Barriers to IoT Business Model Innovation

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Abstract. The Internet of Things (IoT), in which virtually all physical things become connected to the internet, promises enormous economic potential. The IoT might disrupt entire industries and it forces companies to rethink their current business activities. In light of these challenges, research on business model innovation (BMI) can offer promising insights. This research paper aims to contribute to the emerging BMI literature by identifying innovation barriers in an IoT context. 16 barriers are identified based on ten expert interviews that were conducted with employees from five multinational companies. The contributions of our study might lay a fruitful ground for future research.

Keywords: Business Model Innovation, Internet of Things, IoT BMI Barriers.

1 Introduction

General Electric (GE) has been well-known for selling industrial hardware and maintenance services. However, recently the company got under pressure in new fields of competition facing non-traditional competitors such as SAP, IBM as well as big data and analytics startups [7]. Instead of offering reliable industrial equipment, these new competitors shift the customer value proposition towards the Internet of Things (IoT) and "deriving new efficiencies and other benefits through advanced analytics and algorithms based on the data generated by that equipment" [7, p. 91]. To meet the new competition and to address the challenges arising from IoT solutions, GE is currently transforming its entire business model [7]. In this respect, GE faces severe challenges, similar to many traditional manufacturing companies across industries [3, 7].

Little is known about how the IoT will change business models and even less about what IoT specific barriers hamper business model innovation (BMI) [cf. 14]. In fact, first studies already investigate general barriers to BMI [3, 6]. In addition, there is a large literature stream on technical IoT challenges [e.g. 4, 12]. However, to the best of our knowledge, there are no empirical studies that investigate IoT-specific BMI barriers in detail. Previous studies on IoT BMI provide anecdotal evidence and do not base their findings on empirical data [cf. 13]. To shed more light on the depicted research gap, this study identifies barriers to IoT BMI and can be seen as a first explorative step towards a better understanding of IoT adoption. Thereby, the study focuses on large

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multinational companies that conduct technology-driven BMI in an IoT context. More specifically, our research aims to address the following research question (RQ):

What are specific barriers to technology-driven IoT business model innovation?

2 Background

The *Internet of Things* describes a broader vision that all sorts of objects become smart, able to gather data and communicate both with each other and the internet [5]. Porter and Heppelmann argue that the key novelty of IoT solutions lies in "[the changed] nature of the 'things'" [13], including their connectivity and the digital services that they facilitate [5]. Such offerings, spanning the digital and the physical world, require a broad array of enabling technologies [12], which is reflected in various value creation layers inherent to IoT solutions [5].

Despite the lack of an agreed business model definition [15], a common high-level understanding emerged that business models explain a focal firms' value creation and value capture [17]. Taking a transformational perspective on business models is the essence of *business model innovation* [4]. In the light of a missing conceptualization, business model innovation is used as an umbrella term describing companies' efforts connected to "the search for new business logics of the firm and new ways to create and capture value for its stakeholders" [2, 9]. So far, little is known about BMI processes [14]. In fact, scholars agree that the related literature on new product development (NPD), with its much richer record, is most suitable as a starting point for BMI process research [3, 6, 14]. Latest research on NPD identifies four key innovation stages: idea generation and screening (ideas are gathered and the most promising opportunities selected); concept development and evaluation (business model components, such as revenue mechanics, are elaborated); technical implementation (technical realization of the offering and introduction of the business model throughout the organization) as well as commercialization (business model is scaled successfully in the market) [10].

The complexity of emerging IoT solutions brings along some severe *new challenges* [cf. 12]. A rich field of research exists, investigating IoT barriers from a very technical viewpoint. Among the most critical problems identified in this type of literature are a lack of protocol standardization, scalability limitations, energy supply and security issues [cf. 4, 12]. Besides this technical stream, various studies, including the seminal article of Chesbrough, investigate what might generally hinder organizations to innovate their business models [cf. 3]. Amit and Zott [1], for instance, identify the four characteristics novelty, lock-in, complementarities as well as efficiency and elaborate how these aspects might be contradicting to "traditional configurations of firm assets" [3, p. 358]. Several early studies also elaborate on more operational challenges managers face when attempting to innovate their companies' business models, such as overcoming internal resistance, financial hurdles, setup of value networks and the successful management of the applied implementation approach [6].

3 Methodology

Ten in-depth expert interviews were conducted with employees from five leading multinational corporations across the IoT ecosystem. The interviewee selection followed a heterogeneous purposive sample approach applying three pre-defined criteria [16]: (1) interviewees have either been actively involved in or closely guided IoT related BMI projects; (2) they possess more than two years of IoT BMI experience to ensure that they can sufficiently inform the research; (3) they are employees, partners or consultants to manufacturing companies across the IoT ecosystem. Interviews lasted between 30 and 60 minutes, followed the same case protocol, were audio-recorded and additional secondary data about the companies in general or mentioned IoT BMI projects in particular were collected for data triangulation purposes [16].

4 Findings and conclusion

The paper at hand identifies 16 barriers to IoT business model innovation, which are structured along four high-level innovation stages (cf. Table 1) [10].

Table 1. Identified IoT BMI barriers structured along stages adapted from Luchs et al. [10])

I. Idea generation and screening	*II. Concept development and evaluation*	*III. (Technical) implementation*	*IV. Commercialization*
1. Process ownership	5. Innovation-driven R&D vs. reliability-focused IT	9. Clash of cultures	13. IoT revenue mechanics
2. Product-centric focus	6. Collaborate with various partners	10. Data analysis	14. After-sales commercialization
3. Immediate profit thinking	7. Data privacy	11. Legacy systems	15. Customer analytics
4. Uncertainty	8. IoT value propositions	12. Efficient operations	16. Ambidexterity

Thus, this study can be seen as a first explorative step towards a better understanding of IoT adoption. The findings contribute to the ongoing debate on BMI by strengthening scholars' and practitioners' understanding of IoT specific hurdles to business model innovation. Some of the identified barriers build upon well-known BMI barriers, such as *legacy systems* or *ambidexterity* [8, 11]. But, when analyzed in an IoT context these barriers gain unexpected new facets and thus relevance. Others are IoT specific and have not yet been discussed in the BMI literature at all, including barriers such as *data analysis* or *customer analytics*. The results of this study should be assessed in the light of their limitations. One general limitation of qualitative research is generalization of results [16]. More specifically, our research is limited by the number and selection of interviews conducted. Further work in different empirical settings will be required to enhance the validity of the research. Taking these aspects into account, we hope that the contributions of our study lay a fruitful ground for future research. Promising research avenues might include a more in-depth analysis of the identified IoT BMI barriers with regard to their impact on BMI success.

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