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# How Incumbent Firms Navigate Nascent Digital Platform Ecosystems in the Internet of Things:
A Contextualized Perspective on Value Co-Creation in Platform Ecosystems

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# I.    Introduction

The first section (I.1) of this chapter highlights the motivation and relevance of this work. Then, the research gaps and research questions (I.2) are presented, followed by the research design (I.3), the expected contribution (I.4), and the structuring of the dissertation (I.5).

## I.1    Motivation

*"For pipeline firms, the writing is on the wall: Learn the new rules of strategy for a platform world, or begin planning your exit."* (van Alstyne et al. 2016, p. 57)

Although this statement might appear bold, there is robust evidence that platform-based value creation has become a dominant logic in today's business world (Evans and Gawer 2016). With Microsoft, Apple, Amazon, Google, and Facebook, five of the world's six most valuable companies build their success on platforms that connect separated markets and thus create value (PricewaterhouseCoopers 2020). These companies not only connect developers with smartphone owners (Apple), advertisers with Internet users (Google), individuals with each other (Facebook), and buyers with retailers (Amazon) but also nurture flourishing ecosystems around their platform instances. In doing so, these companies have mastered large-scale value creation with millions of contributors, while at the same time revolutionizing the market architectures of established industries such as telecommunications, advertising, or retail (McIntyre and Srinivasan 2017).

Although digital platform ecosystems have been home turf for native platform firms for more than a decade now, emerging phenomena such as the IoT are moving incumbent organizations to the forefront of practitioners and researchers' attention (Wortmann and Flüchter 2015). With the increasing digitalization of the physical world, established companies with roots in the product business are increasingly required to familiarize with the logic of digital platform ecosystems to organize their value creation (Parker et al. 2016). As a result, established companies are exploring value creation in the IoT via their own nascent digital platform ecosystems (Hanelt et al. 2020; Hodapp et al. 2019a). For instance, companies such as Bosch, General Electric, or Siemens provide platforms that allow third parties to connect their devices to the Internet and build software applications on top of it. In doing so, concepts previously known from native platform companies are gradually diffusing into the incumbent firms' business landscape.

However, given the strong emphasis of research on native platform firms, frequently cited platform scholars advocate greater diversification of research efforts in order to obtain a more nuanced understanding of platform-based value creation as the basis for theory building (Constantinides et al. 2018; Hein et al. 2019a; Parker et al. 2016; Reuver et al. 2017). More specifically, Reuver et al. (2017) calls for diversity in the analysis of (i) the maturity levels of platforms, as opposed to solely considering mature platform ecosystems (e.g., Ghazawneh and Henfridsson 2015b), (ii) the different types of organizations acting as

platform sponsors, as opposed to a predominant focus on the prominent native platform companies (e.g., Eaton et al. 2015), and (iii) the varying contextual conditions as opposed to the well-studied mobile phone, web browser or enterprise domain (e.g., Ceccagnoli et al. 2012; Tiwana 2016). This thesis aims to respond to the three calls by contributing to the question of how incumbent organization (as a little researched type of platform sponsor) navigate nascent platform ecosystems (as little researched maturity stage in the platform lifecycle) in the IoT (as little researched contextual condition in the scholarly platform discourse). Each of the three themes can contribute fresh and undiscovered insights to the research stream of digital platform ecosystems (as explained in the following) and is simultaneously highly relevant for the managerial practice of established companies. The interrelation of the three themes is depicted in Figure 1.

First, Tiwana et al. (2010) argue that platforms evolve and thus follow a certain platform life cycle. Even though this is a generally accepted understanding among platform scholars, most research takes mature platforms with evolved ecosystems as a unit of analysis, which leads to a limited understanding of the early stages of platform lifecycles. Initial scholars have already argued that the nascent platform ecosystems are typically based on a smaller number of contributors, have weaker network effects, and often contain limited resources (Dattée et al. 2018; Hannah and Eisenhardt 2018; Reuver et al. 2017). Thus, value creation in the early stages of platform lifetime is likely to follow different dynamics known from their mature counterparts. These observations are in line with empirical findings gained on nascent platform instances studied in the course of this thesis (Hodapp et al. 2019a). Therefore, research efforts on nascent platform ecosystems complement the existing knowledge about mature digital platform ecosystems. In addition, research that considers the maturity stage of a platform brings scholars one step closer to theories on life cycle-dependent platform governance mechanisms (Constantinides et al. 2018; Tiwana et al. 2010).

Second, incumbent organizations that are building a platform ecosystem are a different type of platform sponsor and, as previous research has argued, are most likely facing unique challenges in this process (Parker et al. 2016; van Alstyne et al. 2016). In contrast to native platform organizations, established organizations have previously achieved remarkable success by designing and optimizing linear supply chains. Incumbent firms understood how to take up individual customer requirements, build the technology on this basis, and arrange resources with other downstream suppliers. In this business logic, pushing enough goods through the organization, maintaining quality, and achieving healthy product margins are considered a decisive competitive advantage. However, with the increasing importance of platforms for incumbents, new dominant business logic is emerging, and themes such as network effects (Katz and Shapiro 1994), participation (Baldwin and Clark 2006), and ecosystem governance (Adner 2016) are gaining in importance. These concepts are considered cornerstones for digital platform ecosystems' success but are particularly new in incumbent organizations' business and organizational considerations (Hanelt et al. 2020; Hodapp and Dung Dao 2019). Therefore, research on established companies building

platform ecosystems offers the opportunity to position a new but increasingly important type of platform sponsor in the scholarly discourse.

Third, the IoT harbors many nascent platform instances built by established organizations and is, therefore, by nature, the appropriate research setting for this work (Mineraud et al. 2016). Beyond that, the IoT presents some new and fresh characteristics of platform ecosystems that are not yet present in other contexts. One of them is the cyber-physical nature of platforms in the IoT, implying value creation on a software layer and increased hardware layer dynamics (Nicolescu et al. 2018). This is because integrating several physical devices is considered important for the value creation in IoT platform ecosystems (Lempert and Pflaum 2011). Another contextual condition that the IoT presents to the platform discourse is the merging of multiple horizontal and vertical domains, leading to diverse technologies and standards mixed and matched in platform ecosystems (Porter and Heppelmann 2014). Here, IoT scholars use the term hyper fragmentation, which describes the danger that the sheer number of platforms, technologies, and standards fragments the IoT to such an extent that a value creation dynamic known from other platform-based contexts is not possible per se (Gasser 2015; Nicolescu et al. 2018). Therefore, research that reveals the new contextual conditions that the IoT presents for scholarly discourse on digital platforms appears valuable. At the same time, IoT specific insights made via the digital platform ecosystems lens promotes the scholarly field of IoT research.
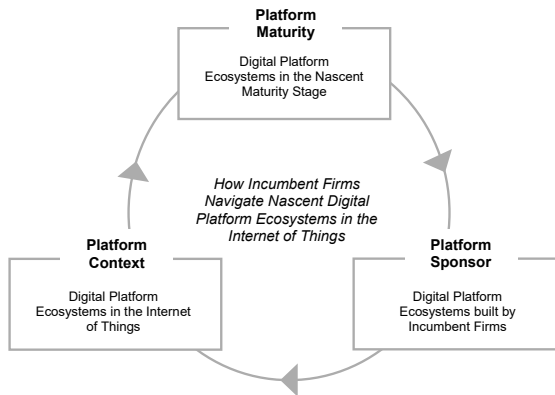


**Figure 1: Contextual Conditions Addressed in this Thesis**

Given the above-mentioned considerations on incumbent organizations navigating nascent platform ecosystems in the IoT, the first overarching objective of this thesis is as follows:

**Objective 1: Advance existing research on digital platform ecosystems through a more contextualized perspective, on the platform maturity, i.e., a nascent stage, on the platform sponsor, i.e., incumbent firms, and the embedding phenomenon, i.e., the IoT.**

The application of the digital platform perspective to the IoT will likely result in new insights specific to the IoT phenomenon. Thus, the second overarching objective of this work is:

**Objective 2: Increase the maturity of IoT-specific research by providing a digital platform perspective on the phenomenon.**

## I.2    Research Gaps and Research Questions

As outlined in the previous section, this work seeks to explore how incumbent organizations navigate nascent digital platform ecosystems in the IoT. To do so, the thesis focuses on three research questions. Each research question is derived by a specific gap in the extant digital platform literature. Afterward, the interrelation of the three research questions is visualized in a research framework.

Over the last decade, digital platform ecosystems have become an important research area within the scholarly IS community (Hein et al. 2019a). Generally speaking, platforms stimulate the participation of contributors who add new software specific to the platform (Tiwana et al. 2010). As the number of contributors increases, it becomes more and more attractive to join the platform ecosystem. A dynamic called the network effect leads to strong self-reinforcing growth (Katz and Shapiro 1994). This type of value creation has become a dominant pattern in today's business landscape and is, therefore, the focus of practical (e.g., McKinsey & Company 2019a) and academic (e.g., Gawer and Cusumano 2014) attention. Given this relevance, contemporary research began to understand better what makes a platform successful. Or in other words, how must a platform be designed and governed in order to enable large-scale value creation together with its complementors (Foerderer et al. 2018b; Huber et al. 2017; Schreieck et al. 2017a). Mature platform instances such as mobile platforms (Ghazawneh and Henfridsson 2015b), game platforms (Boudreau and Jeppesen 2015), enterprise platforms (Ceccagnoli et al. 2012), or Internet browser platforms (Tiwana 2016) have become the unit of analysis. The critical nascent state of platforms has been less considered. This is surprising because the phase of platform emergence is considered a nexus for (i) the success or failure of generative platform activities (Reuver et al. 2017), (ii) the release of network externalities and thus dominance (Dattée et al. 2018), and (iii) the enforcement of crucial design decisions that are often irreversible (Wareham et al. 2014).

Against this background, recent scholarly contributions have begun to argue for an evolutionary differentiation of digital platform ecosystems (Reuver et al. 2017; Tiwana et al. 2010), as the challenges that arise in the value creation are likely to vary depending on the maturity of the platform. Consequently, it is fundamental to position the nascent stage of digital platform ecosystems as a unit of analysis to contribute to the overall research goal. Therefore, there is a need to diagnose how emerging digital platform ecosystems differ from their mature counterparts based on existing platform knowledge and then to explore the challenges specific to the nascent digital platform empirically. Therefore, the first research question is formulated as follows:

**RQ 1:**    *How do nascent platform ecosystems differ from their mature counterparts, and what are specific challenges for value co-creation at this stage of maturity?*

Second, although digital platforms are currently attracting great research interest, contemporary contributions rarely reflect the diversity of platforms in the real world. This

holds true not only for an overly strong focus on mature platform ecosystems as opposed to nascent ones but also for the organizations that sponsor the platform ecosystems. Previous research has primarily focused on the challenges that native platform companies face in building a digital platform ecosystem (e.g., Eaton et al. 2015), while neglecting other types of organizations transitioning into the platform business logic. Against this backdrop, previous scholars have raised concerns that platform ecosystems are not a proxy for technology firms such as Google or Apple, although many known platform instances originate from these companies (Reuver et al. 2017). Instead, platforms are founded by different actors from different industries (Hanelt et al. 2020). In particular, incumbent organizations are increasingly moving to explore the possibilities of digital platform ecosystems in their established markets (Parker et al. 2016). This is not surprising because, on the one hand, digital platform ecosystems enable incumbents to restructure existing market architectures in such a way that they can secure their existing dominant position (Ozcan and Santos 2015). On the other hand, incumbents are experiencing increased competition from native platform actors, prompting them to respond with their digital platform ecosystems (Bharadwaj et al. 2013). Given this trend towards platform building, van Alstyne et al. (2016, p. 60) argues that "firms that fail to create platforms and don't learn the new rules of strategy will be unable to compete for long." However, while native platforms naturally begin with a strong market and ecosystem orientation, established organizations are starting to build digital platforms within the confines of long-established corporate structures, and these platforms often compete with other, more successful linear business models for resources (Pache and Santos 2013). Considering this, it appears that the process of platform building differs significantly between established organizations that are transitioning to platforms and native platform companies that start with a platform business logic at the core.

Although the narrative of incumbent companies that need to learn the platform business rules may seem appealing, the scholarly literature that considers established companies as a unit of analysis is relatively scarce (Hanelt et al. 2020; Hodapp and Dung Dao 2019; Reuver et al. 2017). Given that, there is a need to better position incumbent companies as actors in the scientific platform discourse. To this end, the specific inter- and intra-organizational challenges that established organizations face in building digital platform ecosystems need to be investigated. Therefore, the second research question is formulated as follows:

**RQ 2:** *What challenges face incumbent organizations building digital platform ecosystems, and how do they overcome it?*

Third, both the maturity level of a platform and the organizational nature of the platform sponsor are essential for gaining differentiated knowledge about digital platform ecosystems. In addition, research emphasizes the specific context in which a platform is embedded. Previous contributions represent research areas such as enterprise (Huang et al. 2013) platforms or web browser platforms (Tiwana 2016). With the ongoing digitization of physical industries, platform building is becoming an increasingly important topic in the field of the IoT (Hein et al. 2019b; Mineraud et al. 2016; Nicolescu et al. 2018; Wortmann and Flüchter 2015). The vision of the IoT implies a global infrastructure that enables the development of

advanced software by connecting (physical and virtual) things based on existing and emerging information and communication technologies (International Telecommunication Union 2012). In other words, everything that can be connected to the Internet will be connected to the Internet. To achieve this ambitious goal, organizations of various types are beginning to build IoT platform ecosystems that connect devices to the Internet and provide resources to develop software on top (Díaz et al. 2016; Hodapp et al. 2019b; Mineraud et al. 2016). In doing so, platform sponsors in the IoT are striving for a similar innovation dynamic known from the field of smartphones and mobile platforms such as iOS and Android (Eaton et al. 2015). However, platform building in the IoT holds some particularities for research that are not yet covered by mainstream digital platform research. First, due to the strong focus on physical devices in the IoT, incumbent firms with a broad product portfolio are becoming an important factor in the scholarly platform discourse (see RQ2). Second, research has noted that the IoT is in a state of hyper-acceleration, as the phenomenon involves the mixing and matching of several nascent technologies (Nicolescu et al. 2018). Consequently, many of the IoT platforms deviate from the well-known, mature platform ecosystem dynamics and require the integration of evolutionary aspects into the scientific platform discourse (see RQ 1). Third, the IoT exhibits some phenomena-specific characteristics, such as an increased dynamic of the platforms' hardware layer (Mineraud et al. 2016) or a higher degree of fragmentation (Nicolescu et al. 2018) due to a large number of merged industries. As a result, research is confronted with new and only partially understood contextual conditions that influence cyber-physical value creation in the IoT.

Given the little researched contextual condition that the IoT presents, there is a need to clarify what IoT platforms are and how they relate to the existing scientific platform discourse. Furthermore, contemporary research has highlighted the requirement for a better understanding of the phenomenon specifics that influence the value creation in digital platform ecosystems in IoT, which most probably differ from other contextual conditions so far studied. Therefore, the third and final research question is formulated as follows:

**RQ 3:**      *What types of platforms emerged in the IoT, and what contextual condition prescribe their value co-creation?*

Figure 2 visualizes the three research questions and their interaction in the research framework for this thesis. Thereby the IoT phenomenon can be considered as a contextual setting for studying nascent digital platform ecosystems built by incumbent organizations. The research setting of each study is discussed in the next section.
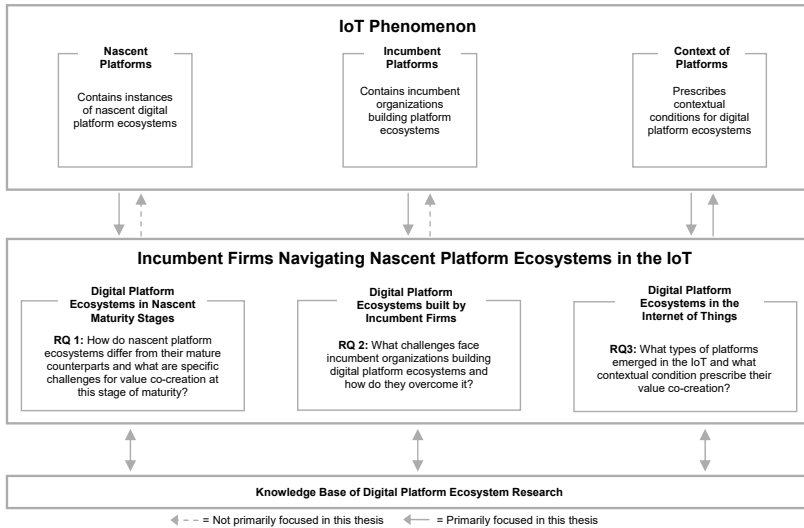
Figure 2: Research Framework

## I.3   Research Design

Six studies aim to answer the research questions in this thesis. Studies 1 and 2 respond to the first research question. Studies 3 and 4 answer the second research question, while Studies 5 and 6 address the third research question. The studies have an explanatory character, i.e., they concern identifying constructs and relationships, rather than confirmatory one, which tests pre-defined relationships (Orlikowski and Baroudi 1991). Although the six studies follow a similar research philosophy, they differ in their research design.

The research philosophy of the six studies, which focus on answering the three research questions, shares a positivistic epistemology and a behavioral research paradigm. A positivist epistemology assumes that an objective physical and social world exists that can be theorized about (Wynn and Williams 2012). Research that follows this epistemological perspective assumes that the world can be objectively recorded, characterized, and measured through systematic observation (Bhattacherjee 2012; Orlikowski and Baroudi 1991). This work follows the understanding that digital platform ecosystems and their value creation processes can be objectively understood by building on appropriate theoretical lenses. Therefore, the six studies in this thesis aimed at ensuring objectiveness by involving different researchers in the coding and discussion process of the results. Also, rigorous methodologies were used to identify the results obtained. Nevertheless, it must be recognized that each researcher - especially in terms of the interpretation perspective - still had a subjective interpretation of reality that might influence the results.

The six studies represent the same research paradigm, i.e., behaviorally oriented. Behavioral research aims to develop and verify theories that explain or predict peoples' or organizations'

behavior in the context of the analysis, design, implementation, management, and use of IS (Hevner et al. 2004). All six studies take a socio-technological perspective on platform ecosystems and, therefore, aim to explain organizations and their interactions with platforms (Reuver et al. 2017). Therefore, all six studies can be considered as behavioral studies. Perhaps an important note here is Study 5, which develops a taxonomy of IoT platforms based on the characteristics of their business models (Nickerson et al. 2013). The taxonomy building methodology used in these studies includes several design and test cycles, so they can also be considered design-oriented (Hevner et al. 2004).

Below, the research design is detailed, followed by the three research questions as guiding logic. The first research question is addressed in Studies 1 and 2. Study 1 consists of systematic literature research based on the guidelines of Webster and Watson (2002) and the qualitative content analysis of Mayring (2014). The study aims to identify and evaluate the state of research on digital platforms from a complementors perspective. Study 1 has no specific platform context and contains platform instances from different areas. Study 2 intends to fill an important research gap identified in Study 1, namely the lack of research on nascent platform ecosystems. Study 1 applies the proven Delphi methodology of Schmidt (1997) to identify and rank the specific issues that arise in the nascent stages of digital platform ecosystems in the process of value co-creation. Study 1 takes IoT platform ecosystems as a research context.

Research question 2 is answered by Study 3 and 4. Similar to Study 2, Study 3 applies Schmidt's (1997) Delphi methodology to identify the most pressing challenges incumbent companies face in building platform ecosystems. The research context is again IoT platforms, but this time with a focus on established organizations. Study 4 aims to understand better the intra-organizational challenges faced by established organizations when building platform ecosystems. Study 4 applies the case study approach of Yin (2016). The research context is the Bosch Group as a single case with several logical sub-units as units of analysis, i.e., the platform projects started within the Bosch Group. The investigated platform projects are mainly located in the areas of mobility, IoT, and building technologies.

Two studies answer the third research question. Study 5 develops a taxonomy of IoT platforms based on their business models' characteristics and derives IoT platform archetypes with common business model configurations. Study 5 applies the taxonomy building approach of Nickerson et al. (2013). Study 6 recapitulates the contextual condition of fragmentation that significantly shapes the value creation in the IoT platform ecosystem. Study 6 employs a literature review based on Webster and Watson (2002) to identify the previous research priorities on fragmentation. Thereupon, the existing knowledge is probed against the emerging IoT phenomenon. In doing so, the limits of the current scholarly knowledge bases are demonstrated, and a research agenda to overcome the identified shortcomings is proposed.

All six studies are motivated by highly relevant practical issues in the field of digital platforms, established organizations, and the IoT. Against this background, this work attempts to follow the appeal of Corley and Gioia (2011) for research with a strong impact by combining

theoretical contributions with practical relevance. Table 1 summarizes the applied research philosophies and designs in the different studies of this thesis. The expected contributions to theory and practice are discussed in the next section.

| Study | RQ | | | Research Philosophy | | Research Design | | | |
|-------|---|---|---|---------------------|----------|-----------------|-----------------|---------------|---------|
| | 1 | 2 | 3 | Epistemology | Paradigm | Methodology | Data Collection | Data Analysis | Context |
| No 1 | X | | | Positivist | Behaviourally oriented | Literature Review (Webster and Watson 2002) | Structured Literature Sampling | Coding | No specific platform instances |
| No 2 | X | | | Positivist | Behaviourally oriented | Delphi Method (Schmidt 1997) | Three-step Delphi study | Coding | IoT platforms |
| No 3 | | X | | Positivist | Behaviourally oriented | Delphi Method (Schmidt 1997) | Three-step Delphi study | Coding | IoT platforms build by incumbent firms |
| No 4 | | X | | Positivist | Behaviourally oriented | Case Study (Yin 2016) | Interviews, firm documents, secondary data | Coding | Mobility, IoT, Building Technology |
| No 5 | | | X | Positivist | Behaviourally oriented | Taxonomy building (Nickerson et al. 2013) | Literature review, structured desk research | Taxonomy building, cluster analysis | IoT platforms |
| No 6 | | | X | Positivist | Behaviourally oriented | Literature Review (Webster and Watson 2002) | Structured Literature Sampling | Coding | IoT Platforms and general platform instances |

**Table 1: Research Philosophy and Design of the Studies**

## I.4    Anticipated Contributions

This thesis contributes to the question of how incumbents navigate nascent platform ecosystems in the IoT. By answering this question, three contributions are expected for the scholarly field of digital platforms: digital platforms in the nascent stage of maturity, digital platforms built by incumbent organizations, and digital platforms in the context of the IoT. Furthermore, the work aims to provide relevant knowledge for managerial practice (see Table 2).

Digital platforms have become an important research topic due to their significance for contemporary value creation (Cusumano et al. 2019). The most successful companies build in their core on platform-based value creation and utilize millions of contributors (PricewaterhouseCoopers 2020). However, the nascent state of digital platform ecosystems has received little research consideration so far (Tiwana et al. 2010). This is surprising because the early phase of a platform ecosystem is considered the starting point for meaningful design and governance decisions that later impact the trajectory of the platform ecosystems (Dattée et al. 2018; Hannah and Eisenhardt 2018; Wareham et al. 2014). Consequently, the thesis aims to position the nascent maturity stage of digital platforms as an integral analytical unit in the scholarly discourse. For example, Study 1 might be useful to give a general overview of the literature on platform ecosystems from a complementors perspective, and emphasizing the need for an evolutionary perception on platform ecosystems as opposed to a snapshot perspective. Thus, providing a sound understanding of value creation in digital platform ecosystems. Study 2 could be interesting for a better understanding of the specific challenges that arise in nascent platform ecosystems during the process of value co-creation.

Although it appears evident that incumbent companies are different from native digital platform companies, existing research often neglects the organization's specific characteristics when building a digital platform ecosystem (Parker et al. 2017; van Alstyne et al. 2016). This lack of differentiation is particularly constraining for studying platforms in a context such as the IoT, where established companies are taking their first steps into the platform world due to the digitalization of their physical products (Nicolescu et al. 2018; Wortmann and Flüchter 2015). Consequently, this work aims at positioning established organizations as a specific actor in platform ecosystem research. Here, Study 3 might provide a holistic overview of the intra- and inter-organizational challenges that established companies face when building a digital platform ecosystem. Study 4 focuses explicitly on internal challenges for incumbent companies that hinder platform building in established organizations and countermeasures to overcome them.

| | Field | Explanation |
|---|---|---|
| Research | Digital Platform Ecosystems in Nascent Maturity Stages | (1) Overview of the literature on digital platform ecosystems with a focus on the evolutionary perspective. |
| | | (2) In-depth knowledge on the value co-creation challenges occurring in the nascent maturity stage of digital platform ecosystems. |
| | Digital Platform Ecosystems built by Incumbent Firms | (1) Overview of intra- and inter-organizational challenges incumbent organizations face when building platform ecosystems. |
| | | (2) Strategies and best practices to address the key challenges of building platforms within the organizational structures of incumbent companies. |
| | Digital Platform Ecosystems in the IoT | (1) Demonstrating that the platform ecosystem perspective is useful for decomposing cyber-physical value creation processes in the IoT. |
| | | (2) Clarity on what IoT platforms are and what specific contextual conditions prescribe their value co-creation processes. |
| Practice | Incumbent Managers building Digital Platforms | (1) Insights on how established companies can be better prepared to build digital platform ecosystems. |
| | | (2) Raising awareness of the uniqueness of each platform ecosystem in terms of maturity and contextual conditions. |

**Table 2: Summary of Anticipated Contributions**

This research is embedded in the specific context of the IoT. Subsequently, this work aims to contribute to IoT research by emphasizing a platform perspective's suitability to understand better cyber-physical value creation processes (Ng and Wakenshaw 2017). To this end, Study 5 shows that there are different types of IoT platforms that differ in their scope and might therefore contribute to conceptual clarity of the relatively new platform instance. Study 6 could contribute to a better understanding of fragmentation as an important contextual condition prescribing value creation in IoT platform ecosystems (Gasser 2015; Noura et al. 2018).

This work's results are particularly useful for incumbent managers who are starting to build digital platform ecosystems within their existing organizational boundaries. For example, Study 4 provides the common intra-organizational barriers that arise when incumbents begin to build digital platform ecosystems and the appropriate countermeasures to overcome them. Besides, this work highlights that each platform ecosystem is different; i.e., it has a specific maturity stage and is embedded in specific contextual conditions. Study 2 emphasizes the most pressing challenges for the value co-creation of digital platform ecosystems in nascent

maturity stages, while Studies 5 and 6 provide an overview of the relevant contextual conditions that affect value creation in IoT platform ecosystems.

## I.5    Structure of the Thesis

This cumulative dissertation is organized into three parts (see Figure 3). Part A sets the foundation for this work by motivating the research effort and the necessary theoretical background. Part B provides the central part of the thesis and comprises six studies. Part C discusses these studies and concludes the work. Each part is detailed in the following.

**Part A** is divided in two chapters. The Introduction chapter (A.I.) describes the motivation for this research, derives the research gaps, outlines the research context and design to answer them, and anticipates the contributions that will be made. The next chapter (A.II.) presents the necessary theoretical background following the three derived research questions. First, the fundamentals of digital platform ecosystems in their nascent maturity stages are presented, then the managerial challenges of incumbent organizations engaging in digital platform ecosystems, and the contextual setting of the IoT is introduced. Ultimately the three sections are synthesized to a pre-understanding on incumbent organizations navigating nascent platform ecosystems in the IoT.

**Part B** reflects the logic of the three research questions. The first chapter (B.I.) focuses on value creation in nascent platform ecosystems and positions this early stage of platform ecosystems as a vital unit of analysis with particular challenges. Study 1 provides a literature review and shows that the evolutionary perspective on platform ecosystems is significantly under-researched. Study 2 empirically shows that value creation challenges in early-stage platform ecosystems differ from their mature counterparts and require dedicated platform governance mechanisms. The second chapter (B.II.) takes an in-depth look at established organizations building platform ecosystems. Thereby, Study 3 provides a comprehensive overview of the intra- and inter-organizational challenges faced by established organizations in building a platform ecosystem. Study 4 focuses more sharply on the internal barriers faced by established organizations in building platform ecosystems and shows how these barriers can be successfully overcome. Therefore, Study 4 details and expands on Study 3. The third part (B.III.) contributes to the platform ecosystems in the IoT since a large part of the studied nascent platform ecosystems of incumbent firms occurred in this context. Study 5 showed that there is no single type of IoT platform. Instead, the developed taxonomy and derived archetypes show several coexisting IoT platform ecosystems with different business model configurations. Finally, Study 6 deals in-depth with an important contextual condition that limits value creation of IoT platform ecosystems, namely fragmentation. The study conceptualizes fragmentation, identifies previous research priorities and their limitations in the light of the IoT, and proposes a research agenda to better position the IS as a knowledgeable research domain in the contemporary fragmentation discourse. Table 3 provides an overview of the studies included in this thesis.