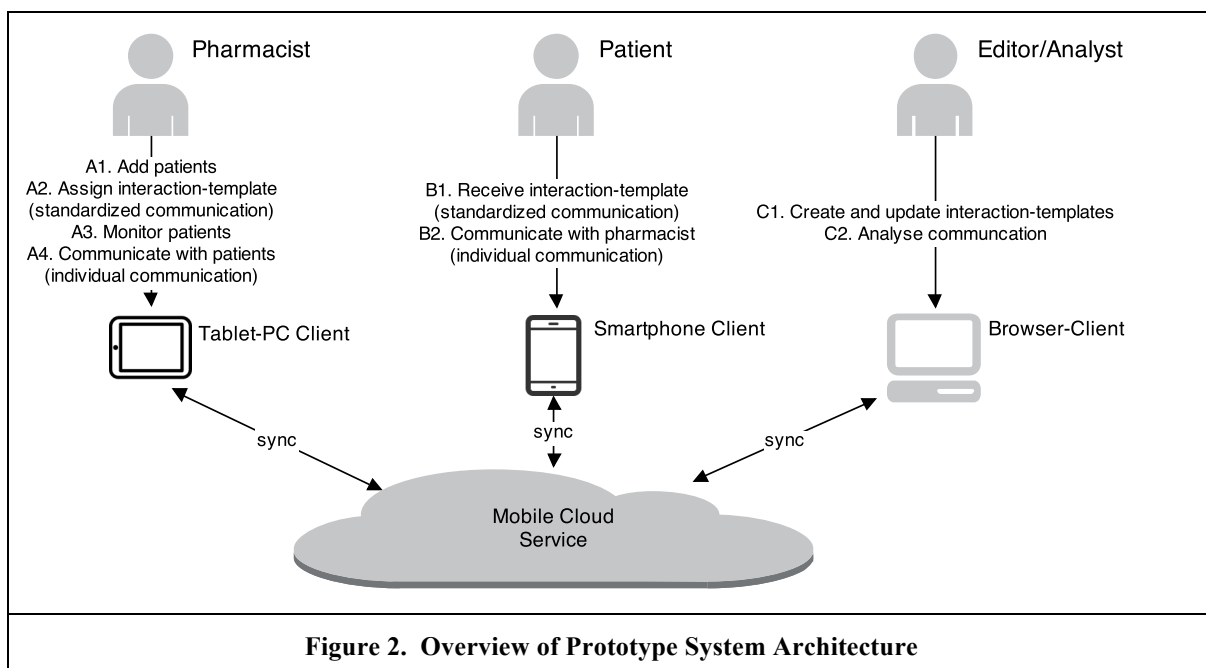


Figure 3 and Figure 4 show annotated screenshots of the pharmacists' and the patients' applications. Figure 3 shows the main screen of the pharmacist's tablet PC, which illustrates the interaction-template (standardized communication) for a specific patient and the feedback received for predefined communication elements such as therapy progress feedback and a photo. The individual communication with the particular patient can be accessed by clicking on the patient's avatar. It is designed as a chat-dialogue similar to modern smartphone messengers' user interfaces.

In their personal encounter with the patient, pharmacists can use the tablet PC application to add a patient to the system and assign an interaction-template for extended communication. The pharmacist hands over a personalized code to the patient that is generated by the system. In addition, the code is sent to the patient via SMS including the download link to the smartphone application.

After the patient has left the pharmacy, s/he enters the personalized code into the application (see Figure 4, Screen 1) and can then access the interaction-template with the communication elements visualized in the form of a recovery cycle for the specified duration of days (see Figure 4, Screen 2). In addition to the predefined communication elements that can be accessed at specified times (see Figure 4, Screen 3 as an example for reporting therapy progress), the patient can also communicate with the pharmacist individually by clicking on the pharmacist avatar in the middle of the screen (see Figure 4, Screen 4). Currently, predefined communication includes the functionality for sending text, graphical, or video information. It further includes several elements that require feedback from the patient such as the request for therapy progress (see Figure 4, Screen 3) or final therapy success, the question if the drug was taken as agreed upon, the request for medical parameters like blood pressure or glucose, or feedback in form of a photo to document a wound or nutrition intake.

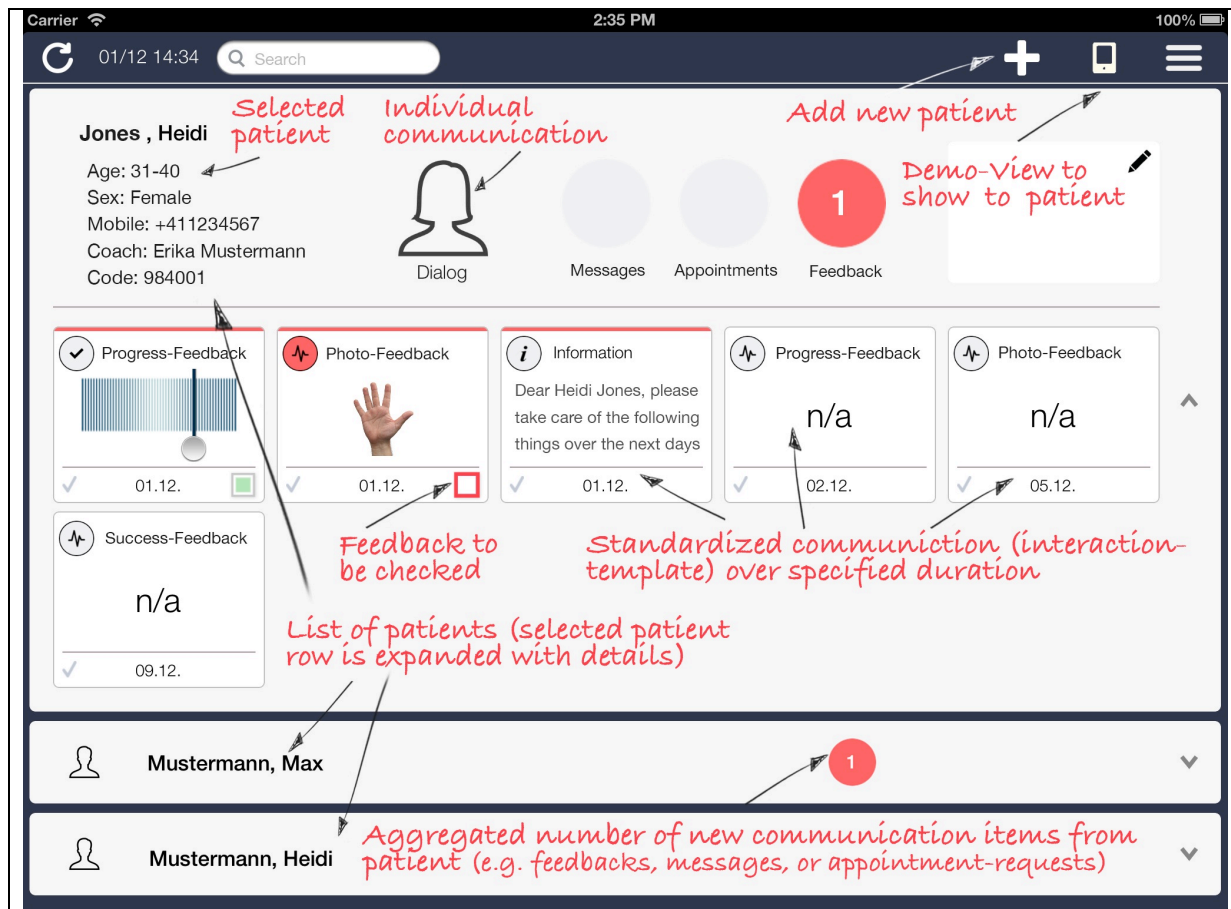


Figure 3. Pharmacist's User Interface Main Screen on Tablet PC

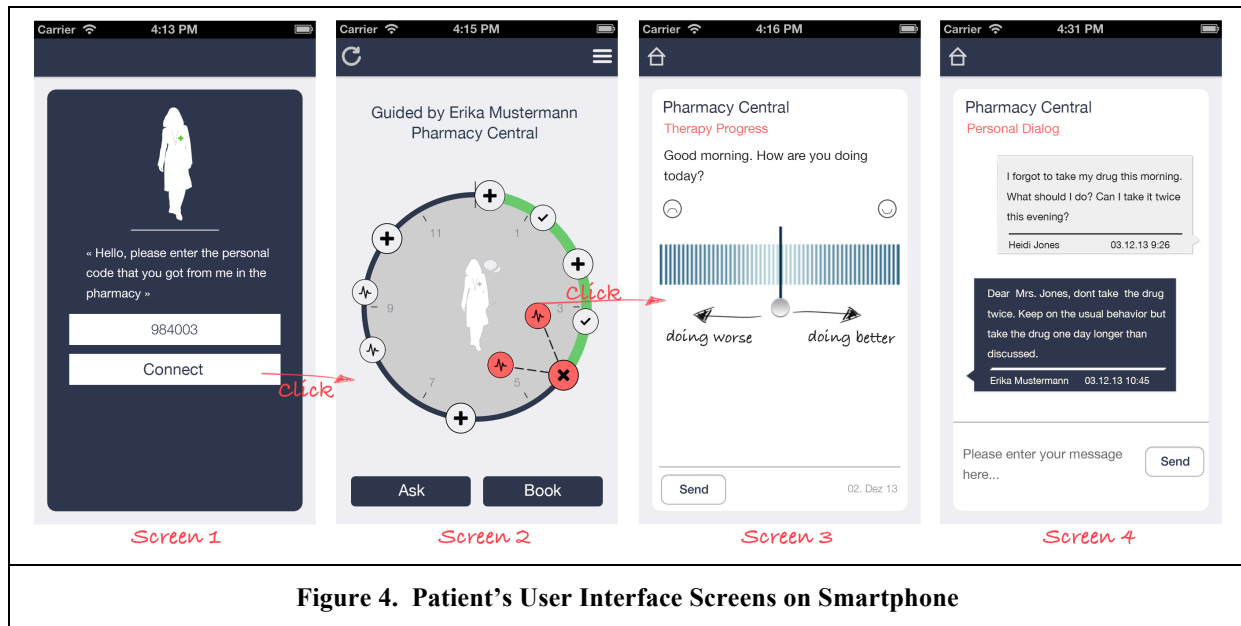


Figure 4. Patient's User Interface Screens on Smartphone

## Value Creation and Appropriation

In this section, we discuss how the derived ICT capabilities - (1) standardized communication, (2) individualized communication, (3) offline/online transition, and (4) communication analysis - create and appropriate value in community pharmacies. We use the mechanisms from Amit and Zott (2001), Rai and Tang (2014), and Teece (2010) as an analytical lens, namely the value creation mechanisms: novelty, efficiency, and complementarity, as well as the value appropriation mechanisms: bundling, lock-in, and barriers to imitation.

**1. Novelty.** The aforementioned ICT capabilities introduce new ways of creating value for pharmacies and their patients. Today after the visit, there is only unidirectional and static information that pharmacists provide to the patient like the obligatory drug leaflet, additional notes written on the drug package itself, or brochures that inform the patient about specific topics like diabetes management. However, no support for structured bidirectional communication exists. In rare cases, pharmacists ask patients to return to the pharmacy after a couple of days, and, in very rare cases, the pharmacist calls a patient to ask for progress or as a reminder for certain tasks. Pharmacists are now enabled to guide patients through the complete therapeutic process and support them whenever needed.

Standardized interaction-templates are another novelty, supporting pharmacists to make better use of their education and knowledge in order to provide added value to patients via advanced pharmacy services. Disease management programs can be extended over the complete therapeutic process and are no longer restricted to the brief face-to-face conversation inside the pharmacy, in which all emerging needs of the patients can hardly be foreseen. For patients, receiving structured support over the therapeutic process presents a new value proposition, which potentially makes them feel better supported, safer, and more satisfied. Third parties like payers, pharmaceutical companies, or pharmacy cooperations can also profit; they are enabled to introduce standardized communications around products and services that are triggered by the pharmacist-patient interaction in the pharmacy and guide both pharmacist and patient through the process.

While successful transitioning from the offline to the online communication presents a new channel for pharmacies to contact patients and offer subsequent services, it also provides a novel value proposition to the patient who is provided with easy access to the pharmacist.

The ability for individualized communication enables interaction whenever something cannot be planned ahead. Pharmacists can intervene whenever patients need specific support. Patients can ask questions or report measures that were not included in the standardized interaction-template. This provides a new opportunity to gather market knowledge by "listening into" (Urban and Hauser 2004) the questions and

feedback of patients. Systematic analysis of patients' questions and data presents valuable market and healthcare knowledge to multiple stakeholders. For example, when multiple patients report that they are feeling worse on the third day after taking a specific drug, this fosters the knowledge of pharmacists about the drug and enables them to advise future patients in advance on how to address this issue. This information can be integrated into interaction-templates and may also present valuable information for payers and pharmaceutical companies.

*2. Efficiency.* The introduced ICT capabilities provide opportunities for more efficiency. The capability of standardized predefined communication releases the initial consultation from the need to discuss everything in advance that could become potentially relevant in the future. Today, advice in the personal encounter must foresee a large number of situations that may never occur. Too much information at once may result in unsatisfied patients (van Geffen et al. 2011) who may be overstrained by the complexity of the treatment regime (Ingersoll and Cohen 2008). With pre-planned communication and associated measures, advice can be provided only when specific situations occur. Pharmacists and patients can prepare personal encounters and increase the quality and efficiency of their face-to-face consultations. Furthermore, pharmacists can guide patients from the back-office in their down time between their duties in the pharmacy. Finally, the offline/online transition and follow-up reduce search costs for the patient, and the support ensures an informed decision making throughout the therapeutic process. A cost-efficient delivery of disease management may also provide efficiency gains for the healthcare system as a whole.

*3. Complementarities.* The introduced ICT capabilities provide opportunities for vertical and horizontal complementarities. Standardized pre-planned communication enables after-sale services, and the offline/online transition provides a complementary service to the patients. On the one hand, online healthcare services can complement sold drugs and the encounter in the pharmacy. On the other hand, the online healthcare service may also be complemented by additional face-to-face encounters and enable cross selling of products. Standardized and individualized communications also complement each other; while standardized communication makes the interaction efficient, individualized communication enables required flexibility. Finally, the ability to provide advance pharmacy services may also provide complementarities with regard to other healthcare providers business models like physicians or hospitals. For example, hospitals may strive to focus on their core value proposition (e.g., diagnostics or surgery) (Christensen et al. 2008), positioning pharmacies to be more involved in complementary after care operations.

*4. Lock-in* is concerned with the extent to which pharmacies can build customer loyalty. Interaction-templates create new touch points with customers, opportunities to satisfy them, and gather valuable knowledge. The emerging relationship and the generated knowledge are likely to create “switching costs” for customers (Smith et al. 1999).

*5. Bundling* is related to the aggregation of products and services and their sale for a fixed price. Coupling products and services with remote services creates a new value proposition for customers. For example, a drug that reduces blood pressure can be bundled with a service to provide nutrition-counseling. The introduction of interaction-templates and the ease of offline/online transition create value for the pharmacist and the customer.

*6. Barriers to imitation.* First mover advantages and the insights from emerging communication patterns provide pharmacies with a competitive edge. First, the continuous analysis of emerging communication creates higher quality and more efficient interaction-templates. The currently available interaction-templates can be configured to be shared or to be held private, i.e., access to the knowledge created in the interaction-templates can be restricted but made available on request to third parties using the system or profiting from the generated data. Second, this ICT-enabled form of support and disease management supports decision-making of policy makers and payers at an early stage. Currently, there are no support programs where extended support is provided by health professionals that can be scaled over a large number of healthcare providers with frequent patient encounters as it is the case with community pharmacies.

## **Preliminary Performance Analysis & Discussion**

Participating pharmacists used the web-interface to create nine interaction-templates that they believed to deliver the best value to the patients. These include three interaction-templates for nutrition-

counseling, antibiotics, pain management, tick bites, head lice, conventional wound treatment or hydro-active wound treatment. Their duration varies between 5 and 28 days. The interaction-templates also vary regarding the number of included standardized communication elements (from 7 to 16). Over the duration of the DSR process, the interaction-templates have been continuously improved. Pharmacists could use their tablet PCs to adjust the synchronized interaction-templates to their specific needs. Some pharmacists and researchers who were assigned editor roles also used the web-interface to create and update existing interaction-templates based on the modifications made by the pharmacists and the analysis of emerging communications. For this purpose, statistical reports can be generated from a developed R-Project environment (R Core Team 2013) that provides insights into contents, frequencies, and patterns of communication. The goal is to standardize as much of the communication as possible without sacrificing value for customers.

Due to the nature of the DSR process, the feedback loops to adjust strategic intent and implementation adaptation were continuously used to refine derived objectives, business model requirements, and the design of the artifact. The usage, functionalities, and experiences with updated versions of the prototype were repeatedly evaluated by pharmacists' and selected patients.

With regard to the evaluation of the *market performance*, we present the first findings from the customer pilot, which involved actual day-to-day customers using the prototype. In Q1/2014, three pharmacies used the system with 16 day-to-day patients. In total, 30 patients showed interest in the application. 14 could not participate due the lack of a compatible smartphone. The nutrition-counseling service was the most used one (N=12). All 14 customers were younger than 50. It can be argued that these customers may not be the most profitable customers of a pharmacy. However, we believe that the current focus on younger customers, which may also be grounded in the lower rate of smartphone usage among older persons, is a temporary one. We anticipate that smartphones will gain further attraction also among elderly people. In 2012, 48 percent of Swiss consumers were already using a smartphone compared to only 3% in 2007 (Comparis 2012). Mobile Internet usage is increasing exponentially with more and more smartphones constantly connected to a network (Cisco 2013).

The following description focuses on the insights that we could gather from the provision of the nutrition-counseling service. The service was characterized by its comparably high price of 200 CHF (about 220 USD) and the frequency of communication between pharmacist and patient, which distinguishes it from the other mostly free and lower involvement pharmacy services. From this experience, we gathered anecdotal evidence that patients are indeed willing to pay for this kind of services. The assumption of patients' willingness to pay is further supported by the participating pharmacists, who anticipate a great market potential as well as by literature that advocates the potential of nutrition counseling (e.g. Heaton and Frede 2006).

Pharmacists reported that they like this new kind of interaction and that the task of responding to individual communication and feedback from remote patients can be done in the down times between their traditional tasks. On average, patients communicated 29.3 times to the pharmacist of which 49.4% were individual communication (such as questions related to nutrition) and 50.6% standardized communication (such as photos to document meals). Pharmacists communicated, on average, 21 times with each patient. The high frequency of communication is likely to be attributed to the comparably high fixed price for the service. Some of the patients sent more than 50 photos during their follow-up, which then needed to be examined by the pharmacist.

Patients were asked to fill out a survey at the last day of the service. All patients participated in the survey (N=12). Items were evaluated on a 7-point Likert scale with 1 representing "strongly disagree" and 7 representing "strongly agree". The evaluation of the survey revealed very positive reactions to the advanced service: patients perceived their extended communication with the pharmacist as very helpful (M=6.67, SD=0.49); appreciated the received information as very valuable (M=6.25, SD=1.29); were more much motivated to follow pharmacist's recommendations (M=6.42, SD=0.90); felt better supported (M=6.58, SD=0.52); and were overall very satisfied (M=6.67, SD=0.49). The Net Promoter Score was 9.17 from 10 (Reichheld 2003). In our discussions with the pharmacists, we found anecdotal evidence that the prototype could support pharmacists in addressing the "cycle of dysfunction" (see Introduction) by freeing their service provision from the personal encounter with the patient. The extended form of nutrition counseling provides a new value proposition (one week of counseling vs. one hour), which makes the pharmacists more confident in offering the service to the patient.

The developed prototype can be easily scaled to include more pharmacies. The major hardware investment is a tablet PC. The device uses the mobile cellular system to connect with the mobile back-end service and does not depend on the pharmacies' existing infrastructure. In our experience, the training of pharmacists in the prototype's central capabilities and functionalities takes between 45 and 90 minutes, with a subsequent trial-out phase and the ability to ask questions and resolve uncertainties.

## **Conclusion**

In order to better understand ICT-enabled value creation in pharmacies, we reflected on a DSR project with 21 Swiss pharmacies, in which we designed an artifact instantiation to extend pharmacist-patient communication beyond personal encounters. We (1) identified strategic objectives for extending the communication. Furthermore, we investigated (2) the business model requirements that are generated, (3) the ICT capabilities that need to be developed, and (4) the value that is created by the artifact instantiation. We presented a fully functional ICT artifact instantiation that addresses the previously derived requirements and supports the operationalization of ICT capabilities. We present first insights from actual day-to-day customer interactions with pharmacists using the created artifact.

With regard to practical contributions, we developed and evaluated an artifact that enables pharmacies to create value. We described the process of value creation from strategic intent to market performance. The new artifact and the first experiences with it provide practitioners and policy makers with anecdotal evidence about the feasibility of an ICT-enabled service provision in community pharmacies, which creates value for pharmacies and patients. Furthermore, the proposed solution may address current healthcare challenges such as providing additional nutritional guidance to patients or addressing non-adherence behaviors.

With regard to theoretical contributions, we not only presented a situated implementation of the artifact, but also provided insights into the co-evolution of business model requirements, ICT capabilities, and ICT artifact. The successful application of the adapted framework (Rai and Tang 2014) within a DSR approach addresses the lack of research on the co-evolution of artifact design and value creation. This project is one of only few recent DSR-based endeavors that addresses artifact design and value creation alike and which led to results that satisfied all involved stakeholders. In hindsight, we see the co-evolution aspect as the key to success: on the one hand, the introduction of novel ICT capabilities without new value propositions might have resulted in an efficiency increase, but the benefits would have been much smaller for both, the pharmacists and the patients (cf. Venkatraman 1994). From a business model perspective, the manner in which new technological artifacts are commercialized is the deciding factor for the economic outcome (Chesbrough 2010). On the other hand, new value propositions without novel ICT capabilities would have led to a dilemma between reach or richness, i.e. either the community pharmacy can provide a high value service to only a few patients (richness) or a low value service to many patients (reach) (Evans and Wurster 2000), but due to time and budget restrictions it cannot do both at the same time. Our case demonstrated that only the introduction of a new ICT artifact together with a reasonable new value proposition could have solved this dilemma.

The adjusted framework and our application in a community pharmacy setting could be transferable to other settings that investigate value creation aspects in parallel to designing artifacts in organizations. Our artifact design allows different configurations with regard to the structure, content, form of interaction-templates, and the functionality available to pharmacist and patient. Future research could extend the created artifact and our approach to other settings such as clinical pharmacies, practices of general physicians or medical specialists, or hospitals where value can be created beyond patients' visits to their institutions, e.g., with the objective to reduce readmissions. Furthermore, future research activities could elaborate on the process of integrating more stakeholders into the artifact design and investigate emerging requirements and created value, e.g. when physician and pharmacist collaboratively guide a patient throughout the therapeutic process. We encourage future design science research to directly integrate the framework from Rai and Tang (2014) with our adjustments into their design processes and further investigate the co-evolution aspects of artifact design and value creation.



## References

- Agarwal, R., Gao, G., DesRoches, C., and Jha, A. K. 2010. "The Digital Transformation of Healthcare: Current Status and the Road Ahead," *Information Systems Research* (21:4), pp. 796–809.
- Amit, R., and Zott, C. 2001. "Value creation in E-business," *Strategic Management Journal* (22:6-7), pp. 493–520.
- Baskerville, R. 2008. "What design science is not," *European Journal of Information Systems* (17:5), pp. 441–443.
- Bellone, J. M., Barner, J. C., and Lopez, D. 2012. "Postdischarge interventions by pharmacists and impact on hospital readmission rates," *Journal of the American Pharmacists Association* (52:3), pp. 358–62.
- Bernsten, C., Andersson, K., Garipey, Y., and Simoens, S. 2010. "A comparative analysis of remuneration models for pharmaceutical professional services," *Health Policy (Amsterdam, Netherlands)* (95:1) Elsevier Ireland Ltd, pp. 1–9.
- Breitenmoser, P., Abraham, R., Eurich, M., and Mettler, T. 2013. "Why Innovation In Air Navigation Services Is So Difficult In Europe? A Study Identifying Current Obstacles And Potential ICT Enablers," in *Proceedings of the 21st European Conference on Information Systems*, Utrecht, Netherlands.
- Brown, D., Portlock, J., Rutter, P., and Nazar, Z. 2014. "From community pharmacy to healthy living pharmacy: positive early experiences from Portsmouth, England," *Research in Social & Administrative Pharmacy* (10:1) Elsevier Inc, pp. 72–87.
- Chesbrough, H. 2010. "Business Model Innovation: Opportunities and Barriers," *Long Range Planning* (43:2-3), pp. 354–363.
- Chesbrough, H., and Rosenbloom, R. S. 2002. "The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spin-Off Companies," *Industrial and Corporate Change* (11:3), pp. 529–555.
- Chesser, A. K., Woods, N. C. K., Davis, A., and Bowers, C. J. 2011. "Prescribing information therapy: opportunity for improved physician-patient communication and patient health literacy," *Journal of Primary Care & Community Health* (3:1), pp. 6–10.
- Chisholm-Burns, M. A., Graff Zivin, J. S., Lee, J. K., Spivey, C. A., Slack, M., Herrier, R. N., Hall-Lipsy, E., Abraham, I., and Palmer, J. 2010. "Economic effects of pharmacists on health outcomes in the United States: A systematic review," *American Journal of Health-System Pharmacy* (67:19), pp. 1624–34.
- Christensen, C. M., Grossmann, J., and Hwang, J. 2008. *The Innovator's Prescription: A Disruptive Solution for Health Care, Technology*, (1st ed.) McGraw-Hill.
- Cisco. 2013. "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013–2018," available from [http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white\\_paper\\_c11-520862.html](http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html); accessed August 27, 2014.
- Comparis. 2012. "2,9 Millionen Schweizer haben ein Smartphone," available from <http://www.comparis.ch/~media/files/mediencorner/medienmitteilungen/2012/telecom/verbreitung-smartphone.pdf>;
- Cutler, D. M., and Everett, W. 2010. "Thinking Outside the Pillbox – Medication Adherence as a Priority for Health Care Reform," *New England Journal of Medicine* (362:17) Massachusetts Medical Society, pp. 1553–1555.
- DiMatteo, M. R., Giordani, P. J., Lepper, H. S., and Croghan, T. W. 2002. "Patient adherence and medical treatment outcomes: a meta-analysis," *Medical Care* (40:9), pp. 794–811.
- DiMatteo, M. R., Haskard-Zolnierok, K. B., and Martin, L. R. 2012. "Improving patient adherence: a three-factor model to guide practice," *Health Psychology Review* (6:1), pp. 74–91.
- Eason, K., Dent, M., Waterson, P., Tutt, D., and Thornett, A. 2012. "Refereed paper Bottom-up and middle-out approaches to electronic patient information systems: a focus on healthcare pathways," *Informatics in Primary Care* (20), pp. 51–56.
- Eichenberger, P., Haschke, M., Lampert, M. L., and Hersberger, K. E. 2011. "Drug-related problems in diabetes and transplant patients: an observational study with home visits," *International Journal of Clinical Pharmacy* (33:5), pp. 815–23.
- Evans, P., and Wurster, T. 2000. *Blown to bits: How the new economics of information transforms strategy*, Harvard Business Press.

- Feletto, E., Wilson, L. K., Roberts, A. S., and Benrimoj, S. I. 2010. "Flexibility in community pharmacy: a qualitative study of business models and cognitive services," *Pharmacy World & Science* (32:2), pp. 130–8.
- Ganal, S. C., Sanos, S. L., Kallfass, C., Oberle, K., Johner, C., Kirschning, C., Lienenklaus, S., Weiss, S., Staeheli, P., Aichele, P., and Diefenbach, A. 2012. "Priming of natural killer cells by nonmucosal mononuclear phagocytes requires instructive signals from commensal microbiota," *Immunity* (37:1), pp. 171–86.
- Gebauer, H. 2008. "Robust management policies for positioning pharmacies as healthcare service providers," *European Management Journal* (26:3), pp. 175–187.
- Van Geffen, E. C. G., Philbert, D., van Boheemen, C., van Dyk, L., Bos, M. B., and Bouvy, M. L. 2011. "Patients' satisfaction with information and experiences with counseling on cardiovascular medication received at the pharmacy," *Patient Education and Counseling* (83:3) Elsevier Ireland Ltd, pp. 303–9.
- George, P. P., Molina, J. a D., Cheah, J., Chan, S. C., and Lim, B. P. 2010. "The evolving role of the community pharmacist in chronic disease management - a literature review," *Annals of the Academy of Medicine, Singapore* (39:11), pp. 861–7.
- Greenhill, N., Anderson, C., Avery, A., and Pilnick, A. 2011. "Analysis of pharmacist-patient communication using the Calgary-Cambridge guide," *Patient Education and Counseling* (83:3), pp. 423–31.
- Gregor, S., and Hevner, A. R. 2013. "Positioning and presenting design science research for maximum impact," *MIS Quarterly* (37:2), pp. 337–355.
- Gregor, S., and Jones, D. 2007. "The anatomy of a design theory," *Journal of the Association for Information Systems* (8:5), pp. 312–335.
- Grönroos, C. 2004. "The relationship marketing process: communication, interaction, dialogue, value," *Journal of Business & Industrial Marketing* (19:2), pp. 99–113.
- Guirguis, L. M. 2011. "Mixed methods evaluation: pharmacists' experiences and beliefs toward an interactive communication approach to patient interactions," *Patient Education and Counseling* (83:3), pp. 432–42.
- Guirguis, L. M., and Chewning, B. 2005. "Role theory: Literature review and implications for patient-pharmacist interactions," *Research in Social & Administrative Pharmacy* (1:4), pp. 483–507.
- Harrison, M., Koppel, R., and Bar-Lev, S. 2007. "Unintended consequences of information technologies in health care—an interactive sociotechnical analysis," *Journal of the American Medical Informatics Association* (14:5), pp. 542–549.
- Heaton, P. C., and Frede, S. M. 2006. "Patients' need for more counseling on diet, exercise, and smoking cessation: results from the National Ambulatory Medical Care Survey," *Journal of the American Pharmacists Association* (46:3), pp. 364–369.
- Hedman, J., and Kalling, T. 2003. "The Business Model Concept: Theoretical Underpinnings And Empirical Illustrations," *European Journal of Information Systems* (12:1), pp. 49–59.
- Heinsohn, J. G., and Flessa, S. 2013. "Competition in the German pharmacy market: an empirical analysis," *BMC Health Services Research* (13:1) BMC Health Services Research, p. 407.
- Heinzl, A., and Güttler, W. 2000. "IT Induced Health Care Reconfiguration: German Hospitals in Transition," in *Proceedings of the 8th European Conference on Information Systems*, H. Hansen, M. Bichler, and H. Mahrer (eds.), Vienna, Austria, pp. 1237–1244.
- Hevner, A., March, S., Park, J., and Ram, S. 2004. "Design science in information systems research," *MIS Quarterly* (28:1), pp. 75–105.
- Hopp, T. R., Sørensen, E. W., Herborg, H., and Roberts, A. S. 2005. "Implementation of cognitive pharmaceutical services (CPS) in professionally active pharmacies," *International Journal of Pharmacy Practice* (13:1), pp. 21–32.
- Van Hulten, R., Blom, L., Mattheusens, J., Wolters, M., and Bouvy, M. 2011. "Communication with patients who are dispensed a first prescription of chronic medication in the community pharmacy," *Patient Education and Counseling* (83:3), pp. 417–422.
- Hwang, J., and Christensen, C. M. 2008. "Disruptive innovation in health care delivery: a framework for business-model innovation," *Health Affairs* (27:5), pp. 1329–1335.
- Ingersoll, K. S., and Cohen, J. 2008. "The impact of medication regimen factors on adherence to chronic treatment: a review of literature," *Journal of Behavioral Medicine* (31:3), pp. 213–24.

- Katz, S. J., Nissan, N., and Moyer, C. a. 2004. "Crossing the digital divide: evaluating online communication between patients and their providers," *The American Journal of Managed Care* (10:9), pp. 593–8.
- Lehoux, P., Daudelin, G., Williams-Jones, B., Denis, J.-L., and Longo, C. 2014. "How do business model and health technology design influence each other? Insights from a longitudinal case study of three academic spin-offs," *Research Policy* Elsevier B.V., pp. 1–14.
- Martin, L. R., Haskard-Zolnierok, K. B., and DiMatteo, M. R. 2010. *Health Behavior Change and Treatment Adherence: Evidence-Based Guidelines for Improving Healthcare*, Oxford University Press.
- McGrath, R. G. 2010. "Business Models: A Discovery Driven Approach," *Long Range Planning* (43:2-3), pp. 247–261.
- Mettler, T., and Eurich, M. 2012. "What is the business model behind e-health? A pattern-based approach to sustainable profit," in *Proceedings of the 20th European Conference on Information Systems*, Barcelona, Spain.
- Mohr, D. C., Burns, M. N., Schueller, S. M., Clarke, G., and Klinkman, M. 2013. "Behavioral Intervention Technologies: evidence review and recommendations for future research in mental health," *General hospital psychiatry* (35:4) Elsevier Inc., pp. 332–8.
- Mohrman, S., and Shani, A. 2012. *Organizing for Sustainable Health Care, Organizing for Sustainable Effectiveness*, (2nd ed., Vol. 2) Emerald Group Publishing Ltd., pp. 1–39.
- Morgado, M. P., Morgado, S. R., Mendes, L. C., Pereira, L. J., and Castelo-Branco, M. 2011. "Pharmacist interventions to enhance blood pressure control and adherence to antihypertensive therapy: Review and meta-analysis," *American Journal of Health-System Pharmacy* (68:3), pp. 241–253.
- Mossialos, E., Naci, H., and Courtin, E. 2013. "Expanding the role of community pharmacists: policymaking in the absence of policy-relevant evidence?," *Health Policy* (111:2) Elsevier Ireland Ltd, pp. 135–48.
- Moullin, J. C., Sabater-Hernández, D., Fernandez-Llimos, F., and Benrimoj, S. I. 2013. "Defining professional pharmacy services in community pharmacy," *Research in Social & Administrative Pharmacy* (9:6), pp. 989–995.
- Orlikowski, W. J. 1992. "The duality of technology: Rethinking the concept of technology in organizations," *Organization Science* (3:3), pp. 398–427.
- Orlikowski, W. J. 2000. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations," *Organization Science* (11:4), pp. 404–428.
- Orlikowski, W. J., and Iacono, C. 2001. "Research commentary: Desperately seeking the 'IT' in IT research—A call to theorizing the IT artifact," *Information Systems Research* (12:2), pp. 121–134.
- Osterwalder, A., and Pigneur, Y. 2010. *Business Model Generation, self published*, (T. Clark, ed.), Hoboken, New Jersey: John Wiley & Sons, Inc.
- Papazoglou, M., and Heuvel, W. Van Den. 2007. "Service oriented architectures: approaches, technologies and research issues," *The VLDB Journal* (16), pp. 389–415.
- Petrakaki, D., Barber, N., and Waring, J. 2012. "The possibilities of technology in shaping healthcare professionals: (re/de-)professionalisation of pharmacists in England," *Social Science & Medicine* (75:2) Elsevier Ltd, pp. 429–37.
- Petterson, S. M., Cai, A., Moore, M., and Bazemore, A. 2013. "State-level projections of primary care workforce, 2010 -2030," Robert Graham Center, Washington, D.C.
- Porter, M. E. 2009. "A Strategy for Health Care Reform — Toward a Value-Based System," *The New England Journal of Medicine* (361:2), pp. 109–112.
- Porter, M. E., and Teisberg, E. 2004. "Redefining Competition in Health Care," *Harvard Business Review*, pp. 64-77.
- R Core Team. 2013. "R: A language and environment for statistical computing," R Foundation for Statistical Computing, Vienna, Austria, available from <http://www.R-project.org>; accessed August 27, 2014.
- Rai, A., and Tang, X. 2014. "Research Commentary—Information Technology-Enabled Business Models: A Conceptual Framework and a Coevolution Perspective for Future Research," *Information Systems Research* (25:1), pp. 1–14.
- Regalado, A. 2013. "A Cure for Health-Care Costs," *MIT Technology Review*, pp. 1–19.
- Reichheld, F. 2003. "The one number you need to grow," *Harvard Business Review*, pp. 1–11.
- Romanow, D., Cho, S., and Straub, D. 2012. "Riding the Wave: Past Trends and Future Directions for Health IT Research," *MIS Quarterly* (36:3), pp. iii–A18.

- Rossi, M., Henfridsson, O., Lyytinen, K., and Siau, K. 2013. "Design Science Research: The Road Traveled and the Road That Lies Ahead," *Journal of Database Management* (24:3).
- Sabaté, E. 2003. "Adherence to long-term therapies: evidence for action," World Health Organization.
- Schneider, S., and Spieth, P. 2013. "Business Model Innovation: Towards an Integrated Future Research Agenda," *International Journal of Innovation Management* (17:1), pp. 1–34.
- Schnipper, J. L., Kirwin, J. L., Cotugno, M. C., Wahlstrom, S., Brown, B., Tarvin, E., Kachalia, A., Horng, M., Roy, C. L., McKean, S. C., and Bates, D. W. 2006. "Role of pharmacist counseling in preventing adverse drug events after hospitalization," *Archives of internal medicine* (166:5), pp. 565–71.
- Schommer, J. C., and Gaither, C. A. 2014. "A segmentation analysis for pharmacists' and patients' views of pharmacists' roles," *Research in Social & Administrative Pharmacy* (10:3) Elsevier Inc, pp. 508–28.
- Sein, M., Henfridsson, O., Purao, S., Rossi, M., and Lindgren, R. 2011. "Action Design Research," *MIS Quarterly* (35:1), pp. 37–56.
- Simon, H. A. 1996. *The sciences of the artificial*, Cambridge, MIT Press.
- Smith, M. D., Bailey, J., and Brynjolfsson, E. 1999. "Understanding Digital Markets: Review and Assessment," in E. Brynjolfsson & B. Kahin (Eds.), *Understanding the Digital Economy*, Cambridge, MA: MIT Press, pp. 99-136.
- Teece, D. J. 2010. "Business Models, Business Strategy and Innovation," *Long Range Planning* (43:2-3) Elsevier Ltd, pp. 172–194.
- Urban, G. L., and Hauser, J. 2004. "Listening In' to Find and Explore New Combinations of Customer Needs," *Journal of Marketing* (68:2), pp. 72–87.
- Valeri, L., Giesen, D., Jansen, P., and Klokieters, K. 2010. "Business models for eHealth," *ICT for Health Unit, DG Information Society and Media*.
- Venkatraman, N. 1994. "IT-Enabled Business Transformation: From Automation to Business Scope Redefinition," *Sloan Management Review* (35:2), pp. 73–87.
- Volland, D., Korak, K., Brückner, D., and Kowatsch, T. 2013. "Towards Design Principles for Pharmacist-Patient Health Information Systems," in *Design Science at the Intersection of Physical and Virtual Design, 8th International Conference, DESRIST 2013, Helsinki, Finland*, J. vom Brocke, R. Hekkala, S. Ram, and M. Rossi (eds.), (Vol. 7939 LNCS), pp. 519–526.
- Volland, D., Korak, K., and Kowatsch, T. 2014. "A health information system that extends pharmacist-patient communication," in *Twenty Second European Conference on Information Systems*, Tel Aviv.
- World Bank. 2014. "Health expenditure, total (% of GDP)," available from <http://data.worldbank.org/indicator/>; accessed August 27, 2014.
- World Health Organization. 1994. "The role of the pharmacist in the health care system," available from <http://apps.who.int/medicinedocs/en/d/Jh2995e/>; accessed August 27, 2014.
- Worley-Louis, M. M., Schommer, J. C., Brown, L. M., Hadsall, R. S., Ranelli, P. L., Stratton, T. P., and Uden, D. L. 2007. "Pharmacists' and patients' roles in the pharmacist-patient relationship: Are pharmacists and patients reading from the same relationship script?," *Research in Social & Administrative Pharmacy* (3:1), pp. 47–69.
- Zhang, R., and Liu, L. 2010. "Security Models and Requirements for Healthcare Application Clouds," in *2010 IEEE 3rd International Conference on Cloud Computing*, pp. 268–275.
- Zhuo, X., Zhang, P., and Hoerger, T. J. 2013. "Lifetime direct medical costs of treating type 2 diabetes and diabetic complications," *American Journal of Preventive Medicine* (45:3) Elsevier, pp. 253–261.