

Developing an Industrial IoT Platform – Trade-off between Horizontal and Vertical Approaches

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Abstract. Demands for a digitalized, connected, and smart production provide a fertile ground for industrial Internet-of-Things (IIoT) platforms to arise within the manufacturing industry (e.g., Siemens MindSphere, AXOOM Smart Enterprise, FORCAM FORCE). Nevertheless, many companies struggle to successfully kick-off platform ecosystems. Information Systems (IS) literature is of limited help, because insights on managing platform ecosystems are mostly derived from successful examples in the business-to-consumer (B2C) context. To better understand the challenging situation of companies in the emerging IIoT environment, we conducted an in-depth case study at a prospective platform provider. Insights gained through interviews and engagement in the field uncovered a tension between a horizontal platform strategy and vertical integrated solutions as a central challenge for companies aiming to launch an IIoT-platform in the market. By conceptualizing this trade-off, its causes along with related benefits and challenges, we add to existing literature on platform governance and launch strategies.

Keywords: Software Platforms, Industrial Internet-of-Things, CPS Platforms, Platform Development, Exploratory Case Study

1 Introduction

In the course of the ongoing fourth industrial revolution ('Industry 4.0'), advanced and innovative information and communication technologies (ICT) are being introduced to logistic and manufacturing companies to facilitate more automated and intelligent processes. Within this context, the importance of service-based, real-time enabled cyber physical systems (CPS) was not only identified in theory [1]. In practice, this constitutes in the emergence of a vast number of Industrial Internet of Things (IIoT) platforms, which enable the connection of machines, devices, materials and sensors to lay the foundation for a smart production system [2, 3].

Information systems (IS) researchers have studied the concept of platforms for several years. A common definition is given by Tiwana, who defines a digital platform as "a software-based product or service that serves as a foundation on which outside parties can build complementary products or services" [4, p. 5]. A growing body of research in this field investigated the concept of platforms from different perspectives.

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Some studies follow an economic perspective investigating two-sided market characteristics of platforms like network externalities, multi-homing behavior or pricing strategies [5, 6, 7], others focus on technological architectures, open decisions and a platform's innovation potential by efficient value co-creation [8, 9, 10, 11].

Even though we find extensive literature about digital platforms, the applicability in the emerging market of IIoT platforms is limited, as most theories are based on findings from platform ecosystems operating in a business-to-consumer (B2C) context (e.g., web browsers, personal computer and mobile operating systems, video consoles, Facebook, Google search engine etc.) [12, 13, 14, 15]. Business-to-business (B2B) platforms – or B2B products and services in general – differ not only in their technological complexity. Also, different market characteristics such as size, fragmentation, and business relationships entail divergent requirements for platform strategies [e.g., 16]. As market structure shapes a platform's emergence process, the emergence processes observable in the context of Industry 4.0 differ from what has been researched in existing literature. The concept of platform development has also often been studied from a broad industry perspective [17, 18], or with focus on mature platforms [19]. Concerning the start-up phase of a platform, IS researchers agree that most successful platforms emerged from existing products in an evolutionary process [4, 20]. However, literature about this emergence process and involved actions and decisions of the platform owner remains limited.

In practice, we note that many prospective platform owners find themselves in a situation where market demands a vertical (product-oriented) and a horizontal (platform-oriented) strategy simultaneously. Literature has rarely addressed the existence and related challenges of such a hybrid strategy for platform emergence. Instead, literature highlights the difference between products or services and platforms in a sense that strategic decisions being made can have contrasting implications. Thus, managers need to decide early, whether to follow a vertical product or a horizontal platform strategy [4, 21, 22].

The purpose of this study is to gain a deeper understanding of a platform's emergence process from the perspective of a platform owner. More particularly, we focus on the platform owner's trade-off between following a vertical vs. a horizontal approach. To understand why this situation arises and how platform owners deal with this trade-off, we defined the following research questions: *Which factors cause the trade-off between following a vertical vs. a horizontal approach? How do platform owners try to reconcile these contrary requirements and what are benefits or challenges involved?*

In the remainder of this paper, we will first provide a brief overview of this paper's theoretical background. Then, we present the design of our exploratory in-depth case study [23, 24]. In order to answer the research questions defined above, we followed the ideas of engaged scholarships [25] and conducted semi-structured interviews at a medium-sized company currently developing an IIoT platform. Based on our findings, we developed a framework explaining the trade-off's circumstances, resulting strategy chosen by the case company as well as its consequences. Further, we discuss our findings against the background of the platform's B2B context. Finally, we present limitations of the study as well as implications for future work.

2 Theoretical Background

The platform concept has been researched in several fields of studies resulting in different definitions and views on the platform phenomenon [8]. Within IS two strands of literature can be identified [26]. The *market-oriented perspective* emphasizes a platform's characteristic to act as an intermediary between two or multiple sides, whereas researchers following the *technology-oriented perspective* study a platform's architecture and its capabilities to facilitate value co-creation and foster innovation. In theory, only a few researches consider both perspectives within their studies [26], which diminishes applicability of existing theories.

Within this paper, the term platform is used to describe a construct encompassing both platform perspectives. These encompassing platforms correspond to the notion of 'industry platforms' found in the typology of Gawer [20]. Furthermore, it matches the widespread definition by Tiwana, who describes a platform as 'a software-based product or service that serves as a foundation on which outside parties can build complementary products or services' [4, p. 5]. Common examples are the mobile operating systems of Google and Apple. Both platforms provide open application interfaces (APIs) allowing complementors (often referred to as third-party developers) to reuse core functionalities and innovate upon these platforms by developing complementary products and services in form of apps. In addition, Apple and Google offer a marketplace where app developers can sell their apps to end users. Thus, the platforms act as an intermediary between two sides.

2.1 Shifting Towards Horizontally Organized Platform Ecosystems

Literature has acknowledged that more and more markets shift towards a platform-centric market structure. In many cases this shift can be traced back to the digitalization of the industry involved [27, 28]. In addition to the increased software embedding, ubiquity of wireless data networks, IoT and packetization, and the need for deepening specialization are drivers for this transformation [4]. Within affected markets, vertical integrated product offerings get replaced by a layered, modular architecture of digital technologies providing the ground for platforms to rise [18, 27]. In this context, the development and provision of an integrated solution (e.g. from sensor to specific end user application) by a single or small group of firms is referred to as the vertical approach in this paper. In contrast, a company following a horizontal approach decided to focus on a single layer and thus the development of a sophisticated and comprehensive open IIoT platform. From the market perspective, the occurrence of these platforms results in a greater specialization of single firms developing complementary solutions and unlocks an increased pace of innovation in the industry [4, 10].

In this setting, scholars differentiate between *interplatform* and *intraplatform* competition. The overall market competition shifted towards a competition between platform ecosystems [28, 29], in which incumbent platforms strengthen their position automatically through network effects [30]. Additionally, high innovation capabilities of an ecosystem make it hard for closed vertical products to compete. In contrary,

intraplatform competition refers to the competition between complementors [31]. This competition ensures quality and price regulation [20], even in the common scenario of a market with one leading platform ('Winner-takes-all') [32].

This ecosystem competition requires the management of firms to adopt a new mindset [4]. Stepping into the role of a platform owner means that value creation does no longer happen internally or in few strategic partnerships [33]. The new focus of platform owners is to orchestrate a big, loosely coupled ecosystem of firms for efficient value co-creation [34, 35, 36, 37]. Innovation is not planned anymore, but rather emerges in the ecosystem [4]. Nevertheless, through the provision of appropriate boundary resources [14, 15, 38, 39] or different pricing strategies [6] a platform owner can still foster or hamper the emergence of innovation. Further platform-related management challenges are summarized in the 'Four Levers of Platform Leadership' by Cusumano and Gawer [40]. They include decisions about scope, product technology, relationships with external complementors and internal organization. Referring to these differences, literature highlights the importance of an early and clear management decision, whether to follow a platform strategy or to offer a vertical integrated (product) solution [4, 21, 22]. Otherwise, it 'can result in dangerous strategic confusion' [21, p. 69], as decisions being made in platform competition differ from those, a firm makes while pursuing a product strategy. Nevertheless, other scholars consider a hybrid business model as useful in the transition phase between product and platform business [41], but also acknowledge that especially small firms may not be able to afford such a hybrid strategy [27].

2.2 Platform Emergence from the Perspective of a Platform Owner

For prospective platform owners, it is necessary to detect the shift towards a layered market, determine their role in this ecosystem (platform leader or complementor) and adjust the strategy accordingly [18]. Most successful platforms arise out of a product or service by including a second market side [4]. Thereby, platform potential of a product can be identified by assessing the existence of a second group interested in a cost-effective interaction with existing customers, the potential for cross-side network effects and/or the existence of unexploited long-tails in the prospective market [4]. Others suggest that the following two conditions should be fulfilled: (1) the product, service or technology needs to provide essential functionalities solving an existing problem of an industry and (2) it offers easy-to-use interfaces to develop complementary services [21]. However, adding a second side can also be interpreted as a process of opening the platform and thereby giving up control. This is also reflected in the evolutionary perspective on platforms by Gawer [20], where internal product platforms evolve into industry platforms.

In sum, the theories and strategies provided in literature are not sufficient to understand the specific steps and actions of platform owners during the emergence of platform development. Furthermore, the mostly linear emergence models proposed in literature do not consider, that market demands may require a company to pursue a vertically integrated product strategy and a horizontally platform strategy simultaneously. However, especially in the emerging market for IIoT solutions, the

existence of these contrary requirements is a common situation for example for providers of IoT technologies when extending their solutions by complementary software offers.

3 Research Design

To explore the process of platform emergence from the perspective of a platform owner, we conducted a single case study [23, 24]. Considering the complexity of a platform's emergence process, it is reasonable to study the phenomenon in its real-life context. Therefore, we did not only conduct semi-structured interviews, but also gained valuable insights through engagement in the field [25]. Furthermore, the 'how' and 'why' research questions confirm the suitability of a case study research approach, which was conducted in an exploratory manner [24]. In this sense, the case study is also designed to reveal yet unknown events and challenges in the process of platform development to later build theory upon [23]. Overall, the case study was carried out in an iterative process of data collection and analysis [23, 24, 42].

The case company being studied (referred to as *HardwareProvider* in the following) is a medium-sized, young company based in Germany. As many other players in the field, the company's background lays in the hardware business [43], so that a software platform was primarily developed as a value-added service for their customers from the manufacturing and logistic industry. The platform should be designed open to raise an ecosystem around it and thereby foster innovation. Thus, the case company is currently facing the tension between following a vertically integrated product strategy and a horizontally open platform strategy. In this regard, *HardwareProvider* is an interesting case for two reasons. First, being in an early stage of its platform development allows observing strategical decisions while being made. Second, the limited business maturity and the company's small size simplify the otherwise very complex environment of an IIoT platform.

For **data collection**, we relied on primary and secondary data. We conducted seven semi-structured expert interviews with employees having a key role in the development of the company's platform offer [44]. Table 1 provides an overview of the interviewee's job responsibilities, date of interviews and the interview length. The respective interview partners (IP) got informed about the interview and its purpose beforehand. In the manner of an iterative study design, questions in the first interviews were rather broad to get an overview of the platform emergence and interview partners for further interviews [42]. In general, topics covered during the interviews included not only the technical development, but also strategical decision making related to platform design, marketing and related partnerships. Due to the fact, that each interview partner had a different role in the process of platform development, not every interviewee was asked the same questions. Besides interviews, additional primary and secondary data was accessible due to our engagement in the field over a period of five months. As our single case study at *HardwareProvider* follows the ideas of engaged scholarship [25], informal conversations and collaboration with key stakeholders from the case company took already place in an early stage to build a practical pre-understanding, formulate

relevant research questions and design the study accordingly. In a later stage, additional data sources like marketing material, internal product roadmaps and project documentation, were used to validate findings from the interviews. Furthermore, the attendance of internal and external meetings and workshops allowed us to include perspectives from additional stakeholders not being interviewed directly (e.g. partners and customers).

Table 1. Summary of interviews (ID, date, interviewee, length)

<i>ID</i>	<i>Date</i>	<i>Interviewee position</i>	<i>Length</i>
IP1	19.06.18	Founder and managing director of <i>HardwareProvider</i>	50 min
IP2	21.06.18	Managing director of <i>HardwareProvider</i>	36 min
IP3	10.07.18	Head of project engineering	48 min
IP4	17.07.18	Head of development	55 min
IP5	18.07.18	Product and project manager	41 min
IP6	20.07.18	Sales and partner manager	49 min
IP7	25.07.18	Founder and managing director of <i>HardwareProvider</i> (follow-up)	39 min

For **data analysis**, we applied procedures of the grounded theory methodology [42, 45, 46]. We used the bottom-up coding technique to analyze qualitative data and find theoretical concepts. In a first step of open coding, we associated about 340 concepts to more than 450 interview quotes. Then, we grouped codes by defining emerging (sub-)categories (Table 2). During axial coding, we adapted the *Six C* coding family to relate identified categories to each other [47]. Furthermore, we wrote theoretical memos to record ideas raised during coding [42]. As a last step, we applied selective coding to establish the core category and identify all relevant categories to describe the phenomenon in more detail and to build a theoretical model.

Table 2. Illustration of coding scheme

Interview statement¹	Concepts	Categories
<i>“The past has shown that we did not do completely wrong, when following a project-driven development strategy. <u>Because we knew, that the market needed the feature or this functionality^{1,2}. We could develop the feature in cooperation with the customer from industry². Thus, also tap into a lot know-how^{2,3}. But we also tried to develop new functionalities independently, which was also driven out of a new product management department⁴.” [IP5]</u></i>	1.Minimizing risk through customer-oriented feature development 2.Cooperative feature development with customer 3.Building up know-how through cooperative development 4.New product management department	<ul style="list-style-type: none"> ▪ Sources of platform features ▪ Project-driven development ▪ Independent feature development

¹ All quotes have been translated from German

4 Results and Interpretation

Within our analysis we did not only gain a deeper understanding of *HardwareProvider's* journey of becoming a platform provider, but we also identified the trade-off between horizontal and vertical platform development as a major issue faced by a platform owner during platform emergence. Therefore, we further studied the issue by investigating context, causes, (pre-)conditions, undertaken strategy and consequences. The established model is depicted in Figure 1 and will be discussed in the following.

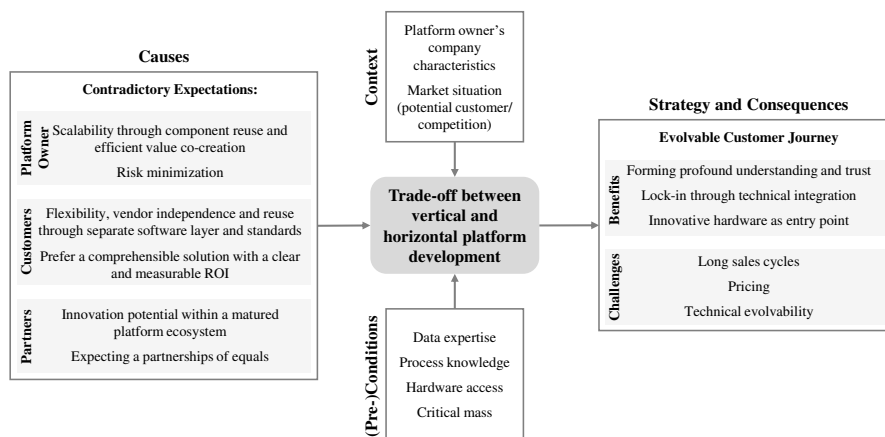


Figure 1. The challenging platform development environment

4.1 Emergence of the Horizontal vs. Vertical Trade-off

The case study helped to understand the circumstances, which brought the prospective platform owner into the trade-off between vertical product and horizontal platform development. The overall situation appears rather complex, though we defined three clusters shaping this trade-off.

Causes: The emergence of the trade-off is driven by anticipated consequences of internal and external stakeholders. On the one hand, the *platform owner*, especially members of the development and project management team, would benefit from focusing on a generic horizontal approach. Such an approach allows for more scalable project business through component reuse, as well as the possibility for efficient value co-creation by the customers themselves or external partners. On the other hand, customer-oriented implementations of vertical end-to-end use cases minimize the risk of implementing features not required by the market and simplifies marketing and sales.

From the *customer perspective*, a comprehensive, company-wide open platform for its data may be desirable as it can be used to set standards. Thus, flexibility and vendor independence for the implementation of vertical use cases can be achieved. This would in turn strengthen the customer's position in future purchasing processes: *'But the [customer's] strategy was, to not be dependent on a specific manufacturer, but to establish a layered model, in which vendors of every layer [e.g. hardware, software,*

application] can be easily replaced.' [IP3] However, although big players and a few progressive medium-sized companies already recognized the potential of a horizontally, layered architecture, many customers, especially employees from operational departments, prefer use-case oriented solutions with a clear and measurable Return-on-Investment (ROI). Especially in manufacturing companies these stakeholders have an important role, as an interview partner mentioned: *'There were mainly the production managers, who wanted that a specific use case is tailored and targeted well-functioning. And as with any manufacturing company, production [departments] have a prominent position and weight [...].'* [IP3]

Lastly, *potential partners* have contradictory expectations as well. While a horizontally matured platform approach would provide them with a fertile ground for innovation, they still expect a close partnership of equals with shared product portfolio often requiring partner-specific vertical use-case implementations. Although these contradictory partner requirements are mainly attributed to the variety of partner types, even within single partner companies, expectations contradict to a certain degree.

Context: The trade-off must be seen in the context it emerged in. On the one hand, the popularity of trends like 'Industry 4.0' or concepts of the 'Smart Factory' not only raised interest for innovative solutions, but also had a positive impact on the customers' or potential partners' willingness to invest. On the other hand, companies in the production and logistics industry are still rather conservative. That is, management staff often belongs to elderly generations lacking a well-versed technological understanding, thus struggling to recognize technological potential. This requires educational work, which in turn is easier when selling vertical end-to-end solutions. Furthermore, the market is flooded by a high number of (I)IoT platforms. In this context, potential customers get confused and a critical attitude towards the platform term is clearly noticeable, as it was pictured by an interview partner: *'[...] there are platforms like sand by the sea. If you go to the customer and you use the word platform, then most say: Please leave immediately, I can't, I really can't hear this [word] anymore.'* [IP2] Hence, a clear value proposition in form of an implemented vertical end-to-end use case is even more important for those customers.

However, not only the target market caused the trade-off being faced, but also the current situation of the platform owner. Conducting interviews at *HardwareProvider* it became clear, that especially the company characteristics like age, size and background are closely intertwined with the trade-off. To begin with, limited resources in the development, sales, partner management as well as the product and project engineering department intensify the trade-off, because a simultaneous realization of both concepts is not feasible. As the company was only founded a few years ago, it had only a small potential to exploit existing (hardware) customer base for upselling. In addition, due to a limited brand recognition, customers expect close customer contact, commitment by the platform owner and a clear value proposition: *'Well, as a company with our name [little prominence] and without any other relationships, we don't have the opportunity to just bluntly sell a platform, which may not have such a huge added value yet, because there are only few applications on it.'* [IP1]

Also for *HardwareProvider*, such a close collaboration is desirable, as they can acquire relevant domain and process knowledge. Lastly, the company went through a

transformation of the business focus as it was operating in the hardware sector before. The shift towards software business was challenging as the company lacked not only technical expertise in this field, but also experience concerning software sales processes and partnerships. By offering vertical end-to-end solutions combining software platform and own hardware products, *HardwareProvider* can leverage their existing resources to obtain a competitive advantage: *'[...] that we had a great deal of know-how in the field of [this type of] data and we were able to develop the right platform for it. [...] That is, I need to differentiate my offer by knowing the data well, understand related use cases and then having a platform for it.'* [IP2]

(Pre-)Conditions: To pursue either of the two approaches a set of conditions need to be fulfilled. A vertical end-to-end solution requires access to hardware components as well as expertise about the created data (transportation, structure, content). In this context, one interview partner explained, why interface standards are only of limited use: *'[...] but if you are able to understand it - that is a different problem. The standardization of [data] transportation [...] is relatively easy. And this is, what most concentrate on, when implementing standard interfaces. And the other [aspects] are often forgotten. Things like content structure. But even if the content is clear, then you still have things like units and coordinate systems. [...] standard definitions leave questions, for example how certain information like battery status is communicated. That isn't standardized. And every supplier does it a bit different. Thus, it is not completely standardized anymore.'* [IP4] In addition, process knowledge is necessary to identify relevant use cases for implementation. While for the implementation of vertical use cases mostly specific data expertise is required, for successfully following the horizontal approach an even broader data expertise is necessary. Furthermore, a critical mass is relevant for making reasonable investments in the development of platform related features like an app store, user management, interface management, or automatic licenses.

4.2 Resulting Strategy and Consequences

Being confronted with this trade-off, *HardwareProvider* established a strategy to combine the two approaches by pursuing an **evolvable customer journey**. Thereby, the concept of a customer journey describes different stages of the actual purchasing cycle, as well as the relation to previous and future purchase experiences [48]. We denote the customer journey as evolvable, because of the customer's shift of interests: from requiring a vertical integrated solution towards requesting horizontal platform characteristics.

Starting with small, timely restricted projects as a proof-of-concept, *HardwareProvider's* customers in most cases focus on the underlying hardware technology. At this stage, the software platform is only seen as a complementary service to implement specific, vertical end-to-end use cases. Generic platform features like device management, user management, or generic standard interface implementations are used rarely within these proof-of-concepts. After a successful proof-of-concept, the customer decides to stay with the technology in form of a permanent hardware installation. Although this entails the installation of more hardware components in

many cases, the scope of software features being used remains mostly the same. However, ensuing customer workshops often result in the identification of further projects. These projects consider not only the implementation of the similar use cases at other sites. Instead, identified use cases increasingly exploit platform characteristics of *HardwareProviders* software components. This is, customers' requirements develop more towards use cases utilizing the platform's standard interfaces to connect external data sources, for integration with existing systems or to connect with other external services on top. Furthermore, cross-cutting use cases depend on the scalability of a platform's architecture.

Benefits: Following such an evolvable customer journey approach has several benefits for *HardwareProvider*. First, it allows the company to exploit its innovative hardware technology and existent expertise by using it as an entry point for launching a more sustainable platform business-model at the customer. Furthermore, this step-by-step approach is the foundation for involved stakeholders at the customer site to develop a deeper understanding concerning the technology and its potential. By also building trust in *HardwareProvider* as a technology vendor, these stakeholders serve as internal promoters for follow-up projects. In general, customer investments in platform adoption and training for software usage, as well as already implemented use cases, including customization and integration with other IT systems, entail a certain lock-in effect. This was also summarized by one interview partner: *'And once [...] you anchored yourself horizontally with other systems, then it is very difficult to lose that position again. This way, you can establish yourself very well and thereby make yourself interesting for follow-up business [...].'* [IP5]

Challenges: In the first place, small proof-of-concept projects, including continuous consulting services and close collaboration, are not profitable. This evolving approach results in long sales cycles requiring *HardwareProvider* to make big investments in the technology not being covered by current revenues.

From a technical perspective, the chosen approach cannot be realized as seamlessly as it may be assumed. This is, further use cases are not just implemented by activating additional features on the platform. For example, an increased scalability required by later use case extensions (e.g., additional data sources) causes changes in the infrastructure. An interview partner outlines the reason for having two different versions: *'For this scalability, which is that this cluster is functioning, it requires a minimum of three servers. Without that, it doesn't make sense. And not every customer wants to put up three servers, if it is not needed. Thus, we also have another mode, which operates on only one server.'* [IP4] Further technical challenges include version management and security aspects related to network integration.

Lastly, *HardwareProvider* faces challenges concerning pricing. At first glance, a mixed offering (hardware plus software) may allow for more flexibility in cost allocation. However, in reality, the combination of one-time hardware costs and recurring software costs associated with an uncertainty about future software development and usage poses a problem. One strategy to solve this problem is the modularization of platform features. Thereby, value-based vs. cost-based pricing considerations as well as questions about feature granularity (e.g., statistic module vs. single charts) and licenses control mechanisms arise.

5 Discussion

Findings of the conducted case study shed light on a platform owner's challenging situation during early platform development. While the previous chapter explained our observations in more detail, we now discuss findings in the context of extant platform literature. We find that the emergence of the identified trade-off, which was rarely addressed in the literature so far, is attributable to characteristics specific to the B2B market. Especially, the complexity of B2B solutions, length of sales processes, bargaining power of customers, as well as the market fragmentation resulting in a lack of standardization, causes the differences to findings of existing literature, which are mostly based on examples from the B2C context [12, 13, 14, 15, 49].

Results of this case study further show, that, initially, customers in this market are mostly interested in single vertical end-to-end solutions for certain use cases. Thus, indirect network effects as a central and valuable mechanism of platforms do not occur because customers do not value the availability of other use cases on the platform. Consequently, the well-researched chicken-and-egg problem is less relevant in this context [32]. Nevertheless, customers expect a flexible and open solution to be able to develop further applications in their own IT departments or jointly with other third-party developers. Hence, platform-specific design principles (modularity, stable interfaces) and provision of boundary resources (documentation, developer communities etc.) are still relevant aspects to consider for the case company [14, 31].

Analyzing the case company's situation and chosen strategy, we provide insights to the prominent research question examining a company's decision to follow a platform strategy in the complex B2B market, considering differences between a horizontal and a vertical strategy [4, 21, 22]. In particular, we outlined the need for a hybrid strategy caused by anticipated consequences for internal and external stakeholder. Furthermore, this work also contributes to theory dealing with 'make-or-join' decisions being made by companies in emerging platform markets, that is, the decision whether to implement a new platform or to join an existing platform ecosystem [50]. Due to a complex and vast market situation, the immature state (in terms of technology and customer base) of existing platforms in the market, as well as the inability of these solutions to serve specific technical requirements (e.g. real-time and scalability), the case company decided to pursue a 'make' strategy.

This paper also adds to literature researching platform development from a market perspective. Unlike the assumption of a homogenous shift towards a horizontal market architecture [27], the results of this case study reveal, that in B2B markets, this transition from vertical integrated products towards a horizontally layered architecture can happen for every customer individually on different points in time. As a result, a company striving for platform ownership needs to provide a hybrid solution first. By describing *HardwareProvider's* hybrid strategy utilizing an evolvable customer journey approach, this paper presents a possible solution for this situation. We also outline the benefit of this strategy as yielding strong lock-in effects through investments by the customers for user education and technical system integration. Due to the complexity of B2B products, these investments are bigger, switching costs are higher and lock-in effects are stronger compared to those of B2C platforms. Thus, we consider

it as unlikely, that the prominent ‘Winner takes all’ mechanisms [32] will apply in this context. Rather we expect the market to be composed of several niche platforms being linked with each other.

Our study also contributes to practice: By breaking down the current situation of a real company in this field, our work reveals important aspects and challenges to consider when working on a business model in an emerging B2B platform market. However, practitioners should consider, that results presented here are derived from a case study at a start-up and thus may not apply to established companies to the same extent [cf. 50, 51].

6 Conclusion

The purpose of our exploratory case study was to deepen the understanding of prospective platform owners’ situation in the context of Industry 4.0. Thereby, we derived novel insights about the early stage of platform development and the challenging trade-off between following a vertical product strategy or the implementation of a horizontal platform business model. We not only presented the identified circumstances fueling this challenging situation, but also outlined the platform owner’s approach of pursuing an evolvable customer journey as one strategy to counteract this trade-off. Although this strategy yields strong benefits like customer lock-in, it still includes business and product related challenges.

However, our study is also subject to several *limitations* laying the foundation for *future work*. Conducting a single case study allowed us to gain in-depth understanding of the company’s situation in the complex emerging IIoT market. Nevertheless, the generalization of findings is restricted. Furthermore, we want to point out, that the long-term success of the presented strategy undertaken by the case company could not be evaluated, as the platform is still in a very early stage. To overcome these limitations, we suggest multiple, long-term case studies also addressing differences in platform type (e.g., edge vs. cloud or platform for equipment supplier vs. for equipment operator) and platform owner’s characteristics (background, size, age) while evaluating findings. Lastly, presented results focus on the technical development and design of the platform. Besides that, building an ecosystem is a key aspect of successful platforms. While the onboarding process of customers has been addressed in more detail, onboarding of the supply side was not in the focus of this work. However, in the course of this exploratory case study we came across interesting aspects differing from extant literature (e.g., partner acquisition, motivation, collaboration). Thus, we call for future work further investigating partner management strategies in the context of IIoT platforms and hope that our work can provide a helpful starting point.

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