Platform Business Models – Insights from IoT firms

Daniel J. Moser*
University of St. Gallen, Dufourstrasse 40a, 9000 St. Gallen, Switzerland
E-mail: daniel.moser@unisg.ch

Oliver Gassmann
University of St. Gallen, Dufourstrasse 40a, 9000 St. Gallen, Switzerland
E-mail: oliver.gassmann@unisg.ch

* Corresponding author

Abstract: The connectivity of technologies and products through sensors, cloud saving capacities, and the analytics of large data sets enable the internet of things (IoT). Especially platform strategies are regarded as dominant concept to leverage the growing business possibilities of the IoT. However, despite their mentioning in the literature, platform business models have not been explicitly studied so far. To address this shortcoming, we use data from seven platform companies in the IoT field and derive patterns for value creation, delivery, and capturing. Furthermore, we shed light on the special role of partners and condense our results into a generic platform business model. We substantiate our empirical findings with theoretical insights from both but so far mainly isolated discussion on platforms and business models. Therefore, we develop an initial understanding how firms can develop platform business models along our proposed design parameters.

Keywords: Business models, platform business models, platform economy, value creation, value capturing, value delivery, internet of things, IoT
1.1 Introduction

The rapid expansion of smart products is fueled by the large scale availability of low cost sensors, cloud services, and fast growing analytic capabilities to make sense of big data sets (Bosche, Crawford, Jackson, Schallehn, & Smith, 2016). The connection of these products and sensors to a network creates the Internet of Things (IoT) wherein they blend seamlessly with the environment and create sharable information (Gubbi, Buyya, Marusic, & Palaniswami, 2013). As a result, new business cases emerge for both, incumbents and new market entrants. Consumer oriented applications, such as wearables, dominate the internet of things (IoT) market so far. However, the industrial IoT makes its way into manufacturing, smart buildings, energy systems etc. expanding the IoT market to a volume of USD 250 billion by the year 2020 (Hunke, Rüßmann, Schmieg, Bhatia, & Kalra, 2017; PWC, 2017). In this emerging market, platforms play a pivotal strategic role as they promise control over the high margin business around analytics and applications (Lamarre & May, 2017). Hence, major companies started to position themselves to take part in this fast-growing business by releasing their own platforms. The likes of General Electric with Predix, Trumpf with Axoom, or Siemens with Mindstorm are only the tip of the iceberg in this industrial transition whereas the competition between platforms will further intensify in the years to come (Bhatia, Yusuf, Ritter, & Hunke, 2017).

Especially in so called “platform wars”, sophisticated business models are regarded as the key to success (Chesbrough, 2012; Gawer, 2014; Thomas, Autio, & Gann, 2015; Van Alstyne, Parker, & Choudary, 2016). However, the modular product design, empowerment of ecosystems, absence of individual contracts, and the economics of multi-sided markets go beyond current, product focused business model notions (Adner & Kapoor, 2010; Gawer, 2014). Yet, platform business models have been described to help companies to create value by connecting stakeholder groups with differing interests within an ecosystem and capture value by charging them for the access to the platform (Boudreau & Hagiu, 2009; Thomas et al., 2015). Moreover, to unlock fast growth and create a monopolistic market, the platform business model needs to moderate the ecosystem by setting incentives for its participants, which ideally result in network effects (Casadesus-Masanell & Zhu, 2013; McIntyre & Srinivasan, 2017; Wareham, Fox, & Giner, 2014).

Despite agreeing on the importance of business models as central platform governance mechanism (e.g., Brousseau & Penard, 2007; Frédéric, Lecocq, & Warnier, 2015; Gawer & Cusumano, 2014; Wareham, Fox, & Giner, 2014), current research provides rather superficial descriptions, referring to anecdotal evidence from well-known technology companies. A specific definition and in-depth insights are largely missing so far. In our article, we address these shortcomings of previous research efforts and develop a comprehensive model of platform business models from a multi-case study, derived from seven IoT companies. By doing so, we apply the perspective of a company, releasing a platform to the market. Consequently, our original cases suggest that a platform business model should be designed to address three key stakeholder groups, namely users, complementors, and partners. In this regard, especially the role of partners has been neglected by previous studies. Subsequently, we define partners as external
stakeholders that play an integral part of the platform business model while contributing value based on individual contracts. In addition, we discuss value creation, value delivery, and value capturing mechanisms for each stakeholder group. Finally, we condense our findings into a generic model for platform business models and provide suggestions for future research.

1.2 Conceptional background

1.2.1 Platforms

Being a versatile concept, platforms have been researched from different perspectives, particularly technology, organization, economics, and strategy. Researchers, applying the technological perspective highlight the properties of systems with modular architectures where platforms act as central building block upon which other companies can create products and services (Gawer, 2014; Gawer & Cusumano, 2014). In this regard, complements describe products and services that function as an enhancement of the platform’s core offering (Eisenmann, Parker, & Van Alstyne, 2011; Zhu & Iansiti, 2012). Especially at digital software platforms, the design of interfaces, which allow data and information sharing with external organizations, plays an important strategic role and is often realized through APIs (application programming interface) (Gawer & Phillips, 2013; Tiwana, 2015).

The organizational perspective highlights the set-up of different stakeholder groups, which interact in a platform ecosystem and co-create value (Adner, 2017; Adner & Kapoor, 2010; Wareham et al., 2014). Different from classic value chains, independent complementors contribute to the platform in absence of supplier-buyer contracts (Boudreau & Jeppesen, 2015; Gawer, 2014). Thus, platform ecosystems mount participants, which are loosely organized in networks (Adner & Kapoor, 2016) and are governed by a platform leader (Wareham et al., 2014). The platform leader is a firm that invests into the technological set-up of the platform, takes the entrepreneurial risk in the early stages of the platform business, decides upon the strategy, and shapes the ecosystem (den Hartigh, Ortt, van de Kaa, & Stolwijk, 2016; Gawer & Cusumano, 2008). Users utilize the various offerings of the platform whereas they can be individual private persons or corporations.

From an economic perspective, platforms get mainly discussed in combination with multi-sided markets. In this regard, pricing decisions to incentivize platform stakeholders while monetizing the platform through others is a key interest of scholars (Rochet & Tirole, 2006; Weyl, 2010). The ultimate goal is to create network effects, which allow fast ecosystem growth and maximize the rent for platform leaders (Armstrong, 2006; Hagiu & Spulber, 2013). The literature distinguishes between two types of network effects – direct and indirect. Direct network effects emerge when users’ benefit in a platform depends on the amount of other users they can interact with (Cennamo & Santalo, 2013; Katz & Shapiro, 1985). Therefore, a social network becomes more valuable the more participants it has. Indirect network effects describe the rising platform value for a participant when participants of a different kind join the ecosystem (Casadesus-Masanell & Halaburda, 2014; Xu, Venkatesh, Tam, & Hong, 2010). For example, users see a higher value in a platform with many application developers and vice versa.
From a strategy perspective, platforms have been discussed as a concept to create value and competitive advantages. The open innovation literature, for example, has identified platforms as a powerful concept to attract and monetize innovations from outside the firm, essentially speeding up the innovation process (West & Bogers, 2014). Through their open architecture, platforms allow firms to tap into a wider set of external capabilities, distributed knowledge, and resources (Chesbrough, 2003, 2011). While open innovation focuses on the type, direction, and conditions of knowledge flows within and across companies, business models capture “the sustainability of the economic activity” (Bogers et al., 2017).

1.2.2 Business models and platforms

The broader discussion on business models centers around the question how firms create, deliver, and capture value (Foss & Saebi, 2017; Teece, 2017a; Winterhalter, Zeschky, & Gassmann, 2016). Researchers explore different choices and designs of business models, which lead to competitive advantages (Baden-Fuller & Mangematin, 2013; Zott & Amit, 2007). Business models have been either described as a concept from a firm centric perspective (Linder & Cantrell, 2001; Morris, Schindehutte, & Allen, 2005) or highlight boundary-spanning aspects (Teece, 2010; Zott & Amit, 2007, 2010). In this regard, open business models have been coined as a term, which delineates independencies between a focal firm’s and its partners’ business models (Berglund & Sandström, 2013; Chesbrough, 2006; Frankenberger, Weiblen, & Gassmann, 2014). Thus, suppliers can become an integral part of the focal firm’s business model, adding their resources and expanding the value of the business model (Chesbrough, 2007).

Parker & Van Alstyne (2017) describe platform business models as open standard and default contract. The standard acts as technological base for external follow-up innovations default contracts make ex ante negotiations obsolete. More specifically, Teece, (2017b) points out that unlike traditional business models, platform business models are prone to “installed base” characteristics, entailing the possibility to create (quasi) monopolistic markets. If a platform business model is designed in a way to release strong network effects, platform leaders can dominate the market, capture its rent, and outrival competitors (Eisenmann, 2008; Eisenmann et al., 2011). This even means, a platform with a superior business model can dominate a market despite inferior technical properties compared to competing platforms (Amit & Zott, 2015). Finally, a platform leader can determine different governance mechanisms, which get operationalized in a platform business model (Gawer, 2014; Teece, 2017b). This usually includes decisions regarding the openness, curation, incentives, level of generativity, control, and creativity of the platform and its ecosystem (Parker, Van Alstyn, & Choudary, 2016; Tiwana, 2015; Wareham et al., 2014). So far, however, the general business model and the platform business model definitions developed in mainly separated fields.

1.3 Methods

In this study, we aim to enrich theory with evidence from original real-world cases (Eisenhardt, 1989). Since there is very limited research on the particular topic of platform business models, a qualitative
research design is most suitable for our endeavor (Yin, 2014). By setting-up a multi-case study, we selected IoT based platform business models as unit of analysis. IoT describes all kinds of businesses that leverage data derived from sensors and actuators, which get uploaded to networks and computer systems (Manyika et al., 2015). Thus, IoT empowers businesses to create value on different layers, which can be physical products (1), sensors/actuators and the local data they produce (2), the connectivity to transport these data (3), the data analytics (4), and digital services (5) (Fleisch, Weinberger, & Wortmann, 2014). Each layer or their combination allows new business models. In our analysis, we selected companies that create value along these layers and therefore qualify as an IoT business. Additionally, to be included in our study, the IoT business must be built around a platform with a modular technological architecture, open interfaces that can be accessed by an ecosystem, which is organized in a two- or multi-sided market.

In total, we conducted seven case studies of platform business models in seven IoT firms. For this reason, we interviewed senior managers and executives of the respective firms. By doing so, we followed a semi-structured interview guideline. For the lead questions, we adopted Teece's (2010) business model definition and asked for value creation, value delivery, and value capturing mechanisms. Moreover, our informants provided insights on their ecosystems and the question, which stakeholders they specifically address in their business models. The interviews were transcribed verbatim and complemented through desk researched information about the companies’ platform business models (web sites, media releases, company reports, media reports). Additionally, where possible, we interviewed multiple managers per company what allowed us to triangulate the data (Gibbert, Ruigrok, & Wicki, 2008; Jick, 1979). Table 4-1 provides an overview of the empirical data of our case studies.

Table 1: Overview of empirical data for case studies

<table>
<thead>
<tr>
<th>Firm</th>
<th>Primary Data</th>
<th>Interview Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>3 interviews</td>
<td>CEO, CTO, Head of platform development</td>
</tr>
<tr>
<td>Case 2</td>
<td>1 interview</td>
<td>Director of marketing</td>
</tr>
<tr>
<td>Case 3</td>
<td>3 interviews</td>
<td>CEO, Head of R&amp;D, Head of board of management</td>
</tr>
<tr>
<td>Case 4</td>
<td>2 interviews</td>
<td>CEO, CMO</td>
</tr>
<tr>
<td>Case 5</td>
<td>2 interviews</td>
<td>Business development manager, Head of competence center</td>
</tr>
<tr>
<td>Case 6</td>
<td>1 interviews</td>
<td>Head of group</td>
</tr>
<tr>
<td>Case 7</td>
<td>1 interviews</td>
<td>COO</td>
</tr>
</tbody>
</table>

Based on the interview transcripts and additional data we obtained from external sources, we composed the case stories. At least two researchers analyzed each case independently to avoid misunderstandings and personal biases in interpreting the interviewees statements (Mayring, 2010). The initial findings were gathered and visualized through tabular pattern matching methods (Miles & Hubermann, 1994).
where first similarities and differences could have been identified. In a next step, we proceeded to a
cross case analysis (Eisenhardt, 1989) were we distilled specific platform business model characteristics
and substantiated our initial findings. Finally, we made various iterations between the literature, our
data, and our initial findings to clarify specific details and to receive a consistent picture.

1.4 Findings

1.4.1 Case 1
Case 1 represents an IoT firm that is specialized in building security and lighting in the private sector.
In the center of the business stands a lightbulb that is equipped with a Wi-Fi module, brightness, and
motion sensors. The sensors can detect intruders and simulate the light-behavior of the home owners
with the purpose to increase the security of the building. Thus, based on moving patterns and light usage
behavior, the platform analyzes and then imitates the owners when they are not home. Through the Wi-
Fi module, the bulb(s) in a household can communicate with a central platform that alarming the home
owner about suspicious movement or allows to remote control the alarm and lighting systems. A free
application acts as platform user interface and can be downloaded from app stores such as Google Play
Store or Apple App Store. The hardware sales of the bulbs represent the main revenue stream for the
platform leader. The product is mainly sold through online distribution channels, such as on Amazon
and classic retailers. Additionally, the platform builds on a growing ecosystem of partners. Insurance
and telecommunication companies re-sell the bulbs and promote the platform amongst their customers.
Especially for insurers, data and analytics from the platform could be interesting when combined with
certain insurance products. The same applies for home security providers that seek to integrate the
platform with their products. Next to their individual partners, the platform has a growing network of
independent third-party developers, who can request the API and build their own applications based on
the hardware and software of the lightbulb.

1.4.2 Case 2
Case 2 is a company that produces light systems primarily for private households with different lighting
bulbs. All the bulbs are Wi-Fi connected and can be controlled via a smartphone. Furthermore, they can
be connected to the TV, which helps to imitate the light schemes of the pictures that are played to create
a better ambience in the room. To make use of the platform, users must purchase the light bulb either
through direct sales or re-sellers. With these hardware sales, the platform leader monetizes the platform.
The platform leader integrated different APIs of the lightbulb, which are shared with a developer
ecosystem. Additionally, developers can download a free developer kit, which makes it easy to create
own applications for the platform. Applications enable additional lighting schemes and connections to
new devices in the household. To get attention and motivate third-party developers, the platform leader
sponsors hackathons and runs an own YouTube channel: “Our light bulbs are a really hackable
hardware and we encourage complementors to engage by sponsoring hackathons. Also, we occasionally
give away light bulbs for free and see what people create” (director of marketing). Furthermore, several
B2B partnerships were established. For example, a business intelligence software company integrated the lightbulb in their systems. If KPIs develop poorly, the lightbulb is changing from green to yellow and red to raise the awareness of issues. Another company offers a software that listens to sounds and voices in a room, such as at story-telling to children, and adapts the background music and light schemes accordingly. For the lighting, customers of this company have to acquire the platform and lightbulb.

1.4.3 Case 3

Case 3 is a smart home platform, which connects different household devices with a central software. The software is connected to proprietary hardware that has to be installed in the buildings’ power circuit to make various devices “smart”. Thus, users need to purchase a smart-meter and other equipment that has to be placed in a house’s electrical system to use the platform. Once the hardware is set-up, the platform allows the user to remote control various devices in the household, dim the light, control the heating, or simulate presence even though no one is in the house. Besides own free and for sale applications, the platform leader provides APIs, resources, a community, and an app store for third-party developers to create and publish their applications for the platform. Moreover, to install the platform in users’ households and to expand the range of compatible devices, the platform builds on partnerships. For example, networks of local electricians are essential to install the hardware parts at the users’ homes. Because they also play a pivotal role in acquiring new users, electricians and architects get selected as certified partners while the platform leader provides them with educational seminars, planning tools, and checklists. Additionally, the platform leader created a partner alliance network, which includes white goods manufacturers that make their devices compatible with the platform. APIs give third-party developers access to the platform and its functionalities and offer them the chance to add their own software modules to the system. Since the release of the platform, the ecosystem has attracted many members and is constantly growing. The platform generates revenues for the platform leader through the sale of the hardware and the participation at sales of services and applications that are offered on the platform.

1.4.4 Case 4

Case 4 is a platform that provides an interface for the internet of things. The interface is a software that acts as meta-platform for applications and connected devices, which can be controlled from a single point of contact. For example, the platform allows to control a Philips Hue bulb and pair it with a weather data to adapt the light according to current weather conditions. Also, other digital objects, such as photographs, videos, maps, or even excel tables can be displayed. Differently from common operating systems, this does not require to start a dedicated software program. Instead, the contents are embedded in digital objects that can be moved, organized, and used in an intuitive way on a big screen. Third-party developers write constantly new applications for the platform that can be either purchased or downloaded for free from an own app store. The platform leader participates with 30% at the application sales. The platform runs on various operating systems, be it Windows, macOS, iOS, Android, or Linux.
Users are typically owners of smart home devices or companies that control their office space via the platform. However, essential are partners that integrate the platform into their products and sell it to users. There is no direct distribution of the platform to end users. Therefore, partners acquire licenses of the platform software from the platform leader and in return, can retrofit their products with an innovative interface while obtaining access to the whole platform ecosystem.

1.4.5 Case 5

The platform in case 5 was developed by a telecommunications company. Based on a new network that allows digital communication on a frequency with very low power consumption, the company developed an infrastructure for large scale machine to machine (M2M) communications. To control and manage these networks, the company provides a platform with open interfaces and developer kits. For example, users can enable or disable connected devices, establish different rules per connection, or check the location of certain entities. Users can access the platform for free. However, each device that communicates with the platform requires a monthly fee for its connectivity. The partner network is essential to the platform leader. Platform applications and users are found in various industries, while the integration at the end-users, especially at B2B, has to be done by companies that know the industry and the specific user requirements. One platform user, for example, is a major oil company and uses the platform to monitor tanks. Another user is a big brewery and applies the platform to monitor and optimize the production. Both users are in different industries while the platform is used in multiple other industry settings. Specialized companies perform the integration into existing IT systems and write specific applications to customize the platform for each user. Besides the partner network, a network of independent third-parties evolved. Mainly software companies add to the platform by providing applications to e.g., track locations of vehicles/persons/animals, remote control vending machines, or monitor water levels or air pressure. In order to access the platform and write applications, complementors need to purchase the developer kit.

1.4.6 Case 6

Case 6 is an open, hardware independent smart home platform that enables the controlling and monitoring of all kinds of devices that have a connectivity interface. Yet, the main focus of this platform lies in the energy management of buildings while integrating silo solutions around energy production and storage in one platform. For example, users get access and insights to the production of their photovoltaic panels or water consumption in a household and can start actions for optimization based on the analysis of the platform. Target users of the platform are mainly home owners with their own autarkic energy production, such as solar panels or heat pumps as well as storage capacities such as electronic vehicles or dedicated batteries. To integrate new devices into the platform, applications are required that can be installed from an app store and get provided either by the device manufacturers or independent third-party developers. To enable developers to come-up with new application ideas, the platform leader provides the core source of the underlying software under an open source license for
free. Additionally, developer kits and APIs are provided to spur developments. The platform leader is not directly distributing the platform. Instead, selected partners integrate the platform in their products, usually together with their own hardware. However, for commercial usage, they have to pay a license fee. This fee represents the main source of income for the platform leader. Additionally, partners can purchase consulting services from the platform leader, which help at the integration and adaptation of the platform into their products.

1.4.7 Case 7

Case 7 is a platform that builds on a software as a service (SaaS) solution for small and medium sized companies without own energy management such as bakeries, hotels, or small production facilities. The platform provides tools for monitoring the energy usage, which gets supported by a smart meter that tracks the consumption. This resonates in a value proposition for users: Reducing energy costs and improving the CO2 footprint. To create that value for the customers, the platform offers analytics and complementary applications to gain better insights into the consumption patterns of the users, which can unlock new saving possibilities. Simultaneously, user data helps to improve the platform constantly: “We create value for users by aggregating our collected user data. Hence the platform can tell how and when to use certain energy products” (COO). To provide this value to the users, the platform leader established partnerships. Hence, the energy products of power providers have been integrated in the core offering of the platform. Users can, based on their preferences and analytics of the platform, choose the best energy product according to their specific needs. Consequently, they have a better understanding of their consumption and can identify areas to optimize their power plans, better integrate own energy productions such as photovoltaic, and even monetize excess capacities. Applications from external developers, which can access several APIs, provide additional value, such as a weather plug-in that allows the adoption of consumption and production patterns based on the weather forecast.

1.5 Discussion

1.5.1 The role of partners in a platform business model

Most of the platform literature has focused on the two-sidedness of platforms incorporating standardized interfaces and standardized contracts as central governance mechanism (Gawer, 2014; McIntyre & Srinivasan, 2017; Parker & Van Alstyne, 2017). We, however, found that platform partners represent a third major stakeholder group, next to users and complementors, in a platform ecosystem. Thus, they play a pivotal strategic role in platform business models. Reasons for partnerships can be twofold. We found that partners are responsible for (1) the addition of essential components or services and/or (2) they help scaling the platform. In case 5, for example, the platform company relies on system integrators, which are external service providers. “We try to have a platform, which can be used in many different industries. However, we do not understand all the details and processes of each industry why we team-up with system integrators and solutions partners who go onsite to the users and implement our platform” (head of competence center, case 5). We also saw platforms in our sample that got integrated
into products of partners. The platform leader of case 2, for example, partnered with different companies, which exclusively use their smart bulb. This is the case with the business intelligence software that adapts the light color depending on the KPIs or the software of another company, that, when activated, listens to the voices in the room and adapts light and sound to the stories that are being told. While integrated into another product, the platform gets automatically spread to new users, adding them to the platform ecosystem. The same idea is applied by the platform leader of case 3, that integrates white goods of big suppliers into the smart home platform. The trade-off for both sides is beneficial. The white goods of the partner can be labeled “smart home ready” and appear more innovative to their customers, increasing product sales on their end. White good customers, on the other side, can be easily converted to platform users. “The partner has actually a very low effort and investment and becomes directly a member of the platform with all its benefits” (head of board of management, platform firm case 3).

Strategic partners, which take an important role in the value creation of a business model have been previously addressed in the business model literature (Chesbrough & Schwartz, 2007; Frankenberger, Weiblen, & Gassmann, 2014; Zott, Amit, & Massa, 2011). Especially the activity system perspective highlights boundary spanning aspects of business models where focal firms create and share value with partners (Zott & Amit, 2010). In this regard, partners have been used ubiquitously for all activities from actors outside a firm that contribute to its business model. However, in this study, we found that different external actors can contribute differently to a platform business model. While we observed that platform partners can add important functionalities or services to the platform, similar to complementors, they are different from them as partners contribute parts, which cannot be included in a standardized contract or APIs. They often add to the core offering of the platform and enable, together with the platform leader, the central building block, upon which complementors can create their complementary services and products. The energy providers in case 6, for example, contribute an integral part of the platform’s core offering with their energy products. Additionally, we saw how strategic partnerships can add new users to the platform ecosystem. Especially in the competition with other platforms, developing strong network effects is paramount as platform markets can turn into winner take all markets (Brousseau & Penard, 2007; Eisenmann, Parker, & Alstyne, 2006). Therefore, the literature stresses the importance of attracting a “critical mass” of users and complementors to a platform to allow the emergence of network effects (D. S. Evans & Schmalensee, 2010; Suarez, 2005). This study supports the argument that partnerships are a way to create this critical mass of users. Thus, it details previous notions on platform business models that focused primarily on the properties of two-sidedness (Boudreau & Lakhani, 2009; Eisenmann et al., 2006, 2011) by adding partners as a third side. At the same time, it provides a more detailed notion of the types of external relations as part of a business model by separating between complementors and partners. Besides, this study shows that platform business models are not only based on standardized default contracts (Gawer, 2014; Parker & Van Alstyne, 2017) but require individualized contracts with selected partners to govern a successful platform ecosystem.
1.5.2 Value creation, value delivery, and value capture with platforms

“A business model describes an architecture for how a firm creates and delivers value to customers and the mechanisms employed to capture a share of that value” (Teece, 2017, p. 1). In the subsequent part, we discuss the insights we derived from our case studies to get a more detailed picture of how value creation, delivery, and capture works with platforms.

1.5.2.1 Value creation with platforms

All platforms we saw in our case studies employ technologies that help users to solve a problem or improve certain situations. In case 7, for example, the platform leader addresses their users’ problems with a specific value proposition: “We solve the problem of high energy costs and reduce the CO2 footprint”. To create the value of such propositions, the platforms in our study employ software only solutions or a combination with proprietary hardware. Existing literature on platforms is much in line with this finding and highlights the fact that a platform has to address a problem for many users or firms in an industry by providing a valuable function (Gawer & Cusumano, 2014; Wareham et al., 2014).

Also, we could observe that platforms collect user data what helps to improve the platform’s service/output. This was very well observable in case 7 where the aggregated data of all the users helps to improve power consumption patterns of an individual user. Therefore, the more user inputs a platform receives, the more it can learn from its users. Based on these learnings, the platform can provide continuously improving solutions to each user. In this case, the perceived platform value for users is dependent on the number of other users in the ecosystem what can lead to the emergence of direct network effects (Chintakananda & McIntyre, 2011; Gawer, 2014). Simultaneously, all platform leaders integrated complementary services and applications in their platforms and made them available in app stores or similar distribution channels. With these complements, the versatility and scope of the platform increases and thus, creates more value to its users. Therefore, the value, a platform creates for its users, increases with the number of complementors that provide new applications. This phenomenon is described by indirect network effects (Casadesus-Masanell & Halaburda, 2014; D. S. Evans & Schmalensee, 2010). Thus, platform leaders have the possibility to create value for users by providing a specific value proposition, direct, and indirect network effects.

In our cases, we could observe another set of value creation patterns, which apply for complementors. As previously described, a platform creates a market where complementors offer and users demand platform complements (D. S. Evans & Schmalensee, 2008; Hagiu & Wright, 2015a). We saw that platform leaders created this market in form of app stores where complementors can publish their contents and users can easily access and install them on their platforms. While some platform leaders kept the app store and the complements for free, others allowed their complementors to charge users for the content, essentially creating a business opportunity for them. In both cases, the platform becomes more valuable for complementors, when there are many users, which either purchase or just use the application. Essentially, a growing user base means a growing potential market for complementors while the platform itself, as a market place, becomes increasingly valuable to them. If this self-enforcing circle
starts spinning, the platform leader created indirect network effects between users and complementors. Therefore, our study argues that a platform can create value to complementors by granting them access to a market, offering them business opportunities, and indirect network effects.

Finally, the platform offers a third set of value creation patterns for its partners. Partners that deliver parts for the core offering of the platform have the chance to grow with the platform. For example, in case 7, software companies deliver components for the platform to the platform leader, same as a manufacturer for smart meters. With the growth of the platform, also their businesses scale. On the other hand, a partnership with the platform might result in a complement for the partner’s product. In case 2, the software company that provides offices with alarm signals complements its product with the platform the same way the company with the audio recognition software does. The electricians, which are partners of the platform leader in case 3, complement their own business by integrating the smart home installation services. At the same time, they grow with the platform as more users require more installations at homes. Therefore, we propose that a platform can create value for partners by growing and/or complementing their business.

Table 2: Value creation patterns for key stakeholders of the platform

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Users</th>
<th>Complementors</th>
<th>Partners</th>
</tr>
</thead>
</table>
|          | • Solve a specific problem / improve situation  
|          | • Direct and indirect network effects | • Market access  
|          | | • Business opportunity  
|          | | • Indirect network effects |
|          | | • Growing with the platform  
|          | | • Complement for own products |

1.5.2.2 Value delivery with platforms

Next to creating a value, a business model also ensures how customers can benefit from this value and how it gets delivered to them (Sabatier, Mangematin, & Rousselle, 2010). In successful business models, operational and managerial processes are in place that allow to deliver value repeatedly and at scale (Johnson, Christensen, & Kagermann, 2008). The platform leaders in our case sample usually provided an interface that makes it easy for all users to access and control the platform. Depending on the type and target group of the platform, the interface is either a mobile application for smartphones and tablets or runs on a computer. Whenever there is hardware necessary to run the platform, we observed that platform leaders either had a direct distribution via online or offline channels, or through a partner and re-seller network including classic retailing.

To enable complementors to tap into the platforms value creation, platform leaders deploy them with different tools and services. The most common tools we could observe were APIs (application programming interfaces) that allow the exchange of data between platform and complements. SDKs (software developer kits) provide complementors with the environment to write and test new complements. In one case, the full code of the platform was provided under an open source license whereas in multiple cases, platform leaders published technical documentations of the platform
including code examples on their homepages to assist complementors. Next to these tools, some platform leaders created communities and hosted hackathons or run a YouTube channel to assist at problems or give suggestions and tutorials.

For partners, however, we observed a more individualized approach. Platform leaders applied three different instruments to deliver the value of their platform to partners. In case 3, for example, the platform leader partners with electricians and architects to implement the smart home solution. For this reason, they select firms, educate and certify them as qualified partners. Furthermore, the platform leader provides a planning tool and checklists to help them with their business. In another example, the platform leader in case 6 delivers value to its partners by offering consulting services to shape and integrate the platform.

Table 3: Value delivery patterns for key stakeholders of the platform

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Users</th>
<th>Complementors</th>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User interface (mobile application or desktop)</td>
<td>APIs</td>
<td>Certifications</td>
</tr>
<tr>
<td></td>
<td>Retail channels (online/offline)</td>
<td>SDK</td>
<td>Consulting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open source code</td>
<td>Education/training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Documentations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hackathons</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>YouTube channels</td>
<td></td>
</tr>
</tbody>
</table>

1.5.2.3 Value capture with platforms

Research on the monetization of platforms has mainly focused on the moderation of incentives in two-sided markets to create network effects (Boudreau & Jeppesen, 2015; Eisenmann et al., 2006). In this regard, the literature suggests the subsidizing of at least one platform stakeholder to fuel platform adoption (Parker & Alstyne, 2005; Rochet & Tirole, 2006). Subsequently, the other stakeholder(s) get charged to monetize the platform and capture value for the platform leader (Gawer, 2014; Rochet & Tirole, 2003, 2006). However, the literature mainly focuses on pricing decisions in two-sided markets in respect of e.g. quality or competition (Armstrong, 2006; Economides & Katsamakas, 2006; Weyl, 2010). Our cases show that platform leaders not only fell pricing decisions but can mix different monetization patterns in their platform business models.

Thus, platform leaders can charge users access fees for hardware, which is necessary to use the platform. This pattern got applied in cases 1, 2, and 3. The usage of the platform itself, however, stays free. A similar pattern has been described by Hagiu & Wright (2015), where users have to buy hardware (video console in their case) to use the platform. Additionally, we saw that the platform leader in case 6 demands no access fee at all while providing the platform for free to users. A hybrid model gets applied in case 5. Whereas the platform itself remains free, the platform leader charges the user a monthly subscription fee for the M2M communications.

Also for complementors, the access and usage to the platform can be free of charge. “Sample source, documentations, and APIs are open to everyone and for free” (head of R&D, case 4). Other platform
leaders apply a revenue sharing model, for example in case 2, 3, and 4. All three platforms have an app store, where users can purchase additional components from complementors. At every purchase, the platform leader participates with a certain percentage of the price. Especially revenue sharing with complementors has been described in the light of app stores from leading platform firms such as Google, Apple, or Microsoft (e.g., Anderson, Parker, & Tan, 2014; Feng & Furr, 2016). Additionally, however, we saw the platform leader in case 5 applying a third monetization pattern when complementors get charged to obtain access to the developer kit and the APIs of the platform.

Lastly, platform leaders can monetize the platform business model through their partners, either directly or indirectly. Direct monetization happens when partners pay license fees. This is, for example, the case for the platforms 4 and 6, where partners play a central role in the distribution of the platform and resell it. Indirect monetization refers to other monetization patterns that get triggered by partners and increase revenues from another platform stakeholder. In case 2, for example, the integration of the platform into a partner’s product increases the hardware sales of the platform leader. “They [partners] are going to build the integration with our bulb which, by default, makes us increase our sales” (director of marketing, case 2). In other cases, partners were not charged to access the platform and its ecosystem.

Table 4: Value capturing patterns for key stakeholders of the platform

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Users</th>
<th>Complementors</th>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Free</td>
<td>• Free</td>
<td>• Free</td>
</tr>
<tr>
<td></td>
<td>• Mandatory hardware sales</td>
<td>• Revenue sharing</td>
<td>• License fee (direct)</td>
</tr>
<tr>
<td></td>
<td>• Subscription</td>
<td>• Access fee</td>
<td>• Spur monetization through other stakeholders (indirect)</td>
</tr>
</tbody>
</table>

The value capturing of a firm not only depends on the monetization but also on the cost structure that is associated with its business model (Teece, 2010). The literature lists different arguments regarding the costs to run a platform. These are commonly reduced development costs for platform diversification compared to traditional product developments (Boudreau, 2010; Frattini, Bianchi, De Massis, & Sikimic, 2014), faster time to market (Eisenmann, Parker, & Van Alstyne, 2009; Gawer & Cusumano, 2015), and cost savings due to economies of scope and scale (Thomas et al., 2015; Wareham et al., 2014). However, more detailed insights on cost structures in platform business models are scarce. In our interviews, we found that one major cost driver of platform leaders is the programming of the platform including qualified experts. “We spend a lot on IT development and HR. This includes top notch personnel, which helps us to bring our products to the market and maintain the infrastructure” (COO, case 7). These costs are high upfront investments and part of the entrepreneurial risk the platform leader takes when creating the new business (Hagiu, 2014). Even though complementors and partners contribute a large part to the development and diversification of a platform’s scope, the platform leader is responsible to direct the evolution of the platform and its ecosystem (Gawer & Cusumano, 2014).
Our cases show that platform leaders keep spending on ongoing software updates and new functions of the platform. “Our biggest cost driver is development – the system is never finished. Especially because we face imitations by competitors and try to further diversify” (head of board of management, case 3). Therefore, our findings suggest three major cost blocs the platform leader must bear in mind when creating the platform business model: platform creation, platform advancement, and platform maintenance. To profit financially with the platform business model, these costs must be covered by revenues, generated through users, complementors, and partners.

Table 0-5: Aggregated value capturing for platform leader

<table>
<thead>
<tr>
<th>+ Revenue capturing from users</th>
<th>+ Revenue capturing from complementors</th>
<th>+ Revenue capturing from partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Costs to create platform</td>
<td>- Costs to advance platform</td>
<td>- Costs to maintain platform</td>
</tr>
<tr>
<td>= Value capturing for platform leader</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.5.3 Towards platform business models

Platforms offer companies new ways to create and capture value (Wessel, Levie, & Siegel, 2016). Due to the growing capabilities of information technologies, platforms build on decreasing communication and transaction costs with external stakeholders (Benner & Tushman, 2015; Eisenmann et al., 2009), which enable firms to hyper scale their businesses and to grow very fast (den Hartigh et al., 2016). However, different from classic product or service driven business models, the versatility of a platform ecosystem and the multiplicity of stakeholders, which have to be addressed, add another layer of complexity (Eisenmann et al., 2006). Thus, platforms business models have to provide incentive mechanisms that address and coordinate all stakeholder groups in a platform ecosystem to create network effects and grow the business. At the same time a platform leader has to find ways to profit from the platform (Hagiu & Wright, 2015b; Teece, 2017b). In our case studies, we found evidence that platform leaders design their business models in a way that each stakeholder group gets addressed with specific value creation, value delivery, and value capturing mechanisms. However, instead of designing three individual and isolated business models, they need to be regarded as composition with a constant value and data exchange via the platform leader as connecting element. Users, for example, feed constantly data into the platform, which the platform leader can share via APIs with complementors. They, in return, create value through complements and services they place in the platform. Similar, platform leaders can share user data with partners or exchange value in form of services, products, or orders.
In an attempt to condense our results from the preceding discussion, we developed a comprehensive definition to describe platform business models. Thus, a platform business model creates and delivers a specific value to users and complementors based on standardized contracts and to partners based on individualized contracts. They capture value by covering associated costs of the platform leader and the subsidy of one or multiple stakeholder groups by charging access fees from the other(s). A constant exchange of value and data between each stakeholder group and the platform leader enables value co-creation and the development of network effects. Figure 4-1 visualizes our definition and provides the blueprint of a generic platform business model.

![Figure 0-1: Generic platform business model](image)

### 1.6 Conclusion

Recent industry reports and research articles highlight the growing importance of the IoT in general and the management of platforms in particular (Bhatia, Yusuf, Ritter, & Hunke, 2017; Hui, 2014; McIntyre & Srinivasan, 2017; Teece, 2017b). In the meanwhile, established and globally leading companies such as Cisco, IBM, Alibaba, or Baidu invested billions to create their own IoT based platform business models (Amiot, 2015). Applications and possibilities, emerging through the IoT, get increasingly sophisticated and are expected to further infiltrate consumers’ daily lives as well as to reshape industrial value creation (Hunke, Rüßmann, Schmieg, Bhatia, & Kalra, 2017). New advances in different fields and industries might even accelerate this socio-economic development. The fast emergence of blockchains or artificial intelligence and machine learning add significant technological possibilities to the IoT and enable progressive firms to break current industry logics and to create new business models (Christidis & Devetsikiotis, 2016; Gubbi, Buyya, Marusic, & Palaniswami, 2013). However, growing interdependencies in ecosystems and between technological systems make platforms a complex task to manage (Wan, Cenamor, Parker, & Van Alstyne, 2017). Therefore, we built on an extensive review of
the precedent literature and insights from seven original case studies to derive a generic framework for platform business models that aims to reduce this complexity and makes platforms a more manageable construct. Furthermore, we provided insights into patterns of value creation, delivery, and capturing in platform business model while shedding light on different roles in the platform ecosystem.

With our study, we are amongst the first authors that explicitly create a bridge between the so far mainly isolated discussions on business models and platforms in their respective domains. In our generic platform business model, we integrate both perspectives by enriching business model dimensions with platform design parameters. Additionally, we address the different roles in an ecosystem that actively shape the design of the business model. While other authors have provided valuable insights into business models of e-businesses and their boundary-spanning activities (Amit & Zott, 2001, 2015; Zott & Amit, 2010), we are amongst the first authors who specifically address the value creation for and by different types of stakeholders, which are loosely organized in a platform ecosystem. Lastly, the discussion on the design of successful business is very dispersed in the literature focusing on single parameters such as technological architecture, ecosystem structure or behavior in multi-sided market. We integrate these fragmented perspectives into a more holistic model through the business model concept.

For practitioners, our results provide valuable insights as they substantiate business models as a widely accepted concept with the less known and understood platform phenomenon. However, platforms are on the rise in various industries across the globe, have a strong potential for disruption, and are accountable for a growing share of innovations (P. C. Evans & Gawer, 2016; Parker, Van Alstyne, & Choudary, 2016; West, Salter, Vanhaverbeke, & Chesbrough, 2014). Many managers have noticed this trend but are lacking knowledge how to adapt and introduce adequate business models. Our generic model as well as the identified patterns offer managers a first step to alternate their business models. Moreover, the clarification of the partners role helps to identify the right firms that might jump start the introduction of a successful platform. Strategic instruments such as the business navigator (Gassmann, Frankenberger, & Csik, 2014), lean start-up (Ries, 2011), or rapid prototyping can support the selection and testing of an adequate platform business model.

This study applies to the typical biases and weaknesses of qualitative research, which also present areas for future research. Nevertheless, we would like to point out two areas for future research that build on our results and advance the understanding of platforms in the light of the business model literature. First, we could identify nine value capturing patterns for platform leaders. Having multiple possible revenue streams to monetize the platform business, such patterns add large flexibilities in designing the platform business model. Hence, a platform leader could charge either stakeholder group while subsiding the other two or combine different value capturing patterns. Future research could specifically search additional empirical evidence for such patterns and their recombination. Second, platform leaders provide a market place for users, complementors, and partners. At the same time, they trade off their
costs for the market-intermediation through the platform (Brousseau & Penard, 2007). Future research could assess optimum settings to maximize value capturing for the platform leader by considering the bargaining power of the platform leader towards the ecosystem in the light of the different value capturing patterns, presented in this paper. This would greatly add to the seminal work of Economides & Katsamakas (2006) on this domain.

References


