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Digital Platforms: Sources of Power, Impacts on Consumers and Organizations, and European Platform Competition

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Preface

By finishing this preface, an exciting and challenging time comes to an end. During my dissertation, I was privileged to work with outstanding scholars and practitioners. Various people from work but also from my personal life supported, guided, and endured my endeavor. I am thankful to everyone who joined me on this journey and will attempt to express my gratitude towards a few, although many more deserve my acknowledgment.

My deepest gratitude goes to my doctoral supervisor, Prof. Dr. Helmut Krcmar. This thesis would not have been possible without your support and guidance. We had many discussions during doctoral seminars and conferences that largely contributed to this thesis. You also provided me manifold opportunities for my academic and personal development such as theory and methods workshops, stays abroad, and paper discussion seminars. I am thankful for the lessons you have taught me and for the responsibilities you have given me. Thanks to research projects such as the SFB768 or PersoCo and lectures such as Information Management for Digital Business Models I improved my understanding of digital business models, health information technology, privacy, and digital platforms. All these experiences have shaped my research and were leading the way for this thesis.

I greatly benefitted from my colleagues at the chair who offered their help and insights during brainstorming and paper discussion sessions. I would like to thank especially Dr. Markus Böhm and Dr. Maximilian Schreieck who have both been outstanding supervisors. Both of you helped me identify interesting research topics, offered valuable feedback to my paper drafts, and provided me with the freedom to follow my path. I also would like to thank Andreas, Jörg, Manuel, Tobias, Rob, Timo, Julia, Kai, Barbara, Leonard, David, Mohammad, Martin (the three), Michael, Lukas, Norman, and many more who made this journey fun and fruitful—I was honored working with you. I further would like to express my thanks to the students I was allowed to supervise in their student theses.

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Special thanks also go to my parents for supporting me in all my endeavors and making me the person I have become today. Last, but not least, I am deeply grateful to my girlfriend Sarah. Your encouragement, patience, and unconditional support build the foundation of this thesis.

Munich, 16.04.2021 Sebastian Hermes

Abstract

Problem Statement: The last decade has been marked by the rise of organizations that operate digital platforms and orchestrate autonomous agents in ecosystems. The underlying concept of digital platforms is that they offer a base for complementary innovations which can be developed and offered on the platform by complementors. Digital platforms thereby facilitate transactions among the supply side and the demand side. Although digital platforms create enormous economic surplus for consumers and businesses, they also create winner-take-all outcomes enabling platform owners to gain significant market power which often translates into abuse of power. To address abuse of power in Europe it is vital to understand the sources of power of digital platforms, their impact on consumers and organizations, and to explore how European firms can compete in the platform economy. While knowledge on all three issues exists, it misses (1) the role of national sources and consumer characteristics and biases for platform power, (2) the impact of platforms on the healthcare industry and to systematically understand the impact of platform envelopment, and (3) the strategies that incumbents can employ to transition into the platform economy as well as a European platform regulation strategy.

Research Design: To address these gaps, we first conducted a literature review on digital platforms and market dominance. Based on these results, we conducted a case study to elaborate on the role of historic and national sources for platform power. Then we administrated two surveys to assess the role of consumer characteristics and behaviors for platform power in the context of privacy. We conclude the issue of platform power by evaluating consumers' irrational privacy decision choices in three experiments. Moving to the impact of platforms we conducted a literature review on value creation and destruction between business model innovations such as platform-based business models and stakeholders. These results informed our case study and ecosystem analysis on the impact of digital platforms on the healthcare industry and our taxonomy development of platform envelopment. For the issue of European platform competition, we relied upon a case study on incumbent firms and discussed a European strategy of platform regulation based on our prior findings. The findings of this thesis build on empirical data from 90 interviews, 4.540 survey responses, and 127 files of secondary data.

Results: We first developed an integrative framework that illustrates how platform-level sources and market-level sources are interconnected and how they shape platform power. Second, we identified which national-level sources shaped American platform domination, China's platform self-sufficiency, and Europe's platform gap. Third, we demonstrated that consumers lack general knowledge about information privacy, are largely unaware of specific information privacy practices of diversified platform owners, and make irrational privacy decision choices due to heuristics and biases. Fourth, we built a framework that integrates research on the reciprocal impacts between business model innovations such as platform-based business models and stakeholders. Fifth, we showed that platformization transformed healthcare delivery from acute value delivery to connected, remote, and preventive care delivered through a network of actors including patients themselves. Sixth, our platform envelopment patterns indicate that platform envelopment has positive impacts on the platform owner in terms of conglomerate advantages and that the pattern of radical envelopment is prone

to have anti-competitive effects. Seventh, we revealed that incumbents pursue multiple transition strategies simultaneously and that their strategies range from building and joining a platform over investing in and acquiring a platform to using a white-label platform. Last, we outlined why regulatory intervention is necessary based on technological discontinuities and consumer preferences, and that European regulators need to (1) provide a fertile platform breeding ground, (2) develop ex-ante regulation frameworks, (3) enable collaborations to build European platforms, and (4) inform consumers about the harm of apparently free platforms.

Contribution: First, we contribute to the literature on sources of power of digital platforms by extending market-level sources with the role of consumer characteristics, behaviors, and biases. We also extend this line of research by revealing the role of national sources for platform power. Second, we contribute to the literature on the privacy paradox. We identify that knowledge about data integration and data usage are new areas of information asymmetries and reveal another cause for the privacy paradox: the lack of viable alternatives. Besides, our results show that the privacy paradox is not dichotomous but exhibits varying degrees across consumers. Third, we contribute to the literature on the impacts of digital platforms. We extend research on positive effects by providing evidence from the healthcare industry and revealing that platform envelopment enables platform owners to exploit conglomerate advantages. Regarding the negative effects, our results provide evidence that radical envelopment is prone to have anti-competitive effects. Fourth, we contribute to the literature on incumbents' transition strategies into the platform economy. Our results move beyond the assumption that transition strategies are either-or decisions. We extend prior work by demonstrating that incumbents pursue multiple transition strategies and identify a new transition strategy: the white-label platform strategy. Last, we contribute to the literature on platform regulation by discussing why regulatory intervention is necessary and how European regulators can intervene.

Study Limitations: This thesis has, amongst others, three main limitations: First, the results of the literature reviews are limited regarding the literature search and coding of the articles. Second, our case studies are limited regarding their generalizability and biases during the conduct of interviews. Third, our factor and cluster analyses are limited in the subjective choice of the number of factors and clusters. To counteract some limitations, we implemented measures such as inter-coder reliability, data triangulation, and statistical tests.

Future Research: This thesis suggests five avenues for future research. First, we propose to explore how platform conglomerates and digital conglomerates are organized and how they compete. Second, we encourage future research to conceptualize and evaluate the effect of platform essentiality. Third, we suggest to better understand how consortia can help to gain control over critical platforms. Fourth, we argue to shed more light on the phenomenon of platform cooperatives and democratic governance. Last, we propose to move beyond the role of Information Systems (IS) within and across organizations towards the role of IS for regulating organizations and regulatory practice.

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List of Abbreviations

AIS:	Association for Information Systems
AMCIS :	Americas Conference on Information Systems
AOM:	Academy of Management Annual Meeting
APJIS:	Asia Pacific Journal of Information Systems
BR:	Business Research
CON:	Conference
ECIS:	European Conference on Information Systems
EFI:	Expertenkommission Forschung und Innovation
EM:	Electronic Markets
EU:	European Union
HICSS:	Hawaii International Conference on System Sciences
ICIS:	International Conference on Information Systems
IS:	Information Systems
JNL:	Journal
Lit. Rev.:	Literature Review
NR:	Not Ranked
OLS:	Ordinary Least Squares
P:	Publication
PACIS:	Pacific Asia Conference on Information Systems
Reg. Analysis:	Regression Analysis
RQ:	Research Question
Tax. Dev.:	Taxonomy Development
TRR:	Transactions on Replication Research
UK:	United Kingdom
USA:	United States of America
VHB:	German Academic Association for Business Research
WI:	International Conference on Wirtschaftsinformatik

Part A

1 Introduction

> *"Whereas over 10.000 online platforms operate in Europe's digital economy, most of which are SMEs, a small number of large online platforms capture the biggest share of the overall value generated. […] These gatekeepers [are prone to engage in] unfair behaviour vis-à-vis business users [and can lead] to negative effects on the contestability of the core platform services concerned. […] Addressing these problems is of utmost importance in view of the size of the digital economy […] and the important role of online platforms in digital markets with its societal and economic implications." (European Commission, 2020b, p. 1)*

In its proposal for the Digital Markets Act, the European Commission (2020b) recognizes that some digital platforms have developed into critical gatekeepers that hold significant market power and increasingly abuse their power. In this dissertation, we aim to contribute to this discussion by revealing the sources of power of digital platforms, their impact on consumers and organizations, and a European way forward to compete in the platform economy.

1.1 Motivation

The last decade has been marked by the rise of businesses that operate digital platforms and orchestrate autonomous agents in ecosystems (Evans & Gawer, 2016). The largest platform owners - Apple, Microsoft, Alphabet, Amazon, and Facebook – made up 17.5% of the S&P 500 in 2020 (Levy & Konish, 2020) illustrating the increasing importance of platform-based business models.

Digital platforms are operating in various markets such as online marketplaces, mobility services, social networks, and operating systems, and transformed the way consumers search for information, communicate, shop, travel, and even date (Parker et al., 2016). They also transformed the way businesses distribute products, find human capital, collect data and store data, and even impacted governments and politics. In the process, digital platforms created enormous economic surplus for consumers and businesses ranging from increased consumer choice and improved efficiency to enhanced participation in society (Cusumano et al., 2019).

The underlying concept of digital platforms is that the platform offers a base for complementary innovations that can be developed and offered on the platform by complementors (Cennamo, 2019; Tiwana, 2014). The platform owner, the digital platform, its users, and its complementors thereby form a digital platform ecosystem that is orchestrated by the platform owner (Kapoor et al., 2021; Kretschmer et al., 2021). Typical for digital platforms is that they do not own or create most of the products and services that are exchanged on them. In contrast, they facilitate transactions among the supply side and the demand side creating a two- or multi-sided market (Rysman, 2009). For instance, Apple does not produce or own every single application that is developed on its mobile operating system and offered through its application marketplace – the products and services are primarily created outside of the firm's boundaries (Gawer, 2020; Parker et al., 2017). By taking an intermediary role, digital platforms can trigger network effects. Network effects describe that the value for one side (e.g. app users) of the platform

increases as the number of users on the other side increases (e.g. apps or app developers) (Schilling, 2002).

As a result, platform markets are likely to tip and create markets with winner-take-all outcomes (Lee et al., 2006) where the largest platform is assumed to win the entire market. These dynamics allow large platform owners to gain significant market power. Although holding market power is not per se anti-competitive, it often translates into abuse of power. For example, Google has been penalized for tying its comparison-shopping service to its dominant search engine and demoting rivals in search results (European Commission, 2017) as well as for abusing its Mobile Applications Distribution Agreement for enveloping mobile search through its mobile operating system Android (European Commission, 2018).

Although the academic discourse has provided valuable insights into sources of power of digital platforms (Cennamo, 2019; Suarez, 2004), their impact on businesses and consumers (e.g. Foerderer et al., 2018; Hein, Schreieck, et al., 2019; Meyer & Cennamo, 2018), and how incumbent firms[1] can transition into the platform economy (e.g. Sebastian et al., 2017; Svahn et al., 2017; Zhang et al., 2018), we identified three gaps that we aim to address with this thesis.

First, sources of power of digital platforms have been primarily studied in isolation. Most studies examine individual sources such as network effects (Katz & Shapiro, 1994), exclusive licensing agreements (Hermalin & Katz, 2013), platform openness (Ondrus et al., 2015), platform envelopment (Eisenmann et al., 2011), or entry timing (Cennamo, 2018). Synthesizing prior work and developing a framework that considers the interplay of the individual sources can deepen our understanding of how digital platforms gain market power. Moreover, extant literature largely examines sources of power at the platform- and market-level (Suarez, 2004). While market-level sources cover multiple aspects such as regulations, network effects, or technological trajectories, it remains opaque how consumer characteristics, behaviors, and biases contribute to platform power. Especially consumer privacy is a fruitful context to extend our understanding of market-level sources of power. As digital platforms are fueled by consumer data, consumers' privacy decision-making, privacy concerns, and knowledge about privacy practices can influence how and to which extend digital platforms capture, accumulated, and use data and thus, shape the power of digital platforms. Largely absent from the discourse of power is also the role of historic and national sources. However, American platforms are dominating the European platform economy in various markets such as search engines, cloud services, operating systems, and social networks (European Commission, 2020b). In contrast, China has largely escaped American domination and formed a self-sufficient platform economy (Evans & Gawer, 2016). Consequently, exploring historic and national sources can contribute additional insights into the sources of power of digital platforms.

Second, the impact of digital platforms and platform-based strategies on business and consumers has largely been studied by investigating the impact on various actor groups and the impact of different actor groups on platform-based business models. For instance, how digital

[1] By incumbent firms we refer to traditional firms with a linear value chain strategy that typically emerged before the Internet age and are therefore to be differentiate from digital-native firms. Related terms that describe the same phenomenon are "big old companies" (Sebastian et al., 2017) and "established companies" (Schreieck & Wiesche, 2017).

platforms impact consumers (Ghezzi et al., 2015) and how consumers impact platform-based business models (Hienerth et al., 2011; Kohler, 2015). However, a synthesis of the reciprocal relationship and a contextualized of platform-based business models within the broader concept of business model innovation has yet not been conducted. Thus, synthesizing prior work into an integrative framework and outlining the reciprocal relationship between business model innovations such as platform-based business models and different actor groups can build a theoretical base for future empirical work. Moreover, prior work has studied various industries such as operating systems (Parker et al., 2017), social media, (Li & Agarwal, 2016), e-commerce (Zhu & Liu, 2018), and the sharing and gig economy (Edelman & Geradin, 2016) and thereby applied a firm- or platform-level perspective. However, the healthcare industry has received little attention and, despite notable exceptions (Basole, 2009; Riasanow et al., 2018; Riasanow et al., 2017), understanding the impact of digital platforms from an industry-level perspective remains also opaque. Hence, applying ecosystem analysis to understand how digital platforms impact the healthcare industry provides valuable insights into a new level of analysis and addresses the proposed research question of de Reuver et al. (2017, p. 130) *"How do digital platforms transform industries?"* Lastly, research on the strategy of platform envelopment overwhelmingly examines the impact of either inter-platform envelopment (Eisenmann et al., 2011; Li & Agarwal, 2016) or intra-platform envelopment (Foerderer et al., 2018; Kang, 2017). However, research that investigates both simultaneously, characterizes them systematically, and explores the role of core platforms to interfere with rivals remains scarce. Developing a taxonomy for platform envelopment and assessing different impacts of different envelopment practices in parallel can contribute to better understanding the impact of digital platforms and platform-based strategies.

Third, research on the transition of incumbents into the platform economy primarily focuses on how incumbents build a platform or join an existing platform (Schreieck et al., 2019; Schreieck & Wiesche, 2017; Sebastian et al., 2017; Svahn et al., 2017; Weiss et al., 2020). This is illustrated by the call for research of de Reuver et al. (2017, p. 131) that *"if not developed internally, what types of digital platforms do incumbents adopt?"* At the same time research largely assumes that transition strategies are an either-or decision. For instance, that an incumbent can either build or join a platform. As a result, it is yet not well understood how incumbents employ other transition strategies such as investing in platforms (Zhang et al., 2018), acquiring platforms, and establishing collaborative platforms (Schreieck et al., 2019; Weiss et al., 2020). It remains also opaque how incumbents pursue multiple transition strategies. Addressing both research gaps can provide valuable knowledge on how incumbents can transition and compete in the platform economy.

1.2 Research Questions

The overall goal of this thesis is to improve our understanding of the sources of power of digital platforms, their impact on consumers and organizations, and a European way forward to compete in the platform economy. In particular, it is of economic, societal, and regulatory importance to (1) move beyond platform-level sources of power (Cennamo, 2019) and to better understand market-level (Suarez, 2004) and national-level sources of power, (2) assess the two-sided impact of digital platforms and how they transform industries (de Reuver et al., 2017),

and (3) investigate strategies for incumbents to transition into the platform economy (Sebastian et al., 2017) and whether and in which form regulatory intervention is needed. The thesis combines literature on digital platforms as well as qualitative and quantitative data[2], and answers the following three research questions:

RQ1: *What are the sources of power of digital platforms?*

Since prior research on the sources of power of digital platforms has focused on sources in isolation and overwhelmingly studied platform-level and market-level sources, this research question entails three aspects. First, we begin with a systematic literature review to uncover how individual sources are interconnected and how they shape platform power. Second, we conduct three quantitative studies on consumer characteristics and behaviors in the context of privacy to contribute a consumer privacy perspective to market-level sources of power. Third, we qualitatively explore reasons for American platform domination, China's platform self-sufficiency, and Europe's platform gap to understand national and historical sources of power.

RQ2: *How do digital platforms affect consumers and organizations?*

Having outlined the sources of power of digital platforms, the second research question aims to understand how digital platforms and platform-based strategies affect consumers and organizations. To this end, we first conduct a systematic literature review on the reciprocal impacts between business model innovations, such as platform-based business models, and stakeholders. We then build a taxonomy of platform envelopment to study the impacts of that strategy and finally, move to an industry perspective and investigate the impact of platformization in the healthcare industry.

RQ3: *How can European firms compete in the platform economy?*

The third research question has two objectives. The primary objective is to move beyond the current debate of whether incumbents should either build or join a platform. In a case study on incumbents, we aim to better understand how they employ multiple transition strategies and to uncover new strategies such as investing in platforms, acquiring platforms, establishing collaborative platforms, and using white-label platforms. The secondary objective is motivated by the platform gap in Europe (Evans & Gawer, 2016) and aims to bundle the results of each research question to discuss an alternative way how European firms can compete in the platform economy: platform regulation[3]. Hence, research question three incorporates two sides of one coin. In order to understand how European firms can compete in the platform economy, we investigate how they can compete on their own and how regulating digital platforms can level the playing field.

[2] A summary of all the data used in the embedded publications can be found in Appendix A: Supplementary Material, Data Material.

[3] We added this objective to research question three as a large part of the embedded publications discuss platform regulation and thus, are part of the research findings of this thesis. However, since platform regulation is not their primary objective we added a synthesis of the different regulatory discussions to the discussion of this thesis (see part C: Part 2.2 and 2.3).

1.3 Structure

The thesis comprises three parts (see Figure 1). Part A begins with an introduction that motivates the topic of digital platforms, outlines the problem statement based on the research questions, and presents the structure of the thesis (see part A: Chapter 1). Next, we introduce the conceptual backgrounds of digital platforms, digital platform ecosystems, sources of power of digital platforms, the two-sided impact of digital platforms and platform-based strategies, and transition strategies of incumbents into the platform economy (see part A: Chapter 2). Part A ends with the research design consisting of a pragmatic, mixed-method research strategy and the employed methods (see part A: Chapter 3).

In part B, we provide an overview of the nine published and peer-reviewed publications (P) along the three research questions. The nine publications are presented in Appendix B in their original format. In the first publication (P1), we begin by reviewing and structuring the literature on digital platforms and market dominance (see part B: Chapter 1). In the second, third, and fourth publications, we empirically examine the context of privacy and identify the role of consumer privacy knowledge (P2 and P3) and consumer privacy decision-making (P4) as important market-level sources shaping the power of digital platforms (see part B: Chapter 2-4). In the fifth publication (P5), we investigate how historic circumstances and national environments contributed to digital platforms gaining market power (see part B: Chapter 5). In the sixth publication (P6), we review the literature on business model innovations, such as platform-based business models, and stakeholders, and identify value-creating and value-destructing mechanisms and outcomes between both (see part B: Chapter 6). In the seventh and eighth publications, we empirically investigate how digital platforms affect consumers and organizations in the healthcare industry (P7) and how it affects organizations when platform owners engage in platform envelopment (P8) (see part B: Chapter 7-8). In the ninth and last publication (P9), we explore which platform strategies incumbents employ to transition into the platform economy (see part B: Chapter 9).

Part C first summarizes the results of the nine publications embedded in the thesis (see part C: Chapter 1). Second, we discuss the findings of the publications (see part C: Chapter 2). Third, we describe implications for research and practice (see part C: Chapter 3). Fourth, we present the limitations of the thesis (see part C: Chapter 4). Fifth, we outline avenues for future research (see part C: Chapter 5). Finally, we conclude the thesis (see part C: Chapter 6).

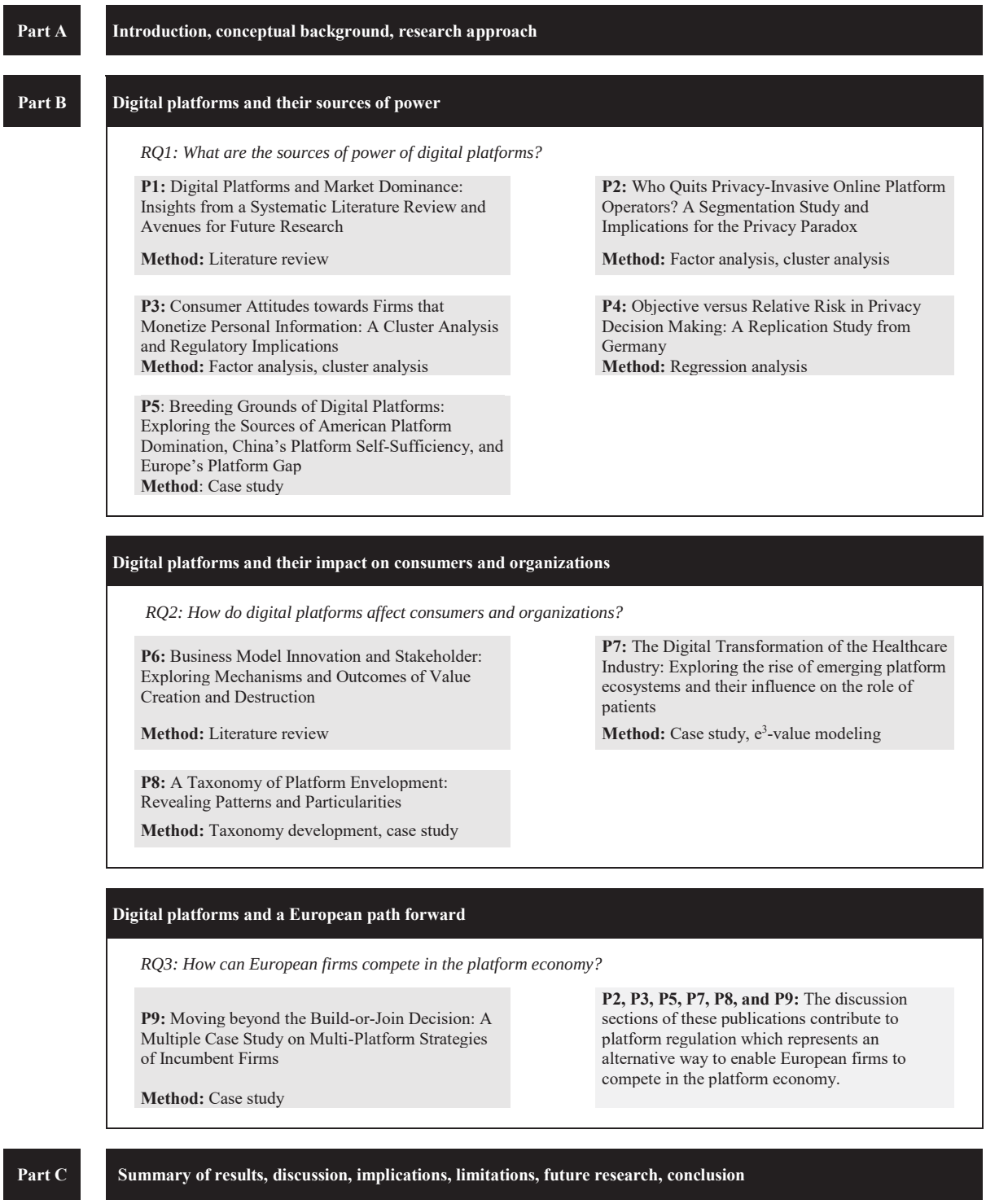

Figure 1. Structure of the Dissertation

In the following paragraphs, we summarize the nine publications that are embedded in part B (see Table 1). For each publication, we briefly outline the research problem, the methodological approach, and the main contributions.

Table 1. Overview of Embedded Publications

RQ	No.	Authors	Title	Outlet	Type
RQ1	P1	Hermes, Pfab, Hein, Weking, Böhm, Krcmar	Digital Platforms and Market Dominance: Insights from a Systematic Literature Review and Avenues for Future Research	PACIS* 2020	CON (VHB: C)
	P2	Hermes, Sutanrikulu, Schreieck, Krcmar	Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study and Implications for the Privacy Paradox	HICSS* 2021	CON (VHB: C)
	P3	Hermes, Clemons, Wittenzellner, Hein, Böhm, Krcmar	Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications	PACIS* 2020	CON (VHB: C)
	P4	Hermes, Hillebrand, Bauer, Böhm, Krcmar,	Objective versus relative risk in privacy decision making - A Replication Study from Germany	AIS TRR* 2020	JNL (VHB: NR)
	P5	Hermes, Clemons, Schreieck, Pfab, Mitre, Böhm, Wiesche, Krcmar	Breeding Grounds of Digital Platforms: Exploring the Sources of American Platform Domination, China's Platform Self-Sufficiency, and Europe's Platform Gap	ECIS* 2020	CON (VHB: B)
RQ2	P6	Hermes, Böhm, Krcmar	Business Model Innovation and Stakeholder: Exploring Mechanisms and Outcomes of Value Creation and Destruction	WI* 2019	CON (VHB: C)
	P7	Hermes, Riasanow, Clemons, Böhm, Krcmar	The Digital Transformation of the Healthcare Industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients	BR* 2020	JNL (VHB: B)
	P8	Hermes, Kaufmann-Ludwig, Schreieck, Weking, Böhm	A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities	AMCIS* 2020	CON (VHB: D)
RQ3	P9	Hermes, Guhl, Schreieck, Weking, Krcmar	Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms	HICSS* 2021	CON (VHB: C)

Outlet:
PACIS: Pacific Asia Conference on Information Systems
ECIS: European Conference on Information Systems
HICSS: Hawaii International Conference on System Sciences
AIS TRR: AIS Transactions on Replication Research
WI: International Conference on Wirtschaftsinformatik
BR: Business Research
AMCIS: Americas Conference on Information Systems
*All publications are published and peer-reviewed.

Type:
CON: Conference
JNL: Journal
VHB: German Academic Association for Business Research
NR: Not ranked

P1: Digital Platforms and Market Dominance: Insights from a Systematic Literature Review and Avenues for Future Research. The first publication (Hermes, Pfab, et al., 2020) provides an overview of the literature on how digital platforms attain market dominance. Although the body of knowledge on digital platforms is rich, prior work has largely examined specific aspects of digital platforms such as network effects, two-sided pricing, or platform openness. As a result, it remains unclear how these aspects are related to one another and how they contribute to digital platforms attaining market dominance. Therefore, we conducted a systematic literature review and developed a framework that illustrates the interrelations

between market-level sources (e.g. network effects) and platform-level sources (e.g. openness) as well as how platform-level sources affect different dimensions of market dominance. The framework makes two contributions. First, it synthesizes the literature and conceptualizes platform dominance which supports platform owners to attain it, helps competitors to cope with it, and assists policy-makers to regulate it. Second, it provides the base for a future research agenda that outlines three avenues: (a) the role of national sources in attaining dominance, (b) sources enabling platforms to sustain dominance, and (c) strategies to dethrone dominant platforms.

P2: Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study and Implications for the Privacy Paradox. The second publication (Hermes, Sutanrikulu, et al., 2021) addresses market-level sources of platform power by investigating consumers in the context of privacy. While research identified that information asymmetries play a critical role in explaining the privacy paradox, it has neglected to examine the characteristics of consumers caught in the privacy paradox and new areas of information asymmetries such as consumer privacy knowledge. To this end, the study reports on the findings of a cluster analysis that has been conducted based on a representative survey of Google and its services across five countries. The results indicate three clusters and that the privacy paradox is only dominant in two of them. Consumers of these clusters lack knowledge about data integration and data usage in contrast to data collection. Privacy information asymmetries, therefore, represent a critical market-level source of platform power. The study makes three contributions. First, the privacy paradox is primarily influenced by variations in actual behavior and less by variations in privacy concerns. Second, the privacy paradox is therefore not a binary concept but a concept exhibiting varying degrees. Third, the identification that consumer privacy knowledge represents a new area of information asymmetries that contributes to the explanation of the privacy paradox.

P3: Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications. The third publication (Hermes, Clemons, Wittenzellner, et al., 2020) also investigates market-level sources of platform power by studying consumers in the context of privacy. The motivation of the study is to support policy-makers in the design of new regulatory frameworks for online privacy. In contrast to P2, the present study assesses consumers' implicit informed consent (knowing of and approving privacy-related business practices) and their willingness to switch and to pay for sage alternatives. The study builds on a representative survey about Google's practices distributed to consumers in Denmark, France, Germany, the United Kingdom (UK), and the United States of America (USA). The descriptive results demonstrate low levels of informed consent across a variety of privacy-related practices. The cluster analysis confirms the privacy paradox in four out of five clusters and indicates three reasons why consumers do not use safe alternatives although they reported to prefer them. The study draws in the theory of newly vulnerable markets to discuss market entry feasibility and regulatory implications. Contributing to the privacy paradox literature, the study shows that the privacy paradox arises because some consumers cannot identify a viable alternative, whereas others lack knowledge about privacy-related business practices.

P4: Objective versus Relative Risk in Privacy Decision Making: A Replication Study from Germany. The fourth publication (Hermes, Hillebrand, et al., 2020) moves beyond consumer privacy knowledge (P2 and P3) and examines consumer privacy decision-making as an additional market-level source of platform power. Understanding consumer privacy decision-making has become an important topic since digital platforms need consumer information to personalize and promote their services, whereas policy-makers aim to reduce consumer harm resulting from privacy violations. However, previous research has investigated either rational or irrational decision-making as antecedents for variations in privacy choices but not the effect of examining both decision-making contexts simultaneously. The only exception is the work of Adjerid et al. (2018). Consequently, the present study reports on the findings from a methodological replication of Adjerid et al. (2018) wherein the theories, methods, and hypotheses have not been altered. In three experiments, the study demonstrates that rational and irrational decision-making influence hypothetical but not actual choice. The findings confirm the original study regarding rational decision-making but contradict it regarding irrational decision-making. The proposed reason for the contradiction is that true responses from privacy-sensitive individuals are not elicitable in the actual choice. Nevertheless, platform owners are able to leverage consumers' irrational privacy decision-making to their advantage.

P5: Breeding Grounds of Digital Platforms: Exploring the Sources of American Platform Domination, China's Platform Self-Sufficiency, and Europe's Platform Gap. The fifth publication (Hermes, Clemons, Schreieck, et al., 2020) follows the future research avenue proposed in P1 of investigating national and historic sources that contributed to digital platforms attaining dominance. Since American platforms largely dominate consumer-oriented markets in the European Union (EU) and China escaped that dominance by creating a self-sufficient platform economy, the three nations represent different platform breeding grounds. This context thereby offers a fruitful opportunity to derive national-level sources that contributed to platform dominance, platform self-sufficiency, and platform lack. The study draws on 32 expert interviews with European executives from seven European countries and 19 industries. The results emphasize general sources for American platform domination, China's platform self-sufficiency, and Europe's platform gap, specific sources for American platform domination and Europe's platform gap, and specific sources for China's platform self-sufficiency. The study contributes to digital platform research by moving beyond platform-level and market-level sources of platform power, by confirming and extending the small set of work on national-level sources of platform power, and by discussing a regulatory strategy that establishes a self-sufficient European platform economy.

P6: Business Model Innovation and Stakeholder: Exploring Mechanisms and Outcomes of Value Creation and Destruction. The sixth publication (Hermes et al., 2019) addresses value-creating and value-destructing mechanisms and outcomes between business model innovation and stakeholders. Despite the influence stakeholders can exercise on an organization's business model and vice versa, limited attention has been given to simultaneously understanding the reciprocal relationship between business model innovation and stakeholders. To achieve this goal, we conduct a systematic literature review and develop a framework that maps extant literature on three dimensions: (1) business model innovation and value creation, (2) stakeholder intervention and value creation, and (3) stakeholder intervention

and value destruction. The framework makes two contributions. First, it synthesizes the literature and conceptualizes the reciprocal relationship between business model innovation and stakeholders. Second, it provides the baseline for a future research agenda comprising two avenues: (1) designing business model innovation from an ecosystem perspective and (2) exploring value destruction of business model innovation.

P7: The Digital Transformation of the Healthcare Industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients. The seventh publication (Hermes, Riasanow, et al., 2020) examines the digital transformation and platformization within the healthcare industry. The motivation is two-fold. On the one hand, research has neglected to adopt an inter-organizational perspective to understand the digital transformation of healthcare. On the other hand, although the change to digital platform ecosystems has been adopted among various industries, research and industry adoption have lagged in the healthcare industry. To address these gaps, the study examines the digital transformation of the healthcare industry by analyzing 1830 healthcare organizations found on Crunchbase. We derived a generic value ecosystem of the traditional and the digital healthcare industry and validated our findings with industry experts. The results indicate eight new roles within the digital healthcare industry and their role in transforming the industry's value proposition, value capture, and value delivery. The theoretical contribution is three-fold. First, to the literature on digital transformation by advancing an inter-organizational perspective. Second, to digital platform research by providing empirical evidence on how digital platforms disrupted linear value chains within the healthcare industry and on what platform types have been adopted by emerging organizations. Third, to the literature on value co-creation in platforms by demonstrating how patients evolved into co-creators of healthcare value.

P8: A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities. The eighth publication (Hermes, Kaufmann-Ludwig, et al., 2020) examines the phenomenon of platform envelopment. While the traditional view of platform envelopment helps to explain competition between competing platforms, it does not account for recent platform envelopment practices that have emerged in research and practice. To capture the variety of platform envelopment practices and systematically identify their distinct characteristics, we have developed a taxonomy based on 20 platform envelopment cases. By encoding these cases into the taxonomy, we derived platform envelopment patterns and particularities which also revealed positive and negative effects of digital platforms. Our work contributes to research on digital platforms by extending the original theory on platform envelopment by incorporating the view of intra-platform envelopment and the relationships between core platforms and new platforms, and between core platforms and target platforms. Our taxonomy enables regulators to identify cases that might be prone to anti-competitive behavior and supports envelopers to develop strategies regarding envelopment trade-offs and associated risks.

P9: Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms. The ninth publication (Hermes, Guhl, et al., 2021) explores how incumbent organizations from traditional industries enter the platform economy. Although research has largely explored how digital-native companies leverage digital platforms, only a small set of research has examined how incumbent organizations transition into the platform

economy. However, this stream of research assumes that incumbent organizations are exclusively pursuing a build or join strategy. To shed more light on incumbents' platform strategies, we conducted a multiple case study on three incumbents from the Chemistry, Construction, and Banking industry. Our results contribute to research on digital platforms in three ways. First, incumbents pursue multiple platform strategies simultaneously and do not pursue them exclusively one after another. Second, platform strategies range from building and joining a platform over investing in and acquiring a platform to using white-label platforms. Third, we provide initial evidence that industry characteristics such as asset-heavy and asset-light industries shape which platform strategies incumbents employ.

In addition to the nine publications embedded in this thesis, we wrote further publications that are related to the three research questions (see Table 2). These publications complement the results of the embedded publications and were largely driven by co-authors. Related to research question (RQ) 1, we investigated the role of affordances and generativity for digital platform leadership (Hein, Setzke, et al., 2019), the concept of multi-platform strategy (Moritz et al., 2021), the characteristics of consumers, producers, and prosumers on sharing platforms and their role for value co-creation (Hermes, Maier, et al., 2020), and the success of start-ups such as platform-based startups in Germany (Böhm et al., 2019; Ritter et al., 2021).

Related to RQ2, we examine the impact of American platform domination on European firms (Clemons et al., 2019), the impact of platform-based business models on stakeholder integration (Weking et al., 2020), the impact of cloud platforms on the digital transformation of platform ecosystems (Riasanow et al., 2021), and the impact of Internet-of-Things platforms on product-service-systems (Basirati, Weking, Hermes, et al., 2019; Basirati, Weking, Hermesc, et al., 2019).

Related to RQ3, we propose regulatory solutions for the dark sides of digital platforms (Clemons et al., 2021), investigate the approach of European platform consortia to collaboratively gain control over critical platforms (Hermes, Töller, et al., 2020), study the challenges and success potentials of platform cooperatives (Philipp et al., 2021), and identify blockchain as a technology that can replace powerful platform owners with a democratized network of nodes (Weking et al., 2019).

Although the additional publications provide complementary results to the three research questions, we selected the publications embedded in this thesis (P1-P9) as the key publications of this thesis.

Table 2. Overview of Additional Publications

RQ	Authors	Title	Outlet	Type
RQ1	Hein, Setzke, Hermes, Weking	The Influence of Digital Affordances and Generativity on Digital Platform Leadership	ICIS* 2019	CON (VHB: A)
	Klimmek, Hermes, Schreieck, Krcmar	Modeling a Multi-Platform Strategy: A Case Study of Google	PACIS* 2021	CON (VHB: C)
	Hermes, Maier, Hein, Böhm, Krcmar	User Roles on Peer-to-Peer Sharing Platforms: A Critical Review of the Literature and Recommended Remedies	HICSS* 2020	CON (VHB: C)
	Böhm, Hein, Hermes, Lurz, Poszler, Ritter, Soto Setzke, Weking, Welpe, Krcmar	Die Rolle von Startups im Innovationssystem. Eine qualitativ-empirische Untersuchung. Studien zum deutschen Innovationssystem	EFI 2019	Report (VHB: NR)
	Ritter, Treffers, Hein, Weking, Hermes, Böhm, Krcmar	Towards a Strategy for Resource Mobilization to Generate High Funding during New Venture Creation	AOM* 2021	CON (VHB: NR)
RQ2	Clemons, Krcmar, Hermes, Choi	American Domination of the Net: A Preliminary Ethnographic Exploration of Causes, Economic Implications for Europe, and Future Prospects	HICSS* 2019	CON (VHB: C)
	Weking, Lupberger, Hermes, Hein, Böhm, Krcmar	Practices for Open Business Model Innovation – An Innomediaries Perspective	WI* 2020	CON (VHB: C)
	Riasanow, Jäntgen, Hermes, Böhm, Krcmar	Core, intertwined, and ecosystem-specific clusters in platform ecosystems: analyzing similarities in the digital transformation of the automotive, blockchain, financial, insurance and IIoT industry	EM* 2020	JNL (VHB: B)
	Basirati, Weking, Hermes, Böhm, Krcmar	IoT as PSS Enabler: Exploring Opportunities for Conceptualization and Implementation	PACIS* 2019	CON (VHB: C)
	Basirati, Weking, Hermes, Böhm, Krcmar	Exploring Opportunities of IoT for Product–Service System Conceptualization and Implementation	APJIS* 2019	JNL (VHB: NR)
RQ3	Philipp, Hermes, Schreieck, Böhm	Challenges and Success Potentials of Platform Cooperatives: Insights from a Multiple Case Study	ECIS* 2021	CON (VHB: B)
	Clemons, Waran, Li, Hermes, Schreieck	Computing and Social Welfare: Minimizing the Societal Harm From Digital Transformation While Preserving the Benefits of Innovation	HICSS* 2021	CON (VHB: C)
	Hermes, Töller, Hein, Weking	Gaining Control over Critical Platforms: A Comparative Case Study of European Consortia	ECIS* 2020	CON (VHB: B)
	Weking, Mandalenakis, Hein, Hermes, Böhm, Krcmar	The Impact of Blockchain Technology on Business Models – A Taxonomy and Archetypal Patterns	EM* 2019	JNL (VHB: B)

Outlet:
APJIS: Asia Pacific Journal of Information Systems
ECIS: European Conference on Information Systems
EFI: Expertenkommission Forschung und Innovation
EM: Electronic Markets
HICSS: Hawaii International Conference on System Sciences
ICIS: International Conference on Information Systems
AOM: Academy of Management Annual Meeting
PACIS: Pacific Asia Conference on Information Systems
WI: International Tagung Wirtschaftsinformatik

Type:
CON: Conference
JNL: Journal
NR: Non-ranked
VHB: German Academic Association for Business Research

*All publications are published and peer-reviewed.

2 Conceptual Background

In this section, we clarify the theoretical concepts that we draw on in this thesis. We first explain the concepts of digital platforms and digital platform ecosystems. Then, we synthesize extant research on the sources of power of digital platforms, the impact of digital platforms and platform-based strategies, and incumbents' strategies to transition into the platform economy.

2.1 Digital Platforms

Although different perspectives of digital platforms exist across disciplines, the consensus is that digital platforms provide the basis for complementary products and services that can be developed and offered on the platform by third parties (Cennamo, 2019; Gawer, 2014; Parker et al., 2016; Tiwana, 2014). For example, Apple iOS, YouTube, and Sony PlayStation all form the basis for complementary products and services such as mobile apps, videos, and video games. To capture the heterogeneity among digital platforms and bridge different scholarly perspectives, we define digital platforms *"as a set of digital resources—including services and content—that enable value-creating interactions between external producers and consumers"* (Constantinides et al., 2018, p. 381).

To further frame the scope of digital platforms we differentiate them from digital infrastructure and linear value chains. Digital infrastructures refer to *"the computing and network resources that allow multiple stakeholders to orchestrate their service and content needs"* (Constantinides et al., 2018, p. 381) and support the creation of digital platforms. In other words, digital platforms run on top of digital infrastructure. Examples of digital infrastructure are the internet, data centers, communication protocols, and consumer devices (Constantinides et al., 2018).

Linear value chains refer to *"step-by-step arrangement[s] for creating and transferring value, with producers at one end and consumers at the other"* (Parker et al., 2016, p. 11). These chains describe the process of firms first designing, then producing, and lastly offering their products and services to customers who end the process by buying the product or service (Parker et al., 2016). In contrast, digital platforms engage in value co-creation with complementors (Ceccagnoli et al., 2011; Vargo et al., 2008). The final product or service is created outside of the firm's boundaries (Parker et al., 2017). For instance, accommodation sharing platforms such as Airbnb do not own the apartments that they rent, the apartments are owned and offered by complementors. In contrast, hotels such as Marriott own accommodation space and offer it themselves without relying on complementors. Similar, Apple does not produce every application that is available in its AppStore, it orchestrates complementors to co-create applications in conjunction.

Having outlined an overarching definition and the conceptual scope of digital platforms, we dive into the market-based and technological perspective of digital platforms to describe their key characteristics. The market-based perspective originates in the industrial organization economics literature views digital platforms as two- or multi-sided markets that facilitate transactions between different market sides such as buyers and sellers (Rochet & Tirole, 2003; Rysman, 2009). Central to this perspective is the concept of network effects (Gawer, 2014).

Network effects can either be direct and indirect. Direct network effects refer to the phenomenon that a user's value of a platform increases the more other users join the platform. For example, the more users join a social network such as Facebook the more valuable it is to other users. As the benefit arises among the same type of users, direct network effects are also called same-side network effects. In contrast, indirect network effects describe that one side's value of joining a platform is dependent upon the size of the other side of the platform (Armstrong, 2006; Katz & Shapiro, 1994). Such indirect network effects occur on digital platforms such as ride-sharing platforms or application stores. Both need to attract consumers and complementors (drivers and app developers). Each new driver and each new application increase the value of the platform from a consumer point of view, and each new consumer increases the value of the platform from a driver and developer point of view. Indirect network effects are therefore also called cross-side network effects. To achieve network effects, the market-based perspective emphasizes the chicken-and-egg problem which platform owners must solve, usually by cross-subsidizing between market sides (Parker & Van Alstyne, 2005). Although this perspective explains that platforms create value by coordinating different market sides, it suffers from two limitations (Gawer, 2014). On the one side, platforms are considered a black box and their capability to evolve is not incorporated into economic models. On the other side, both market sides are treated as equal and their relationships with the platform owner are not differentiated.

Against this backdrop, the technological perspective views digital platforms as enablers and facilitators of complementary innovation (Baldwin & Woodard, 2008; Gawer, 2014). The perspective has its roots in the engineering and product development literature. This stream introduced the concept of product platforms and argues that a modular product architecture can help firms to create product families and to innovate more rapidly by leveraging common assets (Gawer & Cusumano, 2014; Ulrich, 1995). In the words of Wheelwright and Clark (1992, p. 5) platforms are products that *"meet the needs of a core group of customers [and are designed] for easy modification into derivatives through the addition, substitution, or removal of features."* Shifting this concept to the realm of software, Tiwana et al. (2010, p. 675) defines software-based platforms as *"the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the interfaces through which they interoperate."* An example of a software-based platform is Android, Google's mobile operating system. The operating system enables various applications (modules) such as music streaming or navigation to run on top of it and specifies design rules (interfaces) such as application programming interfaces that describe how the platform and modules interoperate and exchange data (Tiwana et al., 2010). Core tenants of software-based platforms are platform architecture, platform governance, and platform openness. Platform architecture describes that the core platform is stable and exhibits low variety and high reusability, whereas modules are of high variety and low reusability. Based on the principles of decomposition, modularity, and design rules, the platform owner can minimize interdependence among modules, reduce ripple effects, and ensure interoperability (Tiwana et al., 2010). Apart from technical considerations, the platform owner can employ governance mechanisms to influence the evolution of the platform. Platform governance describes who can make what decisions about the platform and comprises the partitioning of decision rights, formal and informal control mechanisms, and the ownership status (Constantinides et al., 2018; Schreieck et al., 2016). For platform owners, it is

important to create a fit between platform architecture and platform governance as their interaction can reinforce or diminish the effect of the other (Tiwana et al., 2010). Lastly, platform owners need to consider the degree of openness of their platforms. According to Eisenmann et al. (2009, p. 1 in Chapter VI) *"a platform is "open" to the extent that: 1) no restrictions are placed on participation in its development, commercialization or use; or 2) any restrictions—for example, requirements to conform with technical standards or pay licensing fees—are reasonable and non-discriminatory […]."* Hence, a platform can be open on the provider-, technology-, and user-level and influences how it evolves (Ondrus et al., 2015).

To conclude, key characteristics of digital platforms are the exploitation of network effects by mediating transactions between platform constituents and enabling complementary innovation by sharing common components.

2.2 Digital Platform Ecosystems

Digital platform ecosystems emerge around digital platforms. We define an ecosystem as a *"set of actors with varying degrees of multilateral, non-generic complementarities that are not fully hierarchically controlled"* (Jacobides et al., 2018, p. 2264) and a platform ecosystem as *"a collective of organizations having a common interest in the prosperity of a digital platform for leveraging their application development"* (Ghazawneh & Henfridsson, 2015, p. 200). A platform ecosystem, therefore, captures a socio-technical perspective in which not only a digital platform and complementary innovations are considered to constitute an ecosystem (Tiwana et al., 2010), but also developers, users, platform owners, and other stakeholders (Kapoor et al., 2021). Both the technological artifacts and the social entities represent a platform ecosystem and shape the evolution and success of the digital platform.

The concept of platform ecosystems builds on prior work on business ecosystems and innovation ecosystems. In the following, we synthesize both streams and describe the key characteristics of platform ecosystems. Business ecosystems refer to situations in which *"companies co-evolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations"* (Moore, 1993, p. 76). Hence, companies of a business ecosystem are loosely interconnected, dependent upon each other to succeed, and evolve as a function of the evolution of other companies (Iansiti & Levien, 2004). As a result, companies collectively adapt to the external environment (in contrast to adapting individually) and influence their environment as a collective as well (Shipilov & Gawer, 2019).

Complementary to the concept of business ecosystems, which derives ecosystems from a firm-level perspective, the literature on innovation ecosystems views an ecosystem from a customer perspective (Kapoor, 2018). At the center of an innovation ecosystem is *"the focal offer's user value proposition"* (Kapoor, 2018, p. 2). A focal offer can be a product or a service and does not necessarily require a digital platform as a technological fundament. The important aspects of innovation ecosystems are the linkage between the supply- and demand-side of a focal over, interdependencies among different actors, and complementarities. While interdependencies are also a core tenant within business ecosystems and represent the fact that different offers are

connected at a system-level, complementarities are typical for innovation ecosystems and refer to joint offerings creating or improving the user value proposition (Adner & Kapoor, 2010; Kapoor, 2018). According to Jacobides et al. (2018, p. 2263) the complementarities that are critical to ecosystems are those *"with either unique or supermodular complementarities that are nongeneric, requiring the creation of a specific structure of relationships and alignment to create value."* Supermodular complementarities refer to B becoming more valuable the more of A. For instance, an operating system becomes more valuable the more apps it contains. Unique complementarities refer to A requiring B for A to be of value or A and B requiring each other. Consequently, A and B need to align which sets them apart from generic complementarities for which a product or service is of such a generic nature that it requires no specific alignment structure (Jacobides et al., 2018). Specific alignment structures exist for example between Apple and its third-party developers and are not transferable to other ecosystems such as Google's Android ecosystem. Innovation ecosystems, therefore, don't require hierarchical coordination. Instead, keystone firms orchestrate their complementors based on common standards which allows them to still make their own decisions. Adner (2017) provides an overview of how ecosystems differ from related concepts such as networks, business models, and value chains.

Building on top of business ecosystems and innovation ecosystems, platform ecosystems are also characterized by complementarities, interdependence, and loose coordination (Hein et al., 2020; Kapoor et al., 2021). However, in contrast to innovation ecosystems, platform ecosystems don't center around a focal offer's value proposition. Instead, platform ecosystems focus on the ecosystem and the generativity (Nambisan et al., 2019; Zittrain, 2006) that emerge around a digital platform - usually owned by one legal entity. Consequently, the center of attention of platform ecosystems lies in the integration of complementary innovations and the orchestration of autonomous complementors (Hein et al., 2020). Figure 2 illustrates the core concepts of digital platform ecosystems.

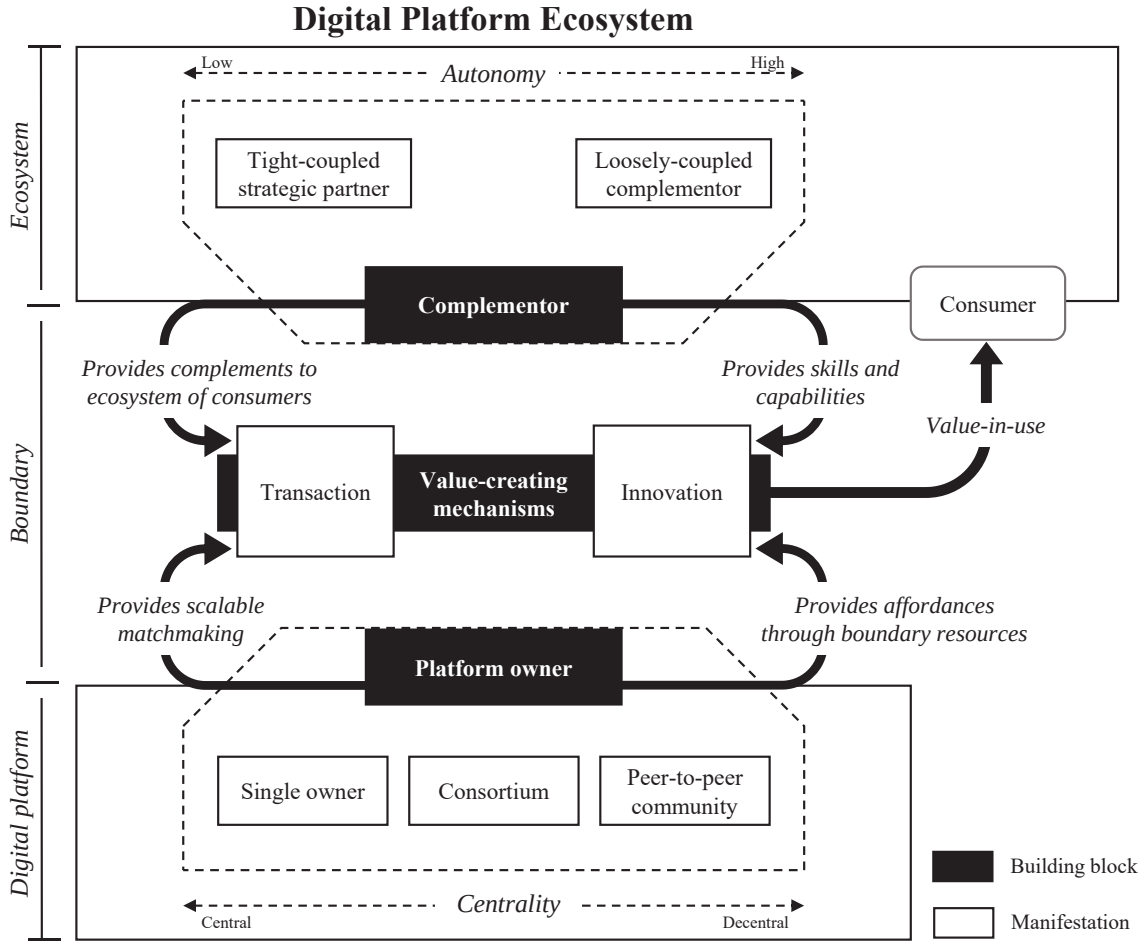

Figure 2. Building blocks and characteristics of digital platform ecosystems according to Hein et al. (2020)

2.3 Sources of Power of Digital Platforms

The literature on the sources of power of digital platforms is diverse and encompasses multiple research disciplines and levels of analysis. In an effort to structure prior work Suarez (2004) and Cennamo (2019) developed overarching frameworks and Rietveld and Schilling (2020) identified four research themes. In particular, Suarez (2004) reveals that both, platform-level sources (e.g. entry timing) and market-level sources (e.g. switching costs), influence platform power. Cennamo (2019) argues that the winner-take-all logic (platform size) and the distinctiveness logic (platform identify) are shaping platform power. Rietveld and Schilling (2020) identify the role of network effects, corporate-level strategy (e.g. diversification), heterogeneity, and ecosystem orchestration as core research themes on platform competition and platform power. In the following, we will synthesize the findings of the three studies and outline the key sources of power of digital platforms.

Network effects, lock-in, and switching costs.
Platform power is largely driven by network effects which continuously increase the value of a platform due to the positive feedback loop between the consumer network size and the complementor network size and their complements (Cennamo, 2019; Katz & Shapiro, 1994). These dynamics lead to winner-take-all outcomes (Lee et al., 2006) where the largest platform is assumed to win the entire market such as Microsoft in desktop operating systems or Google

in online search. The positive effects of increased platform size give also rise to lock-in effects and switching costs which impede consumers and complementors from switching to competing platforms (Suarez, 2004), further enhancing the value of the platform's installed base (Fuentelsaz et al., 2015). Switching costs can also arise in absence of network effects such as through platform-specific investments. For instance, once consumers have created and curated multiple playlists on Spotify, they may remain with Spotify even if Apple Music is of a larger platform size.

Pricing, exclusive complements, first-party complements, entry timing, openness, and platform envelopment.

In order to stimulate faster growth of the platform's network research has explored a variety of strategies (McIntyre et al., 2020). Pricing has always been a key strategy for any product and it is especially important for platforms. To quickly achieve a critical mass of users, platform owners are incentivized to use penetration pricing and cross-subsidization and to recoup profit in later stages (Parker & Van Alstyne, 2005; Rietveld & Schilling, 2020). The increase in the platform's size, in turn, makes it more likely that the platform will become dominant and outperform its rivals. Another strategy to improve the power of a platform is for platform owners to secure exclusive complements. By engaging in exclusive licensing agreements with key complementors, platform owners can raise their margins (Hermalin & Katz, 2013), prevent one side from multi-homing and thereby increase demand from the other side (Armstrong & Wright, 2007), and dethrone incumbent platforms that profit from a larger installed based (Lee, 2013). Platform owners can also provide complements themselves to reinforce indirect network effects (Hagiu & Spulber, 2013). Empirical research indicates that a positive relationship exists in the early stages of a platform (Cennamo, 2018). Besides pricing and exclusive or first-party complements, research suggests that entry timing is an important source to consider for platform power. On the one side, early entry gives a platform a head start to build a larger installed base, creates reputation advantages and learning effects, and might give rise to learning curve effects on the user side. A platform might therefore dominate the market even if it is inferior to late entrance (Rietveld & Schilling, 2020; Suarez, 2004). On the other side, early entry can also negatively impact a platform's power as it can be locked into a specific trajectory that is not congruent with an upcoming dominant technological design (Dosi, 1982; Schilling, 2002). An additional strategy that platform owners can employ to grow a platform's size is to increase its degree of openness. Prior work suggests that greater platform openness increases the number and variety of complementary innovation, accelerates user adoption, and enhances the market potential of the platform (Boudreau, 2010; Ondrus et al., 2015; West, 2003). Lastly, platform owners can engage in platform envelopment (Eisenmann et al., 2011). By tying together services in the origin market with those offered in the adjacent market, the enveloper creates a multi-platform bundle and forecloses user access to the established platform, providing its new platform a competitive advantage.

Platform and Complement Quality.

Besides network effects and strategic maneuvering, a platform's power is also contingent upon its technological capabilities and the ones of its complements. In general, the higher the technological superiority of a platform and its complements, the higher the likelihood that the platform will become dominant (Suarez, 2004). The underlying argument is two-fold. On the one hand, superior platform capabilities offer performance and functionality benefits to users (Zhu & Iansiti, 2012) and enable complementors to develop higher-quality complements,

especially if the development costs are low (Ozalp et al., 2018). Both enhance users' consumption experience on the platform (Cennamo, 2019). On the other hand, superior complements increase users' adoption of the platform (Hogendorn & Ka Yat Yuen, 2009; Rietveld & Schilling, 2020).

Institutional intervention, appropriability regime, and technological trajectories. Market-level sources represent another dimension that influences platform power. Institutional interventions can sometimes decide to regulate a platform and other times choose to support it. For instance, the European Commission decided to fine Google for abusing its market power in online search to provide its shopping comparison platform an illegal advantage (European Commission, 2017). By forcing Google to untie both platforms, Google's shopping comparison platform is likely to have suffered from reduced performance. In contrast, intervention such as government purchases or industry associations can help a platform to gain acceptance and hence make it more likely for it to become dominant (Suarez, 2004). In addition to institutional intervention, platform power is also shaped the appropriability regime. The appropriability regime describes to which extend platform owners can capture the benefits associated with their platforms and is affected by legal mechanisms such as the enforcement of patents (Suarez, 2004). A tight appropriability regime eases the protection of a platform's technology, while the opposite is true for a weak appropriability regime (Teece, 1986). A final market-level source reflects the structure and dynamics of technological trajectories. Tiwana et al. (2010, p. 681) describes technological trajectories as *"the rapidity, unevenness, scope, and unpredictability with which complementary and substitutive technologies are emerging."* As a result, these competing technologies influence the evolution of a platform and the future progression of complements. As technological fields require negotiations among actors, a platform owner's ability to reach agreements with those actors also depends on the technological field itself. For example, on the number and power of actors and the degree of cooperation and competition (Suarez, 2004).

The different sources illustrate that extant literature on platform power has focused on sources in isolation and overwhelmingly studied platform-level and market-level sources. To the best of our knowledge, it remains unclear how individual sources are interconnected and how national and historic sources as well as consumer characteristics and behaviors in the context of privacy contribute to platform power. Synthesizing prior work and developing a framework to interconnect individual sources as well as empirically examining historic and national sources and consumer privacy behaviors contributes to a more holistic understanding of platforms' sources of power.

2.4 The Two-Sided Impact of Digital Platforms and Platform-based Strategies

Digital platforms have transformed the way consumers search for information, communicate, shop, travel, and even date (Cusumano et al., 2019; de Reuver et al., 2017; Parker et al., 2016). They have also transformed the way organizations distribute products, find human capital, collect data, and store data (Riasanow et al., 2021). In the process, they created enormous economic surplus for consumers and businesses. Nonetheless, digital platforms have also raised concerns about competition, privacy, autonomy, labor protection, and democratic processes (Allcott & Gentzkow, 2017; Clemons & Madhani, 2010; De Stefano, 2015; Edelman, 2015;

Edelman et al., 2017; Mantovani et al., 2019; Srinivasan, 2019, 2020). In the following, we will synthesize prior research based on the positive and negative impacts of digital platforms and platform-based strategies on platform owners, rival platform owners, consumers, complementors, and stakeholders.

Positive effects for platform owners and negative effects for rival platform owners. Platform owners – the organization(s) operating and legally owning the digital platform – can profit from digital platforms and platform-based strategies by leveraging third-party innovations, market-level data, and platform envelopment. Especially the benefits of platform envelopment are simultaneously negative effects for rival platform owners.

Moving beyond outsourcing and supplier-networks, third-party innovations describe how platform owners engage in cooperative product and service development with third-parties which they don't even know and don't have bilateral contractual agreements with (Parker et al., 2017). Instead, platform owners orchestrate third-parties by allowing them to innovate on top of the platform's core set of resources. In other words, platform owners harness users as producers and thereby draw on an external labor force that is not considered a traditional workforce. The resulting value creation shift from inside the firm to outside the firm offers scale and scope benefits to platform owners (Cusumano et al., 2019; Parker et al., 2016). Scale benefits are achieved because processes such as hiring, training, development, and coordination are transferred outside of the platform and because ownership and physical assets are no integral part of the business model. For instance, Apple does not own every application in its app marketplace, Uber does not own cars, YouTube does not produce every single video, and Airbnb does not build new accommodation buildings. As a result, platform owners don't shoulder the costs of production and can grow the platform as quickly as they can add third-party innovators (Parker et al., 2016). Scope benefits are achieved because the products and services exchanged through the platform cover a variety of markets and sectors (Cennamo, 2019). Thus, platform owners benefit from third-parties filling whitespaces that they could not have imagined or did not have the capability to fill themselves (Gawer, 2014).

Since digital platforms represent the foundation on which products and services are exchanged, they largely represent the market of these products and services. For example, Apple's App Store represents a market for apps, Amazon's marketplace represents a market for consumer goods, and Spotify represents a market for music content. As a result, digital platforms can collect a variety of data about consumers and complementors. In the context of an online marketplace such data can be prices, number of products sold, ratings, and reviews. By aggregating consumer and complementor data, platform owners obtain a comprehensive overview of the market and its dynamics. Of course, the more dominant a platform is the more data it captures about the market. The advantage of such market-level data is that the platform owner can easily identify relevant product categories to expand in (Khan, 2016) as it can observe whether the demand and margin of a category increased or decreases. Indeed, Zhu and Liu (2018) provide empirical evidence that Amazon prefers to enter categories that are characterized by popular and high rated third-party sellers.

Platform envelopment emphasizes the notion of inter-platform competition (Kang, 2017) and refers to the *"entry by one platform provider into another [platform provider]'s market by*

bundling its own platform's functionality with that of the target's so as to leverage shared user relationships and common components" (Eisenmann et al., 2011, p. 1271). For instance, Google tied its app marketplace to its search engine and browser, and made it mandatory for manufactures to preinstall Search and Chrome in order to receive access to the PlayStore (Edelman, 2015; European Commission, 2018). Hence, platform envelopment is an alternative strategy to Schumpeterian innovation for entering markets. The benefits of platform envelopment are supply-side and demand-side economies of scope, price discrimination, foreclosure effects, sustaining power in the origin market, and data combination and monetization (Condorelli & Padilla, 2020). These benefits are simultaneously negative effects for rival platform owners. Supply-side economies of scope arise when *"it is less costly to combine two or more product lines in one firm than to produce them separately"* (Panzar & Willig, 1981, p. 268) and they are greatly enhanced due to the shareability of software, consumer relationships and user (Bourreau & De Streel, 2019). For example, Li and Agarwal (2016) report empirical evidence that Facebook yielded efficiencies from integrating its new platform Instagram with its core platform Facebook. Demand-side economies of scope, also called supermodularity (Jacobides et al., 2018) or co-specialized assets (Teece, 1986), *"raise the value that consumers attach to consuming the origin product or, more frequently, to consume both the existing and the new product jointly"* (Condorelli & Padilla, 2020, p. 154). Price discrimination is the benefit that is achieved through bundling as bundling decreases variety in consumers' aggregate valuations for a set of products which permits an organization with market power in the origin market to price the bundle at a lower price than the sum of the two products sold individually (Nalebuff, 2004). Foreclosure effects, often resulting in market structures with fewer rivals, are benefits that can be exploited by envelopers due to the additional value offered in the target market or by self-preferencing and thereby increasing rivals' cost in the target market (Condorelli & Padilla, 2020; Whinston, 1989). For example, by prominently placing its flight comparison platform within its search engine, Google increased the clicks on paid advertisement listings and decreased the clicks on organic listings, and thereby increased online travel agencies' marketing costs (Edelman & Lai, 2016). These practices can also hinder rivals to scale and thereby impede them to enter the origin market. Hence, sustaining envelopers' power in the origin market (Carlton & Waldman, 2002). Lastly, envelopers can benefit from data combination and its monetization by harnessing platform envelopment through privacy policy tying. The practice of privacy policy tying describes that an enveloper asks users of the origin platform to grant it access to their data on the target platform. This legal agreement permits the enveloper to combine user data from both platforms providing it a data advantage in both platforms. This data advantage can then be exploited for monetization (Condorelli & Padilla, 2020).

Although digital platforms provide multiple advantages to platform owners, they also pose significant challenges to them. In the following, we focus on the challenges of incumbent firms who are used to work in linear value chains since general challenges, challenges independent of the firm type (incumbent vs. digital-native), are already illustrated in previous chapter 2.3. The first challenge for incumbents is to adopt a new mindset and strategy. Instead of controlling the entire value chain and unique internal resources, incumbents must learn to orchestrate external resources and autonomous third-parties (Cusumano et al., 2019). They need to cope with the fact that innovations are not only produced internally but co-created with

complementors of the platforms (Parker et al., 2016) and that it needs to provide resources for free to stimulate external innovation (Svahn et al., 2017). As a result, incumbent firms need to change their identity and structure and adopt an ecosystem-centered organizing logic (Sandberg et al., 2020). Otherwise, if they fail to adopt platform-based thinking, they risk falling behind rivals (Sebastian et al., 2017). The second challenge is to manage openness. By opening a platform to third-parties, incumbent firms risk exposing critical information (Schreieck & Wiesche, 2017), increasing internal resistance to external collaboration due to the not-invented-here phenomenon (de Araújo Burcharth et al., 2014), and undermining existing partnerships as partners lose their exclusivity status (Schreieck & Wiesche, 2017). Platform openness also requires to redesign IT systems and restructure corporate IT departments (El Sawy et al., 2016). The third challenge is to learn new governance mechanisms. A platform requires *"governance mechanisms that appropriately bound participant behavior without excessively constraining the desired level of generativity"* (Wareham et al., 2014, p. 1195). Consequently, incumbent firms need to understand how to manage the competing concern of control versus flexibility. For instance, Svahn et al. (2017) report that the employment of formal purchasing contracts had a negative effect on co-creation. To address this challenge, the platform and app department had to convince the purchasing department to move from contracting with suppliers (transaction-cost-centric) to contracting with complementors (mutual liability and cost neutrality).

Positive and negative effects for consumers.
Digital platforms generally increase consumer choice, improve efficiency, and enhance consumers' participation in society (Edelman & Geradin, 2016; Parker et al., 2016). By disintermediating linear value chains and aggregating third-party products and services, digital platforms can have a positive influence on consumer prices and consumer search costs. They replace inefficient gatekeepers by leveraging crowd-based market signals, trust mechanisms, and quality control mechanisms (Edelman & Geradin, 2016). For instance, the ride-sharing platform Uber employs market signals such as reviews and ratings, trust mechanisms such as displaying the optimal route to drivers and riders, and control mechanisms such as enforcing drivers to have a valid driver's license or sharing. As a result, consumers benefit from real-time crowd feedback, control over the ride's route, and safety. The benefits for consumers are not only present in the sharing and gig economy, digital platforms benefit consumers in various industries in various ways. In the context of refugees and migration, digital platforms can help to integrate information from different municipalities (Schreieck et al., 2017) and contribute to social inclusion (Abujarour et al., 2021). In the context of social media, social networking platforms can encourage and facilitate civic engagement and political participation (Gil de Zúñiga et al., 2012), ease consumers' access to information such as medical information to manage chronic diseases (Liu et al., 2020), and positively influence self-esteem (Krause et al., 2021). In the context of new product development, digital platforms enable consumers to become co-creators of new products and allow them to generate, experience, evaluate, and discuss ideas and prototypes (Füller et al., 2009; Hienerth et al., 2011).

However, digital platforms also have negative effects on consumers. The call for papers for a special issue on "Ethical Issues and Unintended Consequences of Digitalization and Platformization" of the Journal of Information Technology lists inter alia the following dark

sides of digital platforms: surveillance capitalism, digital privacy, bias in algorithms, misinformation, biased online reviews, and cyberharassment (Rossi et al., 2021). Indeed, in the context of advertisement-based digital platforms prior work identified various privacy violations during the collection, processing, and usage of consumer data (Srinivasan, 2019; Zuboff, 2015, 2019). In the context of social media, digital platforms enable the spread of fake news (Allcott & Gentzkow, 2017; Constantinides et al., 2018; Wylie, 2019), negatively influence health outcomes (Hou et al., 2019), life satisfaction (Krasnova et al., 2013), well-being (Krasnova et al., 2015), increase the risk for bullying (Davies & Cranston, 2008), and increase interdependent privacy (e.g. friends posting embarrassing information (Wang et al., 2011) or sharing co-location data without consent (Olteanu et al., 2016). In the context of e-commerce, digital platforms are prone to fake reviews (Wu et al., 2020) and in the context of the sharing economy, they don't have to adhere to the same safety requirements as their traditional counterparts (Edelman & Geradin, 2016). In the context of search engine, self-preferencing and demoting due to algorithmic opacity denies consumers choices of services (European Commission, 2017).

Positive and negative effects for complementors.
The effect on complementors can be examined from two perspectives. On the one side, from the effect of the digital platform in general and on the other side, from the effect of platform owner entry into complementary markets. Regarding the first perspective, complementors largely profit from knowledge spillovers (Parker et al., 2017). A digital platform is an open system and shares its knowledge with complementors. For instance, software code and software tools are made available to complementors to reduce their development effort and enable them to focus on creating their core products instead of writing boilerplate code. Complementors thereby benefit from access to the intellectual property of the digital platform (Gawer & Henderson, 2007). Since digital platforms aggregate supply and demand sides, complementors also profit from large and easily accessible customer bases. For example, Android developers can reach around 100 million Android consumers with their applications.

However, digital platforms can also have negative effects on complementors. In the context of the sharing and gig economy, digital platforms often classify complementors as independent contractors which prohibits complementors from obtaining certain labor standards such as minimum wage or injury insurance (Gerwe & Silva, 2020; Minter, 2017). As a result, scholars and regulators are increasingly discussing whether these complementors should be considered employees, self-employed, or whether an intermediary category should be created (De Stefano, 2015; Rosenblat & Stark, 2016). Some regulators have decided to opt for the former, to classify complementors as employees, to reduce the negative effects of misclassification (Ferrell et al., 2017). Moreover, digital platforms control which complementors are allowed on the platform and how they process their billing. As a result, digital platforms can deny complementors access to the platform (sometimes in good intentions such as for preventing hate speech but also in bad intentions such as denying rival complementors access to users) and deny complementors access to alternative billing systems (European Parliament, 2019; Kafka, 2016).

Regarding the second perspective, complementors are affected by platform owner entry which is also referred to as intra-platform development and can be defined *"as the launching by the*

platform owner of a product whose functionality overlaps with the functionalities offered by one or more of its platform complementors and thus, directly compete with them" (Kang, 2017, p. 4). On the positive side, intra-platform envelopment can increase competition and thereby stimulate innovation efforts of complementors (Gawer & Henderson, 2007). More specifically, scholars advocate an attention spillover effect. The entry of the platform owner increases consumer demand and feedback which incentivizes complementors to innovate (Foerderer et al., 2018). The effect of platform owner entry is also contingent upon the governance structure of the platform whereby an open and complementor-friendly governance structure produces positive spillover effects (Kang, 2017). In the case of entry threat, innovation efforts are channeled to unaffected and new apps and thus, reduces wasteful development (Wen & Zhu, 2019).

On the negative side, intra-platform envelopment allows platform owners to capture the rents of complementors (Li & Agarwal, 2016). It can enable them to engage in ex-post squeezing (e.g. capturing the entire complementary market segment by depressing prices through cross-subsidization or self-preferencing) reducing innovation efforts and survival of complementors (European Commission, 2017; Gawer & Henderson, 2007). Similarly, platform owners might be able to reduce shipping costs of complementary products which reduces the overall costs to consumers and thereby discourages third-party sellers, especially small ones, to continue offering products and to increase the number of products sold on the platform (Zhu & Liu, 2018). The negative effect is pronounced in platforms with controlling and restrictive governance (Kang, 2017). Even the threat of entry can reduce developers' innovation efforts and lead to increased prices of affected apps (Wen & Zhu, 2019).

Negative effects for stakeholders.
Stakeholders who are not directly involved with digital platforms are especially affected by sharing platforms in form of negative externalities (Gerwe & Silva, 2020). Scholars have discussed harmful effects of transportation platforms such as urban pollution, traffic congestion, and public safety problems (Edelman & Geradin, 2016) as well as negative effects of accommodation sharing platforms such as the rise of rent and the displacement of long-term residents (Malhotra & Van Alstyne, 2014).

The different perspectives illustrate that extant literature on digital platforms and platform-based strategies has studied various impacts and various actor groups. The literature is focused primarily on industries such as the sharing and gig economy, social media, e-commerce, operating systems, or search engines with a firm/platform-level perspective and, in the context of platform envelopment, on either inter- or intra-platform envelopment. However, limited attention has been given to summarizing the reciprocal impacts and the contextualization of platform-based business models within business model innovation, the healthcare industry and an industry-level perspective, and the integration of inter- and intra-platform envelopment and the versatile role of a core platform to interfere with its rivals. Thus, synthesizing prior work into an integrative framework and outlining the reciprocal relationship between business model innovations such as platform-based business models and different actor groups as well as empirically investigating platformization within healthcare and the characteristics and impacts of inter- and intra-platform envelopment simultaneously contribute to better understanding the impact of digital platforms and platform-based strategies.

2.5 The Transition of Incumbent Firms into the Platform Economy

Research on digital platforms has overwhelmingly studied digital platforms in the context of digital-native platform owners such as Uber (Edelman & Geradin, 2016), Apple iOS (Eaton et al., 2015), Google Android (Benlian et al., 2015; Foerderer et al., 2018) TripAdvisor (Alaimo et al., 2019), Amazon (Zhu & Liu, 2018), or Facebook (Claussen et al., 2013; Krasnova et al., 2013). Research on incumbent firms and how they transition into the platform economy remains scarce. In the following, we summarize this burgeoning stream based on five transition strategies.

The first strategy refers to incumbents building a digital platform and integrated it into their existing organizational structure (Hein, Schreieck, et al., 2019; Schreieck & Wiesche, 2017; Sebastian et al., 2017). For example, General Electric built a digital platform by opening up its previously closed operating system Predix to external complementors (Cusumano et al., 2019) and Volvo build a digital platform after Apple's iOS and Google's Android become more and more successful (Svahn et al., 2017). Relevant triggers for incumbents to transform into platform owners are technology-push and demand-pull factors as observed in the mobility and automotive domain (Hein, Schreieck, et al., 2019) and the process automation industry (Sandberg et al., 2020). Building a digital platform is particularly beneficial if the market is new and existing players and technologies are still emerging. That's because incumbents can then establish a leadership position and exploit winner-takes-all outcomes. However, as reviewed in chapter 2.4 building a platform poses multiple challenges to incumbents (Sandberg et al., 2020; Schreieck & Wiesche, 2017; Svahn et al., 2017).

The second strategy refers to incumbents investing in a digital platform and separating it from their existing organizational structure (Christensen, 2013). As a result, incumbents can create and invest in a spin-off or invest in an already existing platform firm. For instance, the steel manufacturer and trader Klöckner launched a separated steel trading platform (spin-off), and the logistics companies UPS invested in the delivery service platform Roadie (existing platform firm). Both options permit incumbents to accumulate knowledge about digital platforms and their management without risking cannibalizing their existing business model due to parallel business models (Velu & Stiles, 2013). Engaging in such an Invest-Learn-Act strategy also puts an incumbent in an advantageous position as it can more easily collaborate with the new digital platform in case it becomes dominant (Zhang et al., 2018). The downside of this strategy is an incumbent is not completely in control of the evolution of the new platform and thereby risks that the new platform might outcompete it or capture a significant proportion of its market.

The third strategy refers to incumbents acquiring a digital platform and integrating it into their existing organizational structure (Cusumano et al., 2019). For example, Facebook acquired Instagram and Karma (a gift-giving application) in 2012 and tightly integrated both and thereby achieve integration efficiencies that were not available to third-party applications (Li & Agarwal, 2016). Another advantage besides integration efficiencies is that the time-to-market is drastically reduced compared to building a digital platform from scratch. However, to exploit this strategy incumbents already need platform-specific management capabilities (Schreieck et al., 2018) otherwise they won't be able to leverage a newly acquired platform. The challenges

of acquiring a platform are retention of talent, integration into the existing IT landscape, and counteraction of cultural frictions (Cusumano et al., 2019).

The fourth strategy refers to incumbents joining a digital platform of another firm (Cusumano et al., 2019) and thus, becoming a supplier/complement producer, a buyer/consumer, or a "prosumer" (engaging in both roles). The advantage of joining is that incumbents can leverage already existing technology and network size of the other platform. It also fosters seamless integration such as in the automotive context in which customers could easily integrate their digital content and apps into a car in case BMW decides to join the Android automotive platform. *"Customers would just need to register their Google accounts in the car, and all playlists, pictures, and videos, as well as all personal data and logins would be synchronized and available without any further effort"* (Weiss et al., 2020, p. 10). The disadvantage is that the incumbent does not control at all the evolution of the platform, loses the customer contact point, and forgoes revenues of the platform business model (Weiss et al., 2020). In the worst case, the platform establishes a dominant position and abuses its power to interfere with the products and services of the incumbent.

The fifth strategy refers to incumbents establishing a collaborative platform to create a common platform that is usable by each incumbent of the collaboration or consortium. For example, in the automotive industry car manufacturers have cooperatively developed the Automotive Grade Linux which is already running in some cars. The benefits are that costs, risks, and competencies are shared and that each new member of the collaboration increases the network size of the platform making it more attractive to complementors (Weiss et al., 2020). The approach also avoids becoming dependent upon rival platforms (Schreieck et al., 2019). However, on the downside industry collaborations might be viewed as cartels in the eyes of competition law. Table 3 summarizes the five transition strategies.

Table 3. Overview of Incumbents' Transition Strategies for the Platform Economy

Transition strategy	Description
Building a digital platform	Developing a new platform based on internal capabilities and resources. The new platform is integrated into the incumbent's organizational structure.
Investing in a digital platform	Creating and investing in a spin-off or investing in an existing platform organization. The new platform is separated from the incumbent's organizational structure.
Acquiring a digital platform	Refers to mergers and acquisitions in the sense that a new platform is bought and integrated into the incumbent's organizational structure.
Joining a digital platform	Participating on a third-party platform either as supplier/complement producer, buyer/consumer, or prosumer.
Establishing a collaborative platform	Developing a new platform through collaboration with other incumbents of the same industry to create a common platform that is usable by each incumbent of the collaboration or consortium.

Although different transition strategies exist, research primarily focuses on incumbent's transition in form of the build or join strategy. This is illustrated by the call for research of de Reuver et al. (2017, p. 131) that *"if not developed internally, what types of digital platforms do incumbents adopt?"* At the same time research largely assumes that transition strategies are an either-or decision. For instance, that an incumbent can either build or join a platform. As a result, it is yet not well understood how incumbents employ other transition strategies such as

investing in platforms, acquiring platforms, and establishing collaborative platforms. It remains also opaque how incumbents pursue multiple transition strategies. Addressing both research gaps can provide valuable knowledge on how incumbents can transition and compete in the platform economy.

3 Research Design

In this section, we elaborate on the research paradigm of this thesis. To investigate digital platforms' sources of power, their impact on consumers and organizations, and a European forward to compete in the platform economy, we use a pragmatic epistemological stance and a mixed-method strategy. We combine qualitative and quantitative approaches by employing literature reviews, case studies, taxonomy development, factor analyses, cluster analyses, and regression analyses.

3.1 Pragmatic, Mixed Method Research Strategy

The pragmatic approach aims to bridge the opposition between the main philosophical paradigms of positivism and interpretivism (Tashakkori & Teddlie, 2010). *"Pragmatism […] sidesteps the contentious issues of truth and reality, accepts, philosophically, that there are singular and multiple realities that are open to empirical inquiry and orients itself toward solving practical problems in the real world"* (Yvonne Feilzer, 2010, p. 8). The approach neither argues that reality exists independently from human experiences and that knowledge needs to be based on deduction, falsification, and generalizability (positivist ontology and epistemology), nor does it propose that reality is constructed by human experiences and that knowledge is gained through induction and understanding the subjective meaning of reality (interpretivist ontology and epistemology) (Chen & Hirschheim, 2004; Creswell & Clark, 2017). In contrast, proponents of pragmatism suggest that qualitative and quantitative research approaches are compatible and not disjunct (Morgan, 2007; Tashakkori & Teddlie, 2010).

To explain how pragmatism converges qualitative and quantitative research, Morgan (2007) proposes the concepts of abduction, intersubjectivity, and transferability. Abduction addresses the issue of the connection between theory and data. Instead of sharply distinguishing between induction and deduction, abductive reasoning acknowledges that during the research process researchers are not exclusively theory- or data-driven, they oscillate between induction and deduction. Intersubjectivity addresses the relationship between the researcher and the research process. Instead of artificially forcing a dichotomy between a subjective and an objective relationship, intersubjectivity captures that multiple worldviews can co-exist. Transferability addresses the issue of inference from data. Instead of distinguishing between either context-dependent knowledge or generalized knowledge, transferability moves beyond extreme views and suggests that *"an important question is the extent to which we can take the things that we learn with one type of method in one specific setting and make the most appropriate use of that knowledge in other circumstances"* (Morgan, 2007). Consequently, the pragmatic approach emphasizes the importance of addressing problems instead of building philosophical systems and frees researchers from mental and practical constraints, and is therefore well-suited for mixed-method research (Venkatesh et al., 2013).

Mixed-method research exhibits multiple advantages (Venkatesh et al., 2013; Venkatesh et al., 2016). The most valuable advantage is the *combination* of the advantages of qualitative and quantitative research methods. The combination allows to investigate exploratory and

confirmatory research questions simultaneously and reduces the limitation of each approach. As a result, mixed-method research is able to generate "meta-inferences" (Venkatesh et al., 2013) – inferences that are better and more accurate since they integrate findings from qualitative and quantitative research (Tashakkori & Teddlie, 2008).

This thesis draws on the mixed-method research approach to derive a detailed and comprehensive understanding of platforms' sources of power, their impact, and a European way forward in the platform economy. We apply several methods. In terms of qualitative methods, we use literature reviews, case studies, e^3-value modelling, and taxonomy development. In terms of quantitative methods, we apply factor analyses, cluster analyses, and regression analyses.

3.2 Research Methods

Following a pragmatic paradigm and a mixed-method research strategy, this thesis builds on two literature reviews (P1 and P6), qualitative methods such as case studies, e^3-value modelling and taxonomy development (P5, P7, P8, and P9), and quantitative methods such as factory analyses, cluster analyses, and regression analyses (P2, P3, and P4). Table 4 summarizes the method(s) of each publication. In the following, we elaborate on each method. Additional details on how we applied each method can be found in the embedded publications.

Table 4. Overview of Research Methods Applied in the Embedded Publications

Publication	Lit. Rev.	Case Study	E^3-value Modeling	Tax. Dev.	Factor Analysis	Cluster Analysis	Reg. Analysis
Digital Platforms and Market Dominance: Insights from a Systematic Literature Review and Avenues for Future Research (P1)	X						
Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study and Implications for the Privacy Paradox (P2)					X	X	
Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications (P3)					X	X	
Objective versus Relative Risk in Privacy Decision Making: A Replication Study from Germany (P4)							X
Breeding Grounds of Digital Platforms: Exploring the Sources of American Platform Domination, China's Platform Self-Sufficiency, and Europe's Platform Gap (P5)		X					
Business Model Innovation and Stakeholder: Exploring Mechanisms and Outcomes of Value Creation and Destruction (P6)	X						

The Digital Transformation of the Healthcare Industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients (P7)		X	X				
A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities (P8)		X		X			
Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms (P9)		X					
Legend: Lit. Rev.: Literature Review; Tax. Dev.: Taxonomy Development; Reg. Analysis: Regression Analysis							

Systematic Literature Review

Literature reviews represent the initial step in every research process and are critical to advance the body of knowledge (Webster & Watson, 2002). Scholars need to identify and synthesize previous research to generate the theoretical foundation of their research (Cooper, 1988). Only by building on top of the work of others, researchers can contribute new knowledge by framing their findings in the light of related work (Rowe, 2014; Vom Brocke et al., 2015). Moreover, literature reviews support researchers to derive research gaps and formulate research questions and thereby help to identify fruitful avenues for future research (Paré et al., 2015).

Although literature reviews can be conducted in various ways and for achieving different objectives, the concept of a systematic literature review offers the most comprehensive approach for reviewing the literature (Cooper, 1988; Paré et al., 2015). The procedure of conducting a systematic literature review comprises two main phases. In the first phase, researchers need to identify articles relevant to their research project. In the second phase, they need to review those articles and synthesize them (Rowe, 2014). Vom Brocke et al. (2015) and Webster and Watson (2002) describe a detailed workflow on how researchers can navigate through the two main phases.

Regarding the first phase, the initial step is to choose relevant keywords and utilize them to search through databases that contain relevant journals and conferences. Based on certain inclusion and exclusion criteria, the researcher needs to identify the core list of papers that will be included in the review. The next step is to use the core list of papers as a base for a backward and forward search (Webster & Watson, 2002). A backward search aims to extract additional relevant work based on the references of the core list of papers. A forward search works the other way around, identifying additional research based on citing papers of the core list of papers.

Regarding the second phase, the first step is to decide upon a data analysis technique. We adhered to the coding procedure of Grounded Theory (Strauss & Corbin, 1997; Wolfswinkel et al., 2013). Following this approach, scholars engage in open, axial, and selective coding. The second step is therefore to use open coding to identify concepts of interest in the papers.

Usually, the level of analysis is a semantic chunk. In the third step, researchers employ axial coding which refers to creating relationships among open codes. Lastly, scholars engage in selective coding through which they identify overarching schemes to structure axial codes. During the entire coding procedure codes are constantly compared in the sense that new codes might alter existing codes (Urquhart et al., 2010).

In the embedded publication "Digital Platforms and Market Dominance: Insights from a Systematic Literature Review and Avenues for Future Research" (P1), we employ a systematic literature review on digital platforms and market dominance to identify how market-level sources and platform-level sources shape a platform's dominance. In the embedded publication "Business Model Innovation and Stakeholder: Exploring Mechanisms and Outcomes of Value Creation and Destruction" (P6), we conduct a systematic literature review to retrieve the current body of knowledge about the reciprocal relationship between business model innovation (e.g. platform-based business models) and stakeholders in terms of value creation and destruction. Both reviews served as theoretical basis of subsequent publications and helped us to identify research gaps and formulate our contributions in the light of related work.

Case Study Research

According to Yin (2014, p. 2) *"a case study investigates a contemporary phenomenon (the "case") in its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident."* A case study, therefore, represents an exploratory research approach and is most suitable to explain "how" and "why" research questions and to gain an in-depth understanding of the phenomenon of interest (Eisenhardt & Graebner, 2007). Since boundaries between phenomenon and context can be blurred, case studies build on multiple data collection techniques and aim for data triangulation (Benbasat et al., 1987).

Figure 3 illustrates the case study approach as proposed by Yin (2014, p. 1). Particularly important is the notion of recursively iterating between preparation, data collection, and data analysis as well as the fact that data collection and data analysis influence the case study design. Case study research thereby emphasizes that newly won insights can change how the case study is conducted (Eisenhardt, 1989).

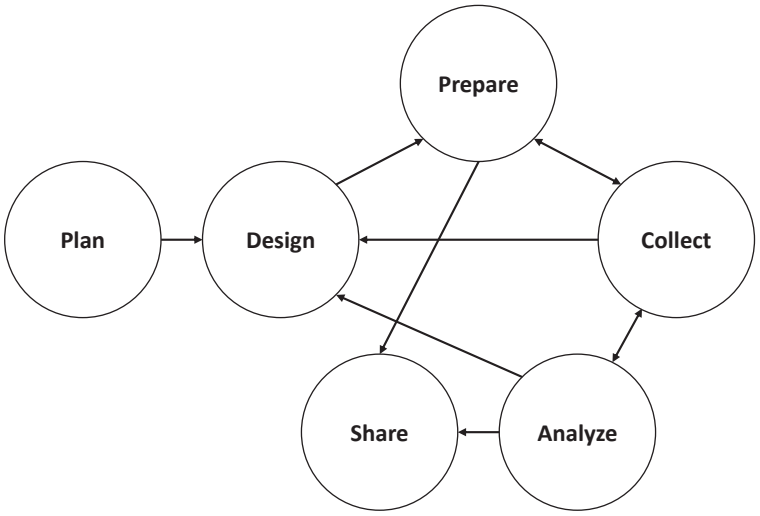

Figure 3. Case Study Research Approach (Yin, 2014, p. 1)

During the **planning phase,** researchers need to formulate their research questions and examine whether they can be appropriately addressed through a case study. A case study is a suitable approach when (1) the research questions addresses "how" or "why" questions, (2) scholars can't control events, and (3) the phenomenon of interest is contemporary (in contrast to historical) (Benbasat et al., 1987; Yin, 2014).

The purpose of the **design phase** is to outline *"[…] the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of the study"* (Yin, 2014, p. 26). Thus, scholars need to consider the research questions, propositions, unit(s) of analysis, the logic of how data is linked to the propositions, and criteria to interpret the findings (Yin, 2014). Appropriate research questions are "how" and "why" questions. Propositions refer to specific aspects that should be investigated during the study. Units of analysis reflect the challenge to define "the case". A case can be, for example, an individual, a group, an organization, or an industry. The linkage between data and propositions relates to the data analysis technique and the coding procedure. Examples of the coding procedures of the embedded publications can be found in Appendix A. Criteria to validate the results refer to assessing whether rival explanations can be rejected. The more rival explanations have been rejected the more robust the findings (Yin, 2014).

Scholars need to refine their data collection skills during the **preparation phase** and decide upon the study protocol and the sampling strategy. The study protocol is critical to improve the reliability of the study and should be pre-tested in a pilot case study (Yin, 2014). The sampling strategy refers to deciding which "case" is suitable to provide valuable answers to the questions of interest. Moreover, scholars need to decide how they gather data (e.g. interview or observation) and where (e.g. events, documents, or meetings). Usually, scholars employ a theoretical sampling strategy meaning that *"decisions about which data to collect next are determined by the theory in progress"* (Eisenhardt & Graebner, 2007, p. 30).

In the **data collection phase**, the objective is to collect data from multiple sources to increase the validity of the results (Yin, 2014). Typical sources of evidence are observations, interviews,

and archival data. In order to ease data analysis, interviews should be recorded and transcribed. In this thesis, we rely on interviews and archival data.

The objective within the **data analysis phase** is to ensure that the results derived from the data are valid and reliable. Common activities are the examination, categorization, coding, and tabulation of data to make inferences (Yin, 2014). Analyzing data can be deductive or inductive (Eisenhardt & Graebner, 2007). For deductive analysis, scholars use theoretical propositions to guide their analysis. Theoretical propositions thereby function like a template or grid that can be placed over the data to analyze it accordingly. In contrast, for inductive analysis, scholars are free of theoretical propositions and work the data from the *"ground up"* to open-mindedly identify new theory (Yin, 2014, p. 123).

Finally, the **sharing phase** emphasizes that the findings need to be reported and that researchers should consider who their target audience is and frame their study results accordingly (Yin, 2014). Coding procedures, such as the examples in Appendix A, are thereby a fruitful tool to transparently guide readers on how insights have been derived from the data collected (Gioia et al., 2013).

In the embedded publication *"Breeding Grounds of Digital Platforms: Exploring the Sources of American Platform Domination, China's Platform Self-Sufficiency, and Europe's Platform Gap"* (P5), we use an embedded, multiple-case study design and interview data to assess national and historic sources of platform power. The embedded publication *"The Digital Transformation of the Healthcare Industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients"* (P7), we employ an embedded, single-case study design with multiple units of analysis to identify how the digital transformation impacted the healthcare industry. The embedded publication *"A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities"* (P8) follows an embedded, multiple-case study design where different platform envelopment practices represent the cases and the different platforms involved the units of analysis. Last, the embedded publication *"Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms"* (P9) adheres to an embedded, multiple-case study design in which the incumbent firms represent the case and the different platform strategies the units of analysis.

E^3-value Modeling

The e^3-value modeling technique is a modeling approach to define, visualize, and analyze a multi-actor network from a value viewpoint (Gordijn & Akkermans, 2001). Its strength is that it *"combines the rigorous approach of IT systems analysis with an economic value perspective from business sciences"* (Gordijn & Akkermans, 2001, p. 11). In particular, the approach adds to the existing system architecture viewpoint and process viewpoint the viewpoint of how value is exchanged between actors. As a result, it can be used to assess the economic sustainability of networks and single actors (Gordijn & Akkermans, 2003). The most important concepts of the e^3-value model are the following (Gordijn & Akkermans, 2003, pp. 10-12):

- *Actors*: describe economically and often legally independent entities. They are modeled as rectangles.

- *Market segments*: describe a set of actors that exhibit common characteristics and that value objects equally. They are modeled as three rectangles.
- *Value objects*: describe objects, such as services, goods, or money, exchanged by actors. They are modeled as text (e.g. 'good' or 'money') next to the value exchanges.
- *Value exchanges*: describe actors willing to exchange value objects. They are modeled as arrows connecting two value ports.
- *Value ports*: describe actors signaling that they want to offer or request value objects and thereby abstract away from internal processes and reduce complexity. They are modeled as circles.
- *Value interfaces*: describe that single value ports are clustered into one value interface. Actors can have one or more value interfaces. Value interfaces demonstrate the mechanism of economic reciprocity. They are modeled as small rectangles with rounded edges.
- *Value offerings*: describe a group of value exchanges indicating ingoing and outgoing value objects.

Gordijn and Akkermans (2003, pp. 14-17) propose five steps to construct an e^3-value model. First, scholars need to identify operational scenarios. These scenarios represent a product or service requested by customers. Second, scholars create a list of relevant actors which are necessary to fulfill the operational scenario. Third, scholars identify the economic exchanges among actors. Within this step, scholars identify value exchanges, value objects, value interfaces, and value ports either through the actor-driven or market-driven approach. While the former begins with one actor and then explores the economic exchanges of other actors, the latter aims to identify the overall exchanges relevant to the operational scenario. Fourth, scholars need to cluster value ports into value offerings and value interfaces. Value interfaces are important to denote which value objects are exchanged for one another (economic reciprocity). Fifth, scholars determine scenario paths. These paths illustrate which value objects are required to be exchanged to satisfy a customer need. A path begins with a start stimulus and terminates with an end stimulus. After these five steps, scholars can additionally construct alternative models (e.g. intermediation or disintermediation) and evaluate the profitability of the network and single actors by defining assigning value to each object. Figure 4 shows an example e^3-value model based on Gordijn and Akkermans (2003, p. 10).

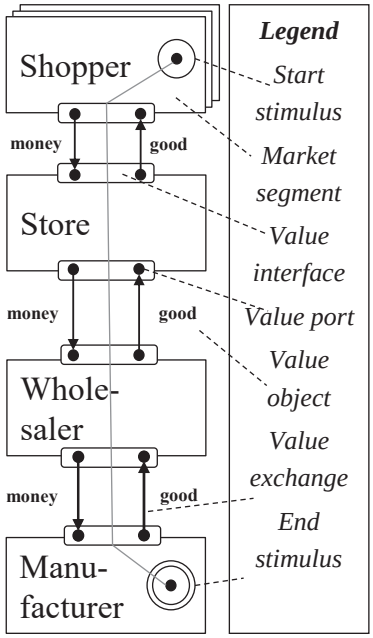

Figure 4. Example e3-value Model based on Gordijn and Akkermans (2003, p. 10)

In the embedded publication *"The Digital Transformation of the Healthcare Industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients"* (P7), we use the e^3-value modeling technique to visualize the traditional and the digital healthcare ecosystem and the value exchanges between actors.

Taxonomy Development

Taxonomies are artifacts that allow scholars to classify objects (Nickerson et al., 2013). They provide a structure and organizing logic to the knowledge of a field and thereby represent the foundation for theory building (Doty & Glick, 1994; Glass & Vessey, 1995). Based on taxonomies scholars can systematically investigate relationships between objects and *"perform ex post theory building"* (Bapna et al., 2004, p. 23).

We follow the taxonomy development approach by Nickerson et al. (2013) who outlines seven steps (see Figure 5). The first step requires the specification of meta-characteristics. Meta-characteristics are overarching characteristics and set the scope for the choice of characteristics in the taxonomy. Nickerson et al. (2013, p. 343) argues that *"each characteristic should be a logical consequence of the meta-characteristic"*. In the second step, scholars need to define conditions when the iterative taxonomy development should end. (Nickerson et al., 2013) proposes eight objective ending conditions (all objects have been investigated, no split/merge of objects in the last iteration, every characteristic is at least used once, no merge/split and no addition in the last iteration, uniqueness of dimensions, no characteristic duplication within a dimension, and uniqueness of cells) and five subjective ending conditions (concise, robust, comprehensive, extendible, and explanatory). Once steps one and two are accomplished, scholars begin with step three in which they have to choose whether they want to begin with an empirical or conceptual approach. The choice is contingent upon the availability of data and the knowledge of scholars about the phenomenon. If a significant amount of data is available but

only limited domain knowledge, research should begin with an empirical approach. In contrast, if the amount of data about objects is low but knowledge about the domain is high, researchers should begin with the conceptual approach. In the empirical-to-conceptual approach (step 4e, 5e, and 6e), the researchers select a subset of objects to classify and then determine common characteristics among those objects. The characteristics must be within the scope of the meta-characteristic. Next, researchers group the identified characteristic into dimensions of the taxonomy. In the conceptual-to-empirical approach (4c, 5c, and 5c), researchers draw on their knowledge about the domain of interest to determine the dimensions and characteristics of the taxonomy. Nickerson et al. (2013, p. 346) argues that *"this process is based on the researcher's notions about how objects are similar and how they are dissimilar"* without examining actual objects. Once this step is complete, actual objects are classified based on the conceptual dimensions and characteristics. The seventh and last step comprises the decision of whether the ending conditions are met. If not, another iteration should be conducted. If the ending conditions are met, the taxonomy development terminates.

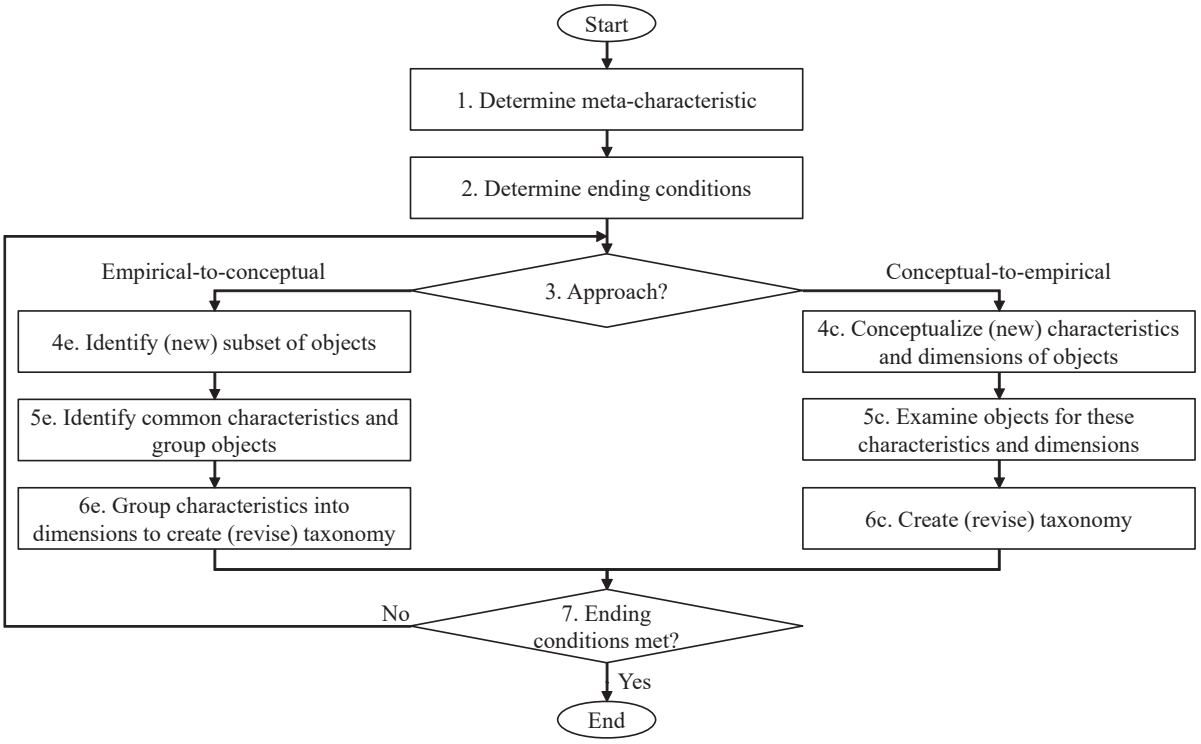

Figure 5. Taxonomy Development Method (Nickerson et al., 2013, p. 345)

In the embedded publication *"A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities"* (P8), we develop a taxonomy to structure knowledge about the phenomenon of platform envelopment. Based on the taxonomy and the case base we derive three platform envelopment patterns and two particularities.

Factor Analysis

Scholars often engage with the identification of constructs and their relationships. Since constructs represent theoretical abstractions and therefore cannot be directly observed, they need to be measured indirectly through observed manifestations (items) (Heck, 1998). Factor

analysis is a helpful method to derive latent constructs because it can link the manifestations to the constructs of interest and help to better understand them and the underlying data structure (Fabrigar & Wegener, 2011). After the linkages have been established, scholars can examine the relationship among constructs. Factor analysis can be divided into two an exploratory and a confirmatory approach. Both aim to reveal the structure of correlations among measured items using a small number of latent constructs. However, exploratory factor analysis is completely data-driven and scholars do not specify any linkages between items and constructs. In contrast, in confirmatory factor analysis scholars specify the linkages and also the number of factors (Fabrigar & Wegener, 2011; Fabrigar et al., 1999). In this thesis, we draw on exploratory factor analysis.

Factor analysis builds on two key activities: extracting factors and choosing the method of rotation (Heck, 1998). In order to identify the optimal number of latent constructs (factors) research proposes multiple approaches. These can be divided into approaches based on eigenvalues derived from principal factors or principal components analysis, and into the maximum likelihood approach (Fabrigar & Wegener, 2011). We start by presenting three approaches based on eigenvalues. One approach is the Kaiser criterion which states that factors with an eigenvalue greater than 1 should be kept and factors with eigenvalues lower than 1 should be removed from the factor solution (Fabrigar et al., 1999). A second approach is the scree test (Cattell, 1966) for which scholars need to plot the eigenvalues of the correlation matrix in descending order. Once the plot is created scholars determine the number of factors based on the last significant drop in the magnitude of eigenvalues. Another approach is parallel analysis (Horn, 1965) which compares eigenvalues from sample data with eigenvalues expected from random data. Factors are kept as long as the eigenvalues of the sample data are higher than the eigenvalues of random data. Factors for which the eigenvalue of random data is higher are discarded. After having outlined three approaches based on eigenvalues, we now describe the maximum likelihood method to extract factors. Its core tenant is the use of goodness-of-fit measures which indicate the degree to which a specified model (factor solution) fits the observed correlations. Based on these fit measures scholars can then *"select a model that explains the data substantially better than simpler alternative models (i.e., models with fewer factors) but does as well or nearly as well as more complex alternative models (i.e., models with more factors)"* (Fabrigar et al., 1999, p. 279).

The activity of choosing an appropriate method of rotation tackles the issue that some items might not be clearly assignable to one factor. Rotation can help in that manner as the axes are rotated so that the clusters of items are more closely positioned to them, making it easier for scholars to interpret the factor solution (Heck, 1998). Although several rotation methods have been explored to derive such a simple structure the most common ones are orthogonal and oblique rotations (Fabrigar et al., 1999). Orthogonal rotations assume that factors are uncorrelated and thereby maximize item loadings on one factor and minimize their loadings on remaining factors. Varimax represents a well-accepted orthogonal rotation procedure (Kaiser, 1958). In contrast, oblique rotations don't assume that factors are correlated, they assume intercorrelation among factors which is argued to better represent the real world (Heck, 1998). Commonly used oblique rotation procedures are quartimin (Jennrich & Sampson, 1966), promax (Hendrickson & White, 1964), and the Harris-Kaiser rotation (Harris & Kaiser, 1964).

In the embedded publications *"Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study and Implications for the Privacy Paradox* (P2) and *"Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications"* (P3) we use explanatory factor analysis to reduce the dimensionality of the datasets and derive underlying factors (e.g. privacy concerns in P2 and regulatory satisfaction in P3) for further analysis such as cluster analysis.

Cluster Analysis

Having identified underlying factors within our datasets, we employ these factors in cluster analysis to discover individuals with mutual similarities. Cluster analysis thereby partitions the dataset in a way that each individual belongs to a single cluster. Each cluster contains individuals that are similar to one another and at the same time dissimilar to individuals of other clusters (Romesburg, 2004).

Cluster analysis generally comprises three aspects: (1) the clustering algorithm, (2) the distance or variance measure, and (3) the number of clusters. Clustering algorithms can be divided into hierarchical and nonhierarchical algorithms. Hierarchical algorithms are based on a hierarchy of clusters. Such a hierarchy can be built from the bottom-up (agglomerative) by adding individuals into clusters or from the top-down (divisive) by deleting individuals from clusters (Ketchen & Shook, 1996). Agglomerative algorithms start by viewing each individual as a distinct cluster and then continuously merge individuals into one overarching cluster. Decisive algorithms work the other way around. They start by viewing all individuals as part of one cluster and then successively divide the cluster until each individual is represented by a single cluster. Popular agglomerative algorithms are single linkage, complete linkage, average linkage, centroid method, and Ward's method (Kaufman & Rousseeuw, 2009). Nonhierarchical algorithms, also known as k-means algorithms, iteratively partition individuals into k clusters where each individual is placed into the cluster to which it has the nearest mean (cluster centroid). Basically, the algorithm works as follows. Once the cluster centroids have been determined each individual is assigned to the cluster with the nearest centroid. Then the cluster centroids are recalculated and individuals are re-assigned. The algorithm terminates when an optimal solution has been found in the sense that the positions of centroids remain constant (Romesburg, 2004).

After researchers have decided which clustering algorithm they want to use, they need to choose how they measure the distance between individuals (hierarchical algorithms) or how they measure within-cluster variance (nonhierarchical algorithms). In general, hierarchical algorithms employ measures such as Euclidean distance, squared Euclidean distance, Manhatten distance, or Mahalanobis distance, and nonhierarchical algorithms use the squared Euclidean distance as they aim to minimize squared errors instead of distances (Kaufman & Rousseeuw, 2009; Ketchen & Shook, 1996; Wierzchoń & Kłopotek, 2018).

Finally, researchers need to determine the number of clusters. The most common approaches are the elbow method, the silhouette index, and the gap statistic. The elbow method plots the explained variation as a function of the number of clusters and researchers then use the number

of clusters where they identify the "elbow" in the graph (Ketchen & Shook, 1996). The silhouette index ranges from -1 to +1 and indicates how similar an individual is to its cluster compared to other clusters. When large amounts of individuals demonstrate high values then the cluster number is suitable (Rousseeuw, 1987). The gap statistic measures the total within intra-cluster variation for different values of k and compares their values to a reference dataset with random uniform distribution. Research should select the number of clusters that maximize the gap statistic (Tibshirani et al., 2001).

In the embedded publications *"Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study and Implications for the Privacy Paradox* (P2) and *"Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications"* (P3) we use cluster analysis to identify different consumer groups based on their perception of Google. In P2 we identify three clusters and in P3 five clusters.

Regression Analysis

Regression analysis describes statistical processes that are used to estimate the relationship between a dependent variable (also known as outcome) and one or more independent variables (also known as predictors) (Backhaus et al., 2015). In particular, it is used to describe relationships quantitatively, predict values of the dependent variable, and infer causality. However, regression analysis does not prove causality, it only proves correlations between a dependent variable and independent variables of a specific dataset. This is a necessary condition for causality, but not a sufficient one (Backhaus et al., 2015). To justify causality, scholars need to provide a theory that explains the relationship.

The most common type of regression analysis is linear regression. It takes a linear approach to model the relationship between a continuous, dependent variable and one or more independent variables. If it is only one independent variable the approach is called simple linear regression and if more than one independent variable is used it is called a multiple linear regression. Either way, linear regressions aim to find a line or other linear combinations (also called a model) such as a plane that closely fits the observed data based on some mathematical criterion (Freedman, 2009). In general, a simple linear regression and a multiple linear regression can be expressed through the following equations:

$$\text{Simple linear regression: } y_i = \beta_0 + \beta_1 x_i + u_i \ , \ i=1,...,n$$

$$\text{Multiple linear regression: } y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + u_i \ , \ i=1,...,n \ , \quad k=1,...,k$$

with y_i as the dependent variable, β_0 as the intercept, β_k as the coefficient of the independent variable x_k and u_i as the error term. The interpretation of the regression coefficients goes as follows: If x_k increases by one unit, y changes by β_k units, given all other independent variables are held constant.

Backhaus et al. (2015) proposes five activities to conduct a regression analysis. First, specifying the regression model. Every model is a simplified representation of reality and the appropriate level of detail is conditional upon the intended use and also on the experience of the researcher

and the available data. As a result, researchers need to decide which independent variables and which control variables are suitable to be included in the regression model and which aren't. Second, estimating the regression function. The general goal is to find a regression line or a more complex linear combination that most closely fits the observed data and hence, to minimize error terms. A common statistical estimation procedure to achieve this aim is the ordinary least squares (OLS) approach. OLS searches for a model in which the sum of squared residuals is minimized. Squaring the residuals avoids that positive and negative deviations compensate each other and incorporates that larger deviations are weighted more heavily (Hutcheson & Sofroniou, 1999). Third, evaluating the regression function. After the regression function has been estimated, its goodness-of-fit must be evaluated in the sense that it must be clarified how well it suits as a model of the observed data. Typical statistical measures to assess the goodness-of-fit of a regression function are the R-squared, the adjusted R-squared, or the F-statistic (Backhaus et al., 2015). Fourth, evaluating the regression coefficients. During this step, scholars test the null hypothesis $\beta k = 0$. They usually employ a t-test and if the test indicates a significance level of 0.05 or less then they can reject the null hypothesis and accept the alternative hypothesis $\beta k \neq 0$. Such a test result indicates that the regression coefficient βk has a statistically significant influence on the outcome variable – either positive or negative (Backhaus et al., 2015). Fifth, examining the model assumptions. Backhaus et al. (2015) outlines seven model assumptions that need to be fulfilled in linear regression analysis: (1) the model is correctly specified in the sense that coefficients βk are linear, relevant variables are included, and the number of parameters is smaller than the number of observations; (2) the error term has an expected value of zero; (3) no correlation between the error term and the predictor variables; (4) the error term has a constant variance; (5) the individual error terms are uncorrelated; (6) no multicollinearity among independent variables; (7) the error term is normally distributed.

In the embedded publication *"Objective versus Relative Risk in Privacy Decision Making: A Replication Study from Germany"* (P4), we use multiple linear regression analysis to investigate how normative and behavioral factors on privacy decision making influence hypothetical and actual disclosure.

Part B

1 Digital Platforms and Market Dominance: Insights from a Systematic Literature Review and Avenues for Future Research

Table 5. Fact Sheet Publication P1

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Publication	24th Pacific Asia Conference on Information Systems, 2020
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Analysis, Interpretation, Reporting

Abstract. Companies that take advantage of digital platforms have rapidly gained a dominant position in their respective markets. While research on digital platforms yielded new insights into winner-take-all markets, envelopment, openness, or governance, no study provided a framework that integrates those aspects and links them to market dominance. We, therefore, conduct a literature review to assess how platform owners attain market dominance. We integrated our findings into a framework that depicts the interrelations between market-level sources and platform-level sources as well as platform-level sources and their effects for market dominance. The framework conceptualizes platform dominance to help a) attain it from a platform owner perspective, b) cope with it from a competitive perspective, and c) regulate it from a policy perspective. We propose three avenues for future research: (1) the role of national sources in attaining dominance; (2) sources enabling platforms to sustain dominance; and (3) strategies to dethrone dominant platforms.

2 Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study and Implications for the Privacy Paradox

Table 6. Fact Sheet Publication P2

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Publication	54th Hawaii International Conference on Systems Sciences, 2021
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. Although individuals are concerned about their privacy, it is increasingly difficult to withdraw from privacy-invasive platform operators and keep activities private. IS research has identified the privacy paradox as a phenomenon and information asymmetries as one critical reason behind users' dichotomy between privacy concern and behavior. However, prior work neglected to investigate (1) the characteristics of consumers caught in the privacy paradox, (2) new areas of information asymmetries such as knowledge about alternative services, and (3) new privacy-decision processes such as quitting privacy-invasive platform operators. To close these gaps, we conducted a representative segmentation study of Google and its services across five countries guided by the theory of planned behavior. Our results identify three clusters and indicate that the privacy paradox is only prevalent in two of them. Consumers in these two clusters lack knowledge about data integration, data usage, and alternative services.

3 Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications

Table 7. Fact Sheet Publication P3

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Publication	24th Pacific Asia Conference on Information Systems, 2020
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. The EU is seeking to develop new regulatory frameworks for online privacy. This entails a complex set of tradeoffs, since regulatory policy must be informed by consumers' preferences, and if regulatory policy contravenes consumer preferences, regulators might need to explain the hidden sources of harm to consumers. To increase our understanding of consumers' attitudes towards firms that monetize privacy, we surveyed 1693 individuals from Denmark, France, Germany, the UK, and the USA about Google. Our cluster analysis confirms the privacy paradox – although consumers disapprove of Google's practices, they still use it – in four out of five clusters but indicates two different explanations: some consumers cannot locate a viable alternative, whereas others lack the information needed for their privacy calculus. We explore regulatory implications and draw upon the theory of newly vulnerable markets to discuss whether market entry may be feasible.

4 Objective versus Relative Risk in Privacy Decision Making: A Replication Study from Germany[4]

Table 8. Fact Sheet Publication P4

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Publication	AIS Transactions on Replication Research, 2020
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. This study reinvestigates the effects of normative and behavioral factors on privacy decision making by conducting a methodological replication of Adjerid et al. (2018). While the normative perspective regards consumers with stable preferences making rational choices, the behavioral perspective regards consumers with unstable preferences making irrational choices due to heuristics and biases. In three experiments, we demonstrate that normative and behavioral factors influence hypothetical but not actual choice. Our results, therefore, confirm the findings of the original study that objective differences in privacy protections influence

hypothetical choice. However, in contrast to the original study, we found that relative changes in privacy protection did not influence actual but hypothetical disclosure as well. We argue that individuals have developed a stronger disposition toward privacy since the original study and that our German student sample represents a more privacy-sensitive case than the American Amazon Mechanical Turk sample. As a consequence, participants may have not been willing to indicate their true choice in the actual setting. In other words, effects may exist in the actual setting, but may not be elicitable from privacy-sensitive individuals. Future research is encouraged to explore other biases and the moderating effect of disposition to privacy.

5 Breeding Grounds of Digital Platforms: Exploring the Sources of American Platform Domination, China's Platform Self-Sufficiency, and Europe's Platform Gap

Table 9. Fact Sheet Publication P5

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Publication	28th European Conference on Information Systems, 2020
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Collection, Data Analysis, Interpretation, Reporting

Abstract. EU firms are largely dominated by American platforms in online consumer-facing markets as well as cloud computing services and are likely to face domination in further markets. In contrast, China has mainly escaped American domination and established a self-sufficient platform economy. This situation provides the opportunity to move beyond research on platform-level and market-level sources of platform power and to assess national and historic sources that foster the power of digital platforms. Understanding different platform breeding grounds is essential to guide EU regulators toward a self-sufficient European platform economy

and to help them protect EU firms from the risk of exploitation by dominant platforms. These insights are also important to develop a theory of platform regulation, especially as dominant platforms violate EU laws. To address this gap, this study builds upon 32 expert interviews across 7 EU countries and 19 industries. Our results indicate that in general, a fragmented market, risk-aversion, lack of local clusters, and lack of funding and, more specifically, late entrance, legacy systems, and historic dependence have led to the EU's platform gap. We discuss why and how EU regulators should intervene and propose a regulatory strategy that establishes a self-sufficient EU platform economy.

6 Business Model Innovation and Stakeholder: Exploring Mechanisms and Outcomes of Value Creation and Destruction

Table 10. Fact Sheet Publication P6

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Publication	14th International Conference on Wirtschaftsinformatik, 2019
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Collection, Data Analysis, Interpretation, Reporting

Abstract. Given the objective of the focal firm to generate value for stakeholders, this research aims at assessing mechanisms and outcomes for value creation and destruction between business model innovation (BMI) and stakeholders. To achieve this goal, we conduct a systematic literature review and apply grounded theory as coding scheme. Taking frequent mechanisms and outcomes into account, we construct a conceptual framework and pioneer theory building. As main result, we identify BMI creating economic return for third parties and product/service access for customers. Both outcomes are based on the mechanism of altering resources and processes. In contrast, analyzing stakeholder's main influence, we find management creating strategic orientation by providing know-how. Our research agenda emphasizes the design of BMI from an ecosystem perspective and the destructive consequences of BMI. While the ecosystem level of analysis provides new insights into the concept, investigating negative impacts contributes to a more holistic understanding of BMI.

7 The Digital Transformation of the Healthcare Industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients[5]

Table 11. Fact Sheet Publication P7

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Publication	Business Research, 2020
Status	Published
Contribution of First Author	Problem Definition, Research Design, Data Analysis, Interpretation, Reporting

Abstract. While traditional organizations create value within the boundaries of their firm or supply chain, digital platforms leverage and orchestrate a platform-mediated ecosystem to create and co-create value with a much wider array of partners and actors. Although the change to two-sided markets and their generalization to platform ecosystems have been adopted among various industries, both academic research and industry adoption have lagged behind in the healthcare industry. To the best of our knowledge current Information Systems research has not yet incorporated an interorganizational perspective of the digital transformation of healthcare. This neglects a wide range of emerging changes, including changing segmentation of industry market participants, changing patient segments, changing patient roles as decision makers, and their interaction in patient care. This study therefore investigates the digital transformation of the healthcare industry by analyzing 1830 healthcare organizations found on Crunchbase. We derived a generic value ecosystem of the digital healthcare industry and validated our findings with industry experts from the traditional and the start-up healthcare domains. The results

indicate 8 new roles within healthcare, namely: information platforms, data collection technology, market intermediaries, services for remote and on-demand healthcare, augmented and virtual reality provider, blockchain-based PHR, cloud service provider, and intelligent data analysis for healthcare provider. Our results further illustrate how these roles transform value proposition, value capture, and value delivery in the healthcare industry. We discuss competition between new entrants and incumbents and elaborate how digital health innovations contribute to the changing role of patients.

8 A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities

Table 12. Fact Sheet Publication P8

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Abstract. Platform envelopment describes a competitive move whereby a digital platform enters an adjacent market. On one hand, it might enable to dethrone an established platform. On the other hand, it might give rise to the creation of platform conglomerates, which increases the concentration of private power. Therefore, platform envelopment has recently attracted significant attention from regulators and scholars. However, the traditional view of platform envelopment does not consider recent platform envelopment practices observed in research and practice. In this study, we aim to determine and structure the complexity of platform envelopment. We investigated 20 cases and developed a taxonomy of platform envelopment. We further encoded these cases into the comprehensive taxonomy and derived platform envelopment patterns and particularities. Our work contributes to research by establishing a foundation for the conceptual understanding of platform envelopment. Regulators can use this taxonomy to classify platform envelopment cases and determine potentially anti-competitive conduct.

9 Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms

Table 13. Fact Sheet Publication P9

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Abstract. Companies that operate digital platforms are growing rapidly. Theoretical and empirical research has largely explored digital platforms in the context of digital-native companies. Only a small set of research explores how incumbent firms transition into the platform economy. However, this stream of research has studied incumbents under the assumption that they can either build a platform or join an existing platform. In contrast, the results of our multiple case study demonstrate that incumbents pursue multiple platform strategies simultaneously and that their strategic options range from building and joining a platform over investing in and acquiring a platform to using white-label platforms. The white-label strategy uses the platform technology of a white-label platform owner to match the users of the incumbent with the complementors of the white-label platform. Based on the results, which further illustrate the motivations to pursue each strategy, we discuss strategic differences between asset-heavy and asset-light incumbents

Part C

1 Summary of Results

Based on the nine publications embedded in this thesis, we address the three research questions by first identifying the sources of power of digital platforms, second describing the impact of digital platforms, and third exploring how European firms can compete in the platform economy. Below, we summarize the results for each research question.

RQ1: *What are the sources of power of digital platforms?*

Sources at the platform level. Following a systematic literature review **(P1)**, we identified openness, pricing, ecosystem management, existing market power, and entry timing as critical strategies for digital platform to attain market dominance. We operationalized market dominance with five dimensions including end-user network, complementor network, economic profitability, platform architecture, and platform scope. For each strategy, we described its effects for different dimensions. For instance, the degree of platform openness affects the development of the complementor network and the platform scope. High openness towards complementors increases the number of complementors as well as the amount and quality of their complements. As a result, the platform enjoys a wider scope and is able to better differentiate itself vis-à-vis competitors. However, excessive openness towards complementors can also increase platform imitation, or more precisely platform forking, which enables competitors to exploit a platform's shared resources to build a competing platform.

Sources at the market level. In the systematic literature review **(P1)** we also revealed the role of network effects, technological trajectories, and external parties for attaining market dominance. We identified that these market-level sources influence how strategies on the platform level are operationalized. Different market environments require different strategies to attain market dominance. For example, technological trajectories represent complementary and substitutive technologies that are emerging on the market. Consequently, these technologies impact the strategies and evolution paths of digital platforms. Increasing competition and quicker technology cycles imply that digital platforms ecosystems need to adapt how they manage ecosystem actors and how they price the two sides of the market. Not each strategic operationalization is suitable or even available in each market context. Although the literature provides a rich set of explanations for the sources of power of digital platforms on the market level, it has omitted to pay larger attention to the characteristics, behaviors, and biases of consumers. In two cluster analyses **(P2 and P3)** and one experiment **(P4)**, we dive into the empirical context of privacy and derive consumer privacy knowledge **(P2 and P3)** and consumer privacy decision-making **(P4)** as important market-level sources shaping the power of platforms. On the one hand, we identified that consumers that are caught in the privacy paradox - the dichotomy between privacy concern and behavior - lack general knowledge about information privacy **(P2)** and that consumers, in general, are largely unaware of specific information privacy practices of diversified platform owners **(P3)**. In both studies, the results indicate the consumers especially lack knowledge along the dimensions of data integration and data usage in contrast to data collection. Hence, privacy information asymmetries between platform owners and consumers represent an important explanation for the privacy paradox and thereby also a critical market-level source of power. On the other hand, we demonstrate that

consumers make irrational privacy decision choices due to heuristics and biases **(P4)**. Our replication study reveals that relative changes in privacy protection influenced consumers' hypothetical disclosure and that those results would be likely robust across the actual disclosure setting if the privacy-sensitive sample would have indicated their true disclosure choice. Although the latter remains hypothetical it has been empirically demonstrated by the original study that relative changes indeed influence actual disclosure. As a result, platform owners are able to leverage consumers' irrational privacy decision-making to their advantage.

Sources at the national and historic level. In addition to platform-level and market-level sources of power, digital platforms have also largely profited from historic circumstances and national environments to gain power. In an interview-based study with European executives, we identified these national and historic sources by reviewing American platform domination, China's platform self-sufficiency, and Europe's platform gap **(P5)**. Our results reveal that both, American platforms and Chinese platforms, have profited from an entrepreneurial and digital mindset, a single market, state financing, and local clusters. For instance, while American and Chinese platforms can rollout their platforms to millions of potential users within their home market, European platforms have to adapt their rollouts to the different languages, laws, and consumer preferences in each European country. Our results also indicate sources that are specific to American platform domination and China's platform self-sufficiency. American platforms were able to exploit first-mover advantages, renowned technical universities, historic partnerships, and access to venture capital. For example, American universities were among the first to emphasize technical areas such as computer science and information systems, which allowed American platforms to quickly and continuously access high-potential software engineers. In contrast, Chinese platforms profited from China's rivalry with America, market foreclosure, and a greenfield approach. For instance, China skipping desktop computing and directly moving to mobile computing, allowed Chinese platforms to benefit from radical innovations associated with digitalization and platformization, whereas European firms struggled to transform their business models due to legacy systems and rigid structures.

RQ2: *How do digital platforms affect consumers and organizations?*

Positive effects. As part of a literature review on business model innovation and stakeholder **(P6)**, we derived how platform-based business models created different forms of value for consumers, third-party organizations, and the organization operating the platform. On the one side, platform-based business models provided consumers broader product and service choices as internal systems have been opened for third-party innovations. For instance, mobile portals only featured the operator's products and services at the time until the shift to the application creation and distribution paradigm provided consumers the benefit of accessing third-party products and services. As a result of opening systems and employing app stores, third-party organizations benefited from new sales channels and economic return. On the other side, third-party organizations, consumers, as well as the organization operating the platform profited from value co-creation. For instance, third-party developers profited from the platform's provision of boundary resources to create new applications for new operating systems and devices. Consumers profited in the way that they have been actively involved in an organization's open innovation projects and were thereby able to contribute their own ideas to the development of

new products. For example, LEGO created a digital platform to continuously involve users in the ideation of new LEGO themes. Organizations operating the platform profited from the complementary innovations of their ecosystem and economies of scope on the demand-side. Moving from the impact of single platforms to the impact of multi-platform operations, we developed a taxonomy of platform envelopment and identified how vertical platform envelopment benefits the platform owner **(P8)**. Vertical envelopment allows the platform owner not only to capture the rents of complementors and competitors but also to establish integration efficiencies and create super-additive value. The latter two benefits are especially advantageous to multi-platform owners as they are unavailable to non-diversifiers and thereby offer a competitive advantage. Operating multiple platforms provides also the opportunity to share data across platforms further improving their competitive advantage if that data is not obtainable to non-diversifiers. As a result of these conglomerate advantages, multi-platform owners can sustain the dominant position of their core platform and quickly establish new dominant platforms. Having explored the impact of single platforms and platform envelopment, we changed the level of analysis and investigated how the digital transformation in the healthcare industry enabled its transition from linear value chains to platform-mediated markets **(P7)**. Compared to the traditional healthcare industry, we identified eight new roles within the digital healthcare industry. Those are information platforms, data collection technology, market intermediaries, services for remote and on-demand healthcare, augmented and virtual reality provider, blockchain-based personal health records, cloud service provider, and intelligent data analysis for healthcare provider. Based on those roles we explain the transformation of the healthcare industry along the dimensions of value proposition, value capture, and value delivery. Diving deeper into the value delivery transformation, the results show that emerging organizations are primarily adopting exchange and community platforms while also scarce efforts of creating innovation platforms exist. For instance, telemedicine providers facilitate healthcare delivery among healthcare provider and patients, online communities foster interaction among patients, and a small number of organizations open their platforms via boundary resources. These platform-based organizations have fundamentally transformed healthcare delivery from one that is focused on acute value delivery towards one in which connected, remote, and preventive care is delivered from a network of actors including patients themselves. For example, blockchain-based personal health records enable patients to share their data with other actors such as intelligent diagnostics provider and thereby co-create value in form of better datasets and algorithmic outcomes.

Negative effects. As an outcome of the literature review on business model innovation and stakeholder **(P6)**, we propose that future research needs to assess how platform-based business models destroy value for stakeholders. The literature has largely contributed to understanding the positive effects of digital platforms and neglected to examine their dark sides. Within our future research agenda, we identify negative externalities among sharing platforms as one concrete example of these dark sides. For instance, among accommodation-sharing platforms, it is often the case that hosts do not pay lodging taxes. As a result, municipalities lose tax revenues and hotels encounter unfair competition since hosts don’t need to incorporate taxes into their prices. In addition, landlords find their long-term tenants turning into short-term landlords, unrightfully enriching themselves and bypassing rent stabilization laws. Another group of indirect stakeholders, neighborhoods, claim to be run over by short-term guests who

bring noise, occupy parking spaces, and increase traffic. Taken together, negative externalities of accommodation-sharing platforms can decrease the amount of housing and increase rent prices. Besides causing negative externalities, one pattern within our platform envelopment taxonomy **(P8)** reveals that digital platforms can also have negative effects for competition. We termed this pattern radical envelopment and it refers to the phenomenon of an enveloper using its core platform to self-preference or bundle its new platform and using it to interfere with target platforms. Thus, core platforms are used for deliberately privileging new platforms and deliberately impairing target platforms. A large amount of these practices has already been ruled anti-competitive in courts and are currently under further scrutiny by regulators.

RQ3: *How can European firms compete in the platform economy?*[6]

The results of a multiple case study **(P9)** on three incumbents from the Chemistry, Construction, and Banking industry demonstrate that incumbents pursue multiple transition strategies and one of the incumbents is exploring a new strategy by leveraging a white-label platform.

In particular, when incumbents transition from one strategy to another they do not exclusively pursue the new strategy. In contrast, all three incumbents pursue multiple strategies simultaneously. For example, ConstructionCo pursues investing in a spin-off, investing in an existing platform firm, joining the spin-off's platform, joining transaction platforms of existing firms, and developing an innovation platform at the same time. Interestingly, incumbents often combine investing in a spin-off and joining the spin-off's platform and thus, support the growth of a platform made by industry insiders. This has been mentioned as critical since incumbents aimed to pre-empt industry outsiders such as pure technology firms to enter the industry and achieve a strategically important position.

The white-label platform strategy has been pioneered by an incumbent in the banking industry. The strategy describes how incumbents use the platform technology of a white-label platform owner to connect their complementors with the users of the white-label platform owner. In the banking case, this meant that customers of the incumbent had access to deposit products offered by third-parties on top of the white-label platform. Following a white-label strategy has the advantage of saving costs for building and maintaining a platform. Another advantage is that incumbents access the already existing network of complementors of the white-label platform owner and can thereby instantaneously supply third-party products and services. Hence, incumbents save the costs of acquiring and maintaining a complementor ecosystem. The disadvantage, however, is that incumbents can become strategically dependent on the white-label platform owner. Moreover, they cannot influence the evolution of the platform technology and forgo the opportunity to gain platform-specific capabilities and knowledge.

Table 14 gives an overview of the key results of this thesis.

[6] To understand how European firms can compete in the platform economy we (1) investigated how incumbents can transition into the platform economy (presented here in part C: Part 1) and (2) discussed different regulatory issues in the embedded publications (the synthesize of these discussions is presented in part C: Part 2.2 and 2.3).

Table 14. Overview of the Key Results of this Thesis

P	RQ	Findings
P1	RQ1	▪ Integrated framework explaining the interconnection between platform-level and market-level and sources for market dominance of digital platforms. ▪ Market-level sources refer to network effects, technological trajectories, external parties, while platform-level sources include openness, pricing, ecosystem management, existing market power, and entry timing. ▪ Three avenues for future research on digital platforms and market dominance: (1) the role of national sources in attaining dominance, (2) sources enabling platforms to sustain dominance, and (3) strategies to dethrone dominant platforms.
P2	RQ1	▪ Characterization of consumers exhibiting the privacy paradox based on age, nationality, beliefs, attitudes, and behavior. ▪ From the three clusters, two clusters indicate medium levels of the privacy paradox and one cluster demonstrates a low level of the privacy paradox. ▪ Clusters with medium levels of the privacy paradox indicate a lack of general information privacy knowledge, especially about data integration and data usage.
P3	RQ1	▪ Consumers report low levels of informed consent about specific information privacy practices of diversified platform owners. ▪ The privacy paradox is prevalent in four out of five clusters and indicates two different explanations: the lack of a viable alternative and the lack of information privacy knowledge. ▪ Although consumers prefer to use safe alternatives, the results provide three reasons why consumers do not use them: (1) unawareness of the hidden costs of existing services, (2) inability to locate safe alternative with the same scope of functionality, (3) unwillingness to pay for safer alternatives.
P4	RQ1	▪ Confirmation of the original study in that objective differences in privacy protections influence hypothetical disclosure. ▪ Contradiction of the original study in that relative changes in privacy protection did not influence actual but hypothetical disclosure. ▪ Consumers' are prone to irrational privacy decision-making which can be exploited by platform owners. ▪ Participants with strong dispositions to privacy are likely to not reveal their true choice in the actual disclosure setting.
P5	RQ1	▪ An overview of the historic breeding grounds of digital platforms based on American platform domination, China's platform self-sufficiency, and Europe's platform gap. ▪ American platforms and Chinese platforms have both profited from an entrepreneurial and digital mindset, a single market, state financing, and local clusters. ▪ Sources specific to American platform domination were first-mover advantages, renowned technical universities, historic partnerships, and access to venture capital. ▪ Sources specific to China's platform self-sufficiency were China's rivalry with America, market foreclosure, and a greenfield approach.
P6	RQ2	▪ Framework explaining how business model innovation creates value for stakeholders and how stakeholders create and destroy value for business model innovation.

		▪ Platform-based business models have positive effects for third-parties in form of new sales channels, economic return, and value co-creation. ▪ Platform-based business models have positive effects for consumers in form of broad access to third-party products and services and value co-creation. ▪ Platform-based business models have positive effects for organizations operating platforms in form of complementary innovations of their ecosystems and economies of scope on the demand-side. ▪ Two avenues for future research on business model innovation: (1) designing business model innovation from an ecosystem perspective, (2) exploring value destruction of business model innovation.
P7	RQ2	▪ A generic value ecosystem for the traditional healthcare industry and a generic value ecosystem for the digital healthcare industry ▪ Identification of eight new roles within the digital healthcare industry: information platforms, data collection technology, market intermediaries, services for remote and on-demand healthcare, augmented and virtual reality provider, blockchain-based personal health records, cloud service provider, and intelligent data analysis for healthcare provider ▪ These roles transformed the healthcare industry's value proposition, value capture, and value delivery. ▪ Platformization transformed healthcare delivery from acute value delivery to connected, remote, and preventive care delivered through a network of actors including patients themselves.
P8	RQ2	▪ A taxonomy of platform envelopment consisting of the meta-characteristics core platform and new entity, and of 11 dimensions. ▪ Three patterns of platform envelopment: horizontal envelopment of platform competitors, vertical envelopment of platform competitors, and vertical envelopment of platform complementors. ▪ Vertical envelopment has positive effects for the platform owner in terms of conglomerate advantages. ▪ Radical envelopment is prone to have anti-competitive effects.
P9	RQ3	▪ Identification of platform transition strategies ranging from building and joining a platform over investing in and acquiring a platform to using a white-label platform. ▪ Using a white-label platform describes how incumbents employ the platform technology of a white-label platform owner to connect their complementors to the users of the white-label platform owner. ▪ The advantages of this strategy are access to existing complementors and cost savings. The disadvantages include strategic dependency, lack of influence on platform evolution, and forgone opportunity to build platform-specific capabilities and knowledge. ▪ Incumbents pursue multiple transition strategies simultaneously in contrast to pursuing them exclusively.

2 Discussion

Based on the summary of results, we discuss our findings along three themes that are of interest with regard to the related body of knowledge. First, we discuss how our work challenges the assumption that digital platforms are operated in isolation or dyads. Second, we discuss how our results support the need for regulatory intervention. Third, we discuss how our work contributes to a European strategy for platform regulation.

2.1 Moving beyond Single Platforms and Platform Dyads towards Platform Conglomerates and Digital Conglomerates

Across research disciplines, the focus of research on organizations operating digital platforms overwhelmingly lies on single digital platforms or dyads of digital platforms. Although these research streams provide important insights into areas such as governance (Schreieck et al., 2016; Tiwana, 2014), openness (Benlian et al., 2015; Ondrus et al., 2015), modularity (Baldwin & Clark, 2000; Wulf & Blohm, 2020), value co-creation (Ceccagnoli et al., 2011; Hein, Weking, et al., 2019; Vargo et al., 2008), boundary resources (Eaton et al., 2015; Ghazawneh & Henfridsson, 2013; Karhu et al., 2018), competition (Armstrong, 2006; Cennamo, 2019; Karhu & Ritala, 2020; Rietveld & Schilling, 2020), and envelopment (Condorelli & Padilla, 2020; Eisenmann et al., 2011), they neglect to account for the fact that some organizations operate a variety of strategically linked digital platforms. For example, Google is often viewed as a search platform (Iacobucci & Ducci, 2019) or as a mobile platform managing and competing against its third-party application providers (Foerderer et al., 2018). However, Google as an organization is much more than a search engine or an operating system provider, the organization operates platforms in various markets such as music streaming, video streaming, mapping, browser, flight comparison, voice assistants, and cloud storage (P2, P3, P5, and P8). Strategic linkages between platforms are also not bound to platform dyads as Google uses its operating system to preinstall multiple platforms or its voice assistant and browser to provide its search engine preferential treatment. As a result, examining single platforms or dyads of platforms is unsuitable to understand large platform organizations in their entirety and the power of a platform that is embedded within a large platform organization. At the same time, we also recognized that some of these organizations are product-heavy and some are product-light (P9). For example, Apple operates not only various digital platforms but also consumer devices (P8) whereas organizations such as Grab[7] operate only digital platforms without operating any physical products. Additionally, we identified that data does not only play a vital role in algorithmic learning and data network effects of *single* digital platforms (Gregory et al., 2020; Hagiu & Wright, 2020a, 2020b), but that data represents a sharable asset that can be utilized *across* platforms to improve their competitive advantage (Condorelli & Padilla, 2020; Hermes, Kaufmann-Ludwig, et al., 2020) (P8). These three observations – (1) strategic linkages between platforms, (2) product-heavy versus product-light platform

[7] https://www.grab.com/sg/

organizations, and (3) data as sharable assets - are supported by the organizations that we analyzed in this thesis (P2, P3, P5, P8, and P9).

As a consequence, research on digital platforms needs to incorporate related concepts and theories such as diversification (Ahuja & Novelli, 2017; Markides & Williamson, 1994; Wan et al., 2011) or conglomerates (Bourreau & De Streel, 2019; Lim, 2020) to capture those observations or build new theories. To this end, we discuss two concepts to better differentiate the heterogenous types of large platform organizations observed in our studies: Platform conglomerates and digital conglomerates. Platform conglomerates are organizations that operate multiple digital platforms that are usually closely related and no physical products. A prime example is the organization Grab. Grab is operating digital platforms for food delivery, package delivery, on-demand mobility, payment, hotel booking, and ticket booking. In contrast, digital conglomerates are organizations that operate multiple digital platforms that are usually not related in an obvious way and physical products. Amazon, for instance, operates platforms in music streaming, cloud storage, e-commerce, video streaming, and mobile operating systems, but also physical products such as smart speakers and smart streaming devices (P8). Figure 6 illustrates the concepts of single platforms, platform dyads, platform conglomerates, and digital conglomerates.

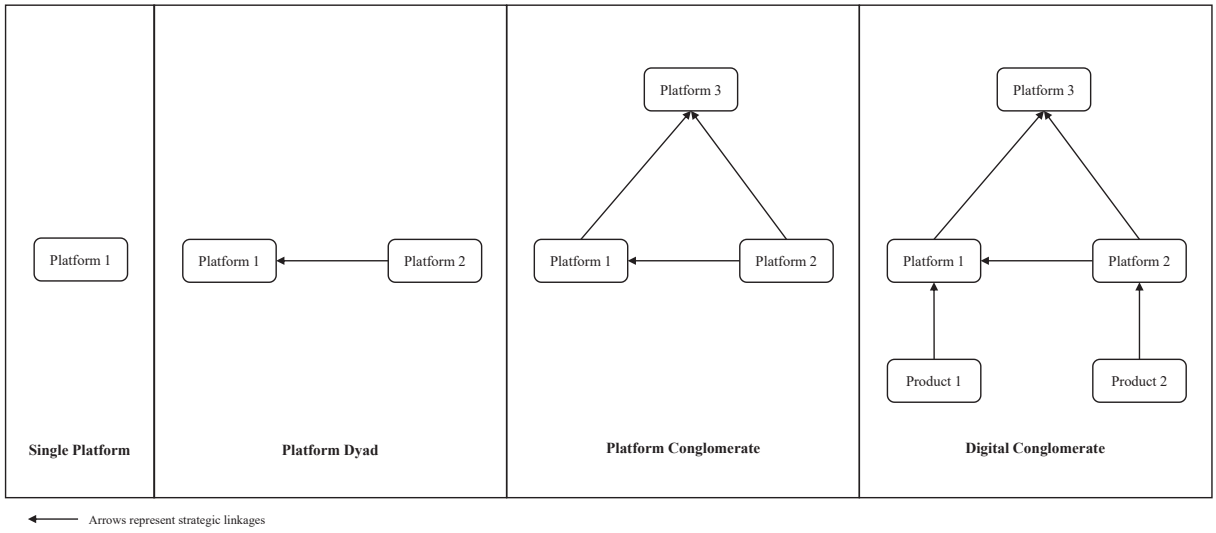

Figure 6. A Conceptualization of Single Platforms, Platform Dyads, Platform Conglomerates, and Digital Conglomerates

Independent of being a platform conglomerate or a digital conglomerate, such organizations can leverage strategic linkages between their platforms and products. Strategic linkages range from preinstallation and interoperability (Hermes, Clemons, Schreieck, et al., 2020; Li & Agarwal, 2016) over preferencing (Edelman & Lai, 2016; Hermes, Guhl, et al., 2021; Iacobucci & Ducci, 2019) and setting something as default to bundling (Condorelli & Padilla, 2020; Edelman, 2015; Hermes, Kaufmann-Ludwig, et al., 2020) to marketing promotion (see P5, P8, and P9). On a more general level, strategic linkages refer to an organization's decision to nudge, and under severe circumstances, to force consumers to use another platform of that organization. Through strategic linkages platform conglomerates and digital conglomerates can gain competitive advantages over single platform owners. On top of exploiting single strategic linkages, platform conglomerates and digital conglomerates often combine strategic linkages.

This practice further increases users' incentives to adopt a new platform and establishes a linking/nudging strength that is unmatchable by non-conglomerates. The combination of linkages is only available between platforms or platforms and products, but not between products since strategic linkages occur on the software and not on the hardware layer. The combinations of linkages result in the four phenomena.

First, two or more strategic linkages between a product and a platform. For example, an operating system being interoperable with the hardware and also preinstalled. The more linkages the stronger the link between both. Second, two or more strategic linkages between two platforms. Such a combination represents a strong link whereas platforms combined by one strategic linkage are considered a weak link. Third, two or more platforms link to another platform. For instance, an operating system preinstalling a search engine and a browser setting that search engine as a default. The more platforms link to another platform the stronger the strategic linkage to that platform. Fourth, one platform links to two or more platforms. For instance, an operating system can preinstall multiple platforms. The more platforms one platform links to the stronger its linking capability. Figure 7 visualizes the four phenomena of combining strategic linkages. Product 1 demonstrates the phenomenon (1), Platform 1 shows the phenomena (2) and (4), and Platform 3 illustrates the phenomenon (3). The different designs of the arrows represent different types of strategic linkages.

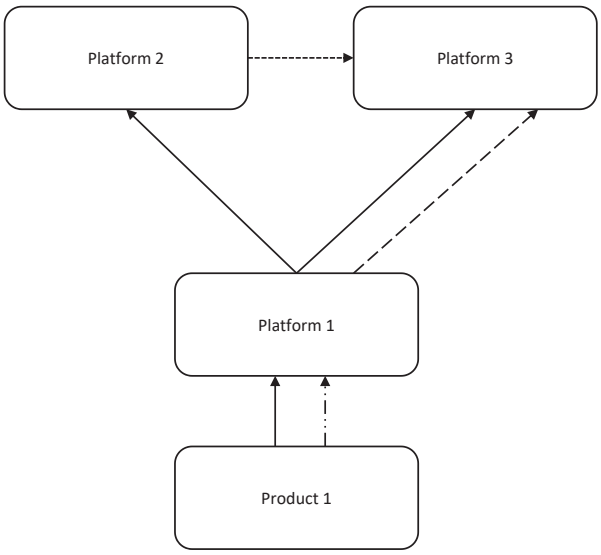

Figure 7. Combining Strategic Linkages

In addition to leveraging strategic linkages, platform conglomerates and digital conglomerates are able to collect a variety of data from users' online and offline behavior. Especially digital conglomerates are well equipped to collect offline data since they operate consumer-oriented products. As a result, platform conglomerates and digital conglomerates can leverage a larger pool of data than single platform owners. The advantage of such a pool of data is that the data is largely sharable across platforms (P8) and that some of the data is strategic and thereby non-obtainable by non-diversifiers. In combination with human-written or machine-generated algorithms, conglomerates exploit two competitive advantages. First, the generation of strategic information about users, and second, the development of strategic, platform-specific algorithms.

The first advantage builds on the capability of conglomerates to integrate user data from different platforms into comprehensive user profiles. These profiles are analyzed by internal algorithms to refine user data into user information. The information becomes strategic because it builds on strategic data and/or because profiles are analyzed through strategic algorithms. Either way, conglomerates generate strategic user information that flows back into the profile turning the profile strategic as well. The second advantage represents the capability to use these strategic user profiles as an information base across platforms and to employ existing algorithms, or parts of the code or of the pre-trained models, among other platforms to improve their algorithms. Thus, by utilizing strategic profiles and/or strategic algorithms as the foundation of a new platform, conglomerates can develop a strategic algorithm for a new platform as well.

As a result of the proposed strategic linkages and competitive advantages, platform conglomerates and digital conglomerates can leverage competitive strategies unavailable to non-diversifiers to sustain dominance in existing markets and to establish platforms with market power in new markets (P8). Linking those insights from the discussion with the results to research question one, we identify that the power of a single platform is contingent upon four sources: platform sources, conglomerate sources, market sources, and national sources (see Figure 8).

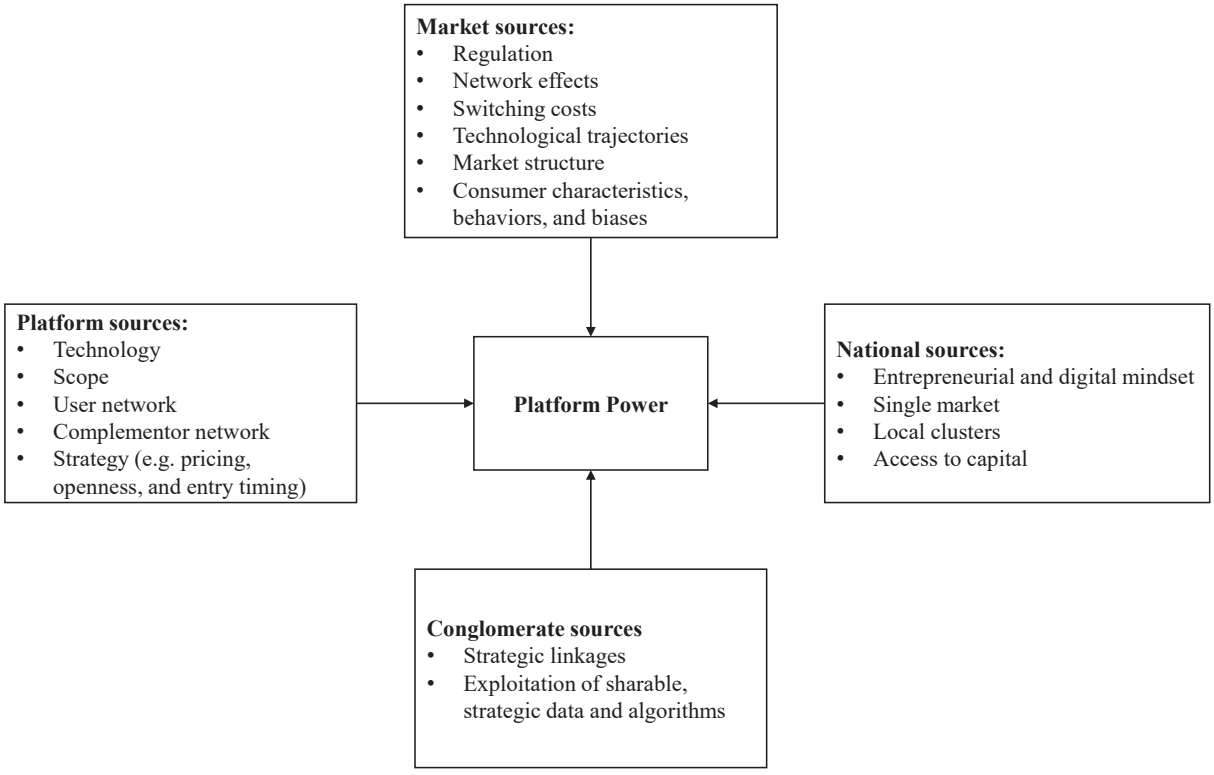

Figure 8. Platform Power as Outcome of Four Sources of Power based on (Hermes, Clemons, Schreieck, et al., 2020; Hermes, Kaufmann-Ludwig, et al., 2020; Hermes, Pfab, et al., 2020)

2.2 The Need for Regulatory Intervention in the Platform Economy

Digital platforms transformed the way consumers search for information, communicate, shop, travel, and date. They have also transformed the way organizations distribute products, find

human capital, collect data, and store data. In the process, digital platforms created enormous economic surplus for consumers and businesses. Nonetheless, digital platforms have also raised issues about competition (Bostoen, 2018; Edelman, 2015; Khan, 2016; Srinivasan, 2019, 2020), discrimination (Edelman et al., 2017; Edelman & Luca, 2014), privacy (Srinivasan, 2019), labor protection (De Stefano, 2015), and democratic processes (Allcott & Gentzkow, 2017). We discuss our results in the light of the literature stream that addresses concerns about competition and market contestability (Clemons & Madhani, 2010; Edelman, 2015; Khan, 2016; Srinivasan, 2020). In particular, we discuss the feasibility of new entry in markets operated and especially dominated by platform conglomerates and digital conglomerates based on two arguments: technological discontinuities and consumer preferences. In combination with increasing abuses of power, we conclude that regulatory intervention is needed.

Technological discontinuities are innovations that radically trigger significant cost or quality advantages (Anderson & Tushman, 1990). In the digital platform economy, these innovations refer to new technologies such as artificial intelligence in general and machine learning and deep learning in particular as well as smart products like smart cars, smart TVs, smart speakers, and smartwatches. Prior work has argued that technological discontinuities can reduce entry barriers and offer an opportunity for new entry (Suarez, 2004). However, we argue that technological discontinuities do not level the playing field in markets dominated by platform conglomerates and digital conglomerates. Instead, they enable conglomerates to sustain dominance in their core market and build dominance in new markets. For instance, artificial intelligence greatly benefits from large data sets which are usually not available to new entrants to the same degree as they are available to conglomerates (P5 and P8). Consequently, new entry encounters difficulties to replicate or even surpass the value created by conglomerates. Consumers will therefore continue using services of conglomerates to maximize their utility which enables conglomerates to extend their data advantage over new entry which further increases their value to consumers (Zuboff, 2019). We argue that this positive feedback loop hampers the ability of new entrants to exploit new information technologies and to offer new services rendering markets operated by conglomerates largely incontestable.

Similarly, smart products might also enhance the competitive advantage of conglomerates instead of leveling the playing field in markets emerging for and around smart products. Our argument is three-fold. First, since large amounts of conglomerates already operate mobile operating systems, they can more easily adapt their existing operating systems to new hardware compared to new entry building operating systems from scratch. Hence, in the market for operating systems for smart products conglomerates enjoy significant advantages that represent high barriers to entry for new competitors. Second, in markets emerging around smart products, conglomerates can leverage their control over relevant information domains (Hermes, Riasanow, et al., 2020; Schreieck et al., 2019). As conglomerates are collecting a variety of data from their existing platforms and services, they can exploit that data to provide new platforms and services in smart product markets competitive advantages. In the automotive context, for example, conglomerates operating smartphone operating systems can leverage users' smartphone location data to provide more efficient services for autonomous driving compared to automotive companies that may operate car operating systems but who are unaware of users' location (Schreieck et al., 2019). Automotive companies might even be commodified if

conglomerates decide to build their own car operating systems. That is because, in combination with their smartphone operating systems, conglomerates control sufficient information domains to offer mobility services independent of the underlying car. In the healthcare industry, we discuss the same issue (P7). Since conglomerates control a vast amount of healthcare-related user data such as health search queries, purchased medical products, movement data, or life-style data, they enjoy significant advantages over new entry – especially over the ones that are focusing on simple rather than complex medical solutions (Hermes, Riasanow, et al., 2020). In combination with conglomerates' analytical capabilities and their increasing control over new smart products such as smartwatches or smart glasses (e.g. for exercising in virtual reality), the barriers to entry into simple medical solutions are likely to increase. Third, controlling smart products and their operating systems allows digital conglomerates to shift their existing platforms and services into new eras. By eras, we refer to periods in which consumers indicate a specific way to enter the digital economy. At the beginning of the Internet, the common way to enter the digital economy were PCs and browsers. In the next era, consumers shifted largely to smartphones and app marketplaces. Currently, smart speakers and smart wearables mark the beginning of a new era. Consumers' pathways through the digital economy are therefore of changing nature. As a consequence of a shift from one era to another (or at least from a new era co-existing with previous ones), digital conglomerates could be replaced in some markets by new rivals. This might be a reason why most digital conglomerates operate a variety of consumer devices and operating systems since the operation of those products allow digital conglomerates to shift the success of higher-level platforms and services from one era to another. For instance, Google without control over a mobile operating system and a browser could have forfeited its dominant position of the desktop search era when entering the smartphone era. Similarly, Microsoft might have remained in a dominant position in the browser market if it had recognized the shift from desktop to mobile and built a mobile operating system and a smartphone as early as Apple and Google. Hence, by exploiting their control over smart products and operating systems, digital conglomerates remain dominant in their core consumer-facing markets and are unlikely to be successfully contested in those markets by new entry.

Having discussed why technological discontinuities in the digital platform economy are unlikely to render markets operated and dominated by conglomerates contestable for new entry, we move to our second argument: Consumer preferences do not weaken the competitive advantage of conglomerates.

On the one hand, consumers are largely concerned about their online privacy (P2) and largely dissatisfied with specific, privacy-related practices of conglomerates such as Google (P3). However, both studies indicate that most consumers continue using conglomerate services revealing that they are caught in the privacy paradox (Hermes, Clemons, Wittenzellner, et al., 2020; Hermes, Sutanrikulu, et al., 2021). In addition, consumers are unwilling or unsure to pay for safe alternatives – alternatives that are less privacy-violating (P3). Thus, although consumers demonstrate to value privacy, they value it less than capability and the absence of charges. Consequently, consumer preferences are decreasing new entry's opportunities to contest these markets with safe alternatives.

On the other hand, consumers prefer the super-additive value creation (Schreieck et al., 2019) and integration efficiencies (Li & Agarwal, 2016) of conglomerates (Hermes, Clemons, Schreieck, et al., 2020; Hermes, Kaufmann-Ludwig, et al., 2020). Since the value of a conglomerate's multi-platform bundle is greater than the sum of the values of the individual platforms, consumers would lose value if they switched to less integrated platform owners (P8). Thus, consumer preferences enable conglomerates to sustain and extend their dominant positions and disadvantage single platform providers in these markets (P5).

To conclude, since both – technological discontinuities and consumer preferences – are not likely to render markets operated and dominated by conglomerates contestable for new entry, and since conglomerates are increasingly abusing their power (Edelman, 2015; European Commission, 2017, 2018; Khan, 2016; Srinivasan, 2019, 2020), we argue that regulatory intervention is needed. In the subsequent chapter, we outline a European strategy for platform regulation.

2.3 A European Strategy for Platform Regulation

Having outlined why regulatory intervention is necessary, we move one step further and discuss our results in the light of the literature on platform regulation (Edelman & Geradin, 2016; Feld, 2019; Furman, 2019; Khan, 2016; Nooren et al., 2018; Srinivasan, 2020). In particular, we discuss how European regulators can intervene to establish a self-sufficient platform economy at the EU level. We argue that European regulators need to (1) provide a fertile platform breeding ground, (2) develop ex-ante regulation frameworks, (3) enable collaborations to build European platforms, and (4) inform consumers about the harm of apparently free platforms.

First, European regulatory needs to engage in regulatory support by providing a fertile breeding ground to promote the emergence and growth of digital platforms. Based on the results from the USA and China (P5), we argue that European regulators need to provide a greater amount of financial support, reduce the perception of risk, build digital capabilities, create European platform clusters, and encourage an entrepreneurial and digital mindset (Hermes, Clemons, Schreieck, et al., 2020).

Second, European regulatory needs to engage in regulatory ban by developing ex-ante regulation frameworks that level the playing field and safeguard fair and transparent competition. We argue that European regulators need to move beyond penalizing single practices ex-post and to move towards more general frameworks that constrain dominant platforms ex-ante. Ex-ante regulation is especially critical in platform markets as these markets develop at a speed in which regulating ex-post is too slow to timely penalize illegal practices and prevent unfair tipping of markets (Rietveld & Schilling, 2020; Stigler Committee on Digital Platforms, 2019). For instance, after being penalized by the European Commission for abusing its Mobile Application and Development Agreement to extend its dominance in search (European Commission, 2018), Google offers European Android users the possibility to select their preferred search engine as default during the initial phone setup (Gennai, 2019). However, such an ex-post regulation does not restore fair competition for search since the market has already tipped towards Google Search. As a result, Google Search was able to collect a critical

amount of user search data compared to competitors. This data advantage enabled Google Search to offer a degree of personalization and relevance in its search results that were unmatchable by competitors. Consequently, increasing users' likelihood to adopt Google Search, which further enhances its data advantage and thereby again its recommender engine. Thus, rendering the market uncontestable even after the regulation. In contrast, constraining dominant platforms ex-ante enables regulators to better maintain a level playing field. Inspiration can be drawn from banking laws that require the separation of banking and commerce (Shull, 1999) and ban banks from entering markets outside of the business of banking. The laws ensure fair allocation of credit to prevent concentration of power and conflicts of interest (Khan, 2016; Srinivasan, 2020). Similar reasons have been mentioned by traditional incumbents who decided to build platforms as a separated spin-off in contrast to integrated them into their organizational structure (P9) (Hermes, Guhl, et al., 2021). As dominant platforms are prone to concentration and conflicts of interest when enveloping into their ecosystem, it might be worth building on related ex-ante regulations to develop adapted regulations for platform markets. Adaption is particularly important as empirical work suggests that platform envelopment is more complex than vertical integration in banking (Foerderer et al., 2018; Hagiu et al., 2020; Kang, 2017; Wen & Zhu, 2019; Zhu & Liu, 2018). The proposal of a digital markets act by the European Commission represents a significant step forward in this manner (European Commission, 2020b).

Third, European regulators need to engage in regulatory relief by allowing European collaborations to build critical European platforms (Hermes, Töller, et al., 2020). We argue that such an intervention is important to enabling Europe to achieve digital sovereignty (P5). By digital sovereignty we don't understand excluding foreign platforms, which would better fall under the term digital protectionism, rather we view digital sovereignty as ensuring that European alternatives exist. This is an important objective as it might be risky for the EU to allow a small group of foreign firms to control critical platforms. For instance, the European Commission (2020a, p. 9) illustrates the threats of foreign cloud platforms as follows: *"There is uncertainty about compliance of cloud service providers with important EU rules and standards, for example on data protection. Micro-enterprises and SMEs suffer economic detriment because of contract-related problems, e.g. non-conformity with the contract or unfair contract terms."* Consequently, we argue that the EU needs to build critical platforms to avoid the risk of exploitation by foreign platforms. To this end, we encourage European regulators to promote collaborations among European firms as the success of individual European firms to build critical platforms and to compete against foreign dominant providers seems unlikely and as European firms are likely to adopt critical platforms of foreign providers (e.g. Volvo Cars, 2020). However, collaborations, especially within an industry, are often equated with cartels engaging in anticompetitive practices. For instance, a cartel offering a single choice is seen as offering no choice at all. In the current circumstances of globally dominant platforms, we argue, however, that in the absence of a single, new, viable choice, business and consumers truly do have no choice at all. Thus, European collaborations are likely to result in a single European platform, instead of several small platforms, but this would be a single viable platform that could compete effectively and worldwide with foreign dominant platforms. Interestingly, it would increase the number of viable European competitors from zero to one. European regulators would need to guarantee that access was fair and affordable, but rather than

decreasing the number of alternatives, this approach would increase the number of viable alternatives preserving competition. European regulators are therefore encouraged to provide regulatory relief for European collaborations.

Fourth, European regulatory needs to engage in regulatory protection by educating consumers about the real and hidden harm of apparently free platforms. Not only do regulators need to better inform consumers about privacy-related business practices of platforms and conglomerates (Hermes, Clemons, Wittenzellner, et al., 2020; Hermes, Sutanrikulu, et al., 2021), but our results (P2 and P3) also indicate that regulators need to inform consumers about the real and hidden harm of apparently free platforms. To illustrate, while the former relates to practices such as data mining, building consumer profiles, and sharing data with third-parties, the latter refers to practices such as price discrimination (Clemons & Wilson, 2015; Shiller, 2014; Zuboff, 2019). We argue that informing consumers about real and hidden harms is critical because (1) they value convenience and the absence of charges higher than privacy and (2) they are largely unsatisfied with their current regulatory protection (P3). Hence, as regulatory protection of consumers' privacy would invariably result in higher prices and less convenience, consumers are unlikely to tolerate regulation. In contrast, consumers might be willing to accept costs of safer platforms if they were more aware of the real and hidden costs of free platforms. In other words, although consumers want protection, they are unlikely to tolerate regulation that reduces convenience or increases costs and therefore need be better educated about the real and hidden costs of free platforms as this can increase their tolerance for regulation.

3 Implications

The findings of this thesis have implications for both theory and practice. Based on the mixed-method research approach of this thesis we can address exploratory and confirmatory research questions (Venkatesh et al., 2013; Venkatesh et al., 2016) and contribute rich theoretical insights and guidance for practice.

3.1 Implications for Theory

Our findings contribute to five literature streams. First and foremost, we contribute to the literature on **sources of power of digital platforms**. We contribute to this stream by synthesizing prior research into an integrative framework that illustrates how platform-level sources (Cennamo, 2019) and market-level sources (Suarez, 2004) are interconnected and how they shape platform power **(P1)**. To the best of our knowledge, no framework exists that exhaustively integrates findings on platform power. The framework not only structures extant literature but also gives rise to a future research agenda in which we propose to explore the role of national sources in attaining dominance, the sources enabling platforms to sustain dominance, and strategies to dethrone dominant platforms.

Building on the first avenue of this research agenda, we further contribute to the literature stream on sources of power of digital platform power by identifying national-level sources that influence platform power **(P5)**. Our results thereby move beyond platform-level sources and market-level sources and complement prior work by making use of a new level of analysis. In particular, we confirm that American platforms gained power by leveraging military support, renowned technical universities, access to venture capital, first-mover effects, local clusters, and an entrepreneurial and digital mindset (Mowery, 1992; Porter, 1990; Rothaermel et al., 2006). We extend this line of research by revealing that the large size and homogeneity of the American market and America's historic partnership with the EU allowed American platforms to scale their business in their home market and to rapidly capture the European market. We confirm that China's platform self-sufficiency is a result of market foreclosure, local clusters, state financing, and its entrepreneurial and digital mindset (Froese et al., 2019; Li, 2019; Zeng & Glaister, 2016). We extend this line of research by identifying that the lack of legacy systems and the political and economic rivalry with the USA have been additional aspects of China's self-sufficiency. Moreover, we complement prior work by demonstrating the national-level sources that have led to the platform gap in the EU.

We also extend the line of research that explores market-level sources (Suarez, 2004; Tiwana et al., 2010). Our results shed more light on the role of consumer characteristics, behaviors, and biases for platform power and thereby move beyond market-level sources such as network effects, switching costs, and market structure. More specifically, we show that consumers lack general knowledge about information privacy **(P2)** and that consumers are largely unaware of specific information privacy practices of diversified platform owners **(P3)**. Consequently, privacy information asymmetries between platform owners and consumers represent an important explanation for the privacy paradox and thereby an important market-level source of

power. Our results also demonstrate that consumers make irrational privacy decision choices due to heuristics and biases **(P4)**. Our replication study reveals that relative changes in privacy protection influenced consumers' hypothetical disclosure and that those results would be likely robust across the actual disclosure setting if the privacy-sensitive sample would have indicated their true disclosure choice. As a result, platform owners can exploit consumers' irrational privacy decision-making to their advantage which represents another market-level source of power.

The discussion of this thesis contributes to the literature on sources of power of digital platforms in two ways. On the one side, we discuss how a single platform can profit from being strategically linked to other platforms of a conglomerate. By strategically linking platforms a conglomerate can nudge, and under severe circumstances, force consumers to use another platform of that conglomerate. Thus, strategic linkages represent a conglomerate-level source of platform power. On the other side, conglomerates can collect a variety of data from users' online and offline behavior. The advantage of such a pool of data is that the data is largely sharable across platforms **(P8)**. In combination with algorithms, conglomerates can generate strategic information about users and develop strategic, platform-specific algorithms – both of which are further increasing the power of a conglomerate's platform. To the best of our knowledge, conglomerate-level sources of platform power have not yet been identified by extant literature. By integrating platform-level, conglomerate-level, market-level, and national-level sources into a framework for platform power, we synthesize our contributions to the literature on sources of power of digital platforms.

Second, we contribute to the literature on the **privacy paradox** which describes the dichotomy between privacy concern and behavior (Gerber et al., 2018; Norberg et al., 2007). Our results confirm that the privacy paradox exists and that information asymmetries represent an important cause for the privacy paradox **(P2 and P3)**. However, our results also extend related work in several ways. On the one side, our results demonstrate the characteristics of consumers caught in the privacy paradox. On the other side, they extent research on information asymmetries (Acquisti & Grossklags, 2005) by identifying that knowledge about data integration and data usage are new areas of information asymmetries within the privacy paradox. Moreover, our results move beyond information asymmetries and reveal another cause for the privacy paradox: the lack of viable alternatives **(P3)**. The lack of viable alternatives describes that consumers only behave paradoxically because no viable alternatives are available which forces consumers to remain with the platform they are concerned about. If they would be able to locate a viable alternative, they would behave normally and choose a platform that addresses their privacy concerns. Besides, our results extend the idea that the privacy paradox is a dichotomous phenomenon and show that the privacy paradox can exhibit varying degrees across consumers. For instance, consumers exhibit a high (medium; low) degree of privacy paradox when privacy concerns are high and the willingness to use alternative services is low (medium; high). While one publication finds evidence that the degree of the privacy paradox is primarily influenced by variations in privacy concerns **(P3)** the other study reveals that the degree of privacy paradox is largely driven by the use of alternative services **(P2)**.

Third, we contribute to the literature on the **impacts of digital platforms**. We contribute to this stream by synthesizing prior research into an integrative framework that illustrates how business model innovations such as platform-based business models impact different actor groups (Ghezzi et al., 2015) and vice versa (Hienerth et al., 2011; Kohler, 2015) **(P6)**. In particular, we identify the outcomes of value creation and destruction and the mechanisms by which they are triggered. To the best of our knowledge, no framework exists that integrates findings on the reciprocal impacts and that contextualizes platform-based business models within business model innovation. The framework not only structures extant literature but also gives rise to a future research agenda in which we propose to explore the design of business model innovations from an ecosystem perspective and the value destruction of business model innovations. Our results also contribute to the positive effects of digital platforms **(P7 and P8)**. We extend this line of research (Cusumano et al., 2019; Edelman & Geradin, 2016; Eisenmann et al., 2011; Parker et al., 2017) by applying an ecosystem analysis of the healthcare industry and demonstrating that platformization transformed healthcare delivery from acute value delivery to connected, remote, and preventive care delivered through a network of actors including patients themselves **(P7)**. Our results thereby address the proposed research question of de Reuver et al. (2017, p. 130) of *"how do digital platforms transform industries?"* From a platform owner perspective, our results extend prior work by integrating research on inter-platform envelopment (Eisenmann et al., 2011; Li & Agarwal, 2016) and intra-platform envelopment (Foerderer et al., 2018; Kang, 2017) and systematically characterizing both envelopment types. The results also show that intra-platform envelopment – in the publication called vertical envelopment – has positive impacts on the platform owner in terms of conglomerate advantages **(P8)**. Regarding the negative effects of digital platforms, our results provide evidence that radical envelopment is prone to have anti-competitive effects. These results extend prior work as they uncover the versatile role of the core platform: preferring the new platform and simultaneously interfering with target platforms **(P8)**.

Fourth, we contribute to the literature on **incumbents' transition strategies into the platform economy** (Sandberg et al., 2020; Schreieck & Wiesche, 2017; Sebastian et al., 2017; Svahn et al., 2017). Our results move beyond the assumption that transition strategies are either-or decisions. We extend prior work by demonstrating that incumbents pursue multiple transition strategies and that these strategies are pursued simultaneously, in contrast, to being pursued exclusively **(P9)**. Furthermore, our results identify a new transition strategy: the white-label platform strategy. This strategy describes how incumbents employ the platform technology of a white-label platform owner to connect their complementors to the users of the white-label platform owner. The advantages are access to existing complementors and cost savings, while the disadvantages include strategic dependency, lack of influence on platform evolution, and forgone opportunity to build platform-specific capabilities and knowledge **(P9)**.

Last, the discussion of this thesis contributes to the literature on **platform regulation** (Edelman & Geradin, 2016; Khan, 2016; Nooren et al., 2018; Srinivasan, 2020). We synthesized the regulatory discussions of the embedded publications and outlined why regulatory intervention is necessary and how European regulators can intervene. In particular, we contribute to the debate on the necessity of platform regulation by discussing the feasibility of new entry in markets operated and especially dominated by platform conglomerates and digital

conglomerates. We discuss that technological discontinuities are unlikely to render markets contestable for new entry **(P5, P7, and P8)** and that consumer preferences do not weaken the competitive advantage of conglomerates **(P2, P3, P5, and P8)**. In conjunction with the increasing abuses of power, we conclude that regulatory intervention is needed. Regarding the debate on a European strategy for platform regulation, we discuss that European regulators need to (1) provide a fertile platform breeding ground, (2) develop ex-ante regulation frameworks, (3) enable collaborations to build European platforms, and (4) inform consumers about the harm of apparently free platforms **(P2, P3, P5, and P9)**.

3.2 Implications for Practice

The findings of this thesis have practical implications for platform owners, incumbents, and European regulators. For platform owners, the findings of this thesis have three implications. First, they provide a framework for platform power (see Figure 8). Platform owners can use this framework to better understand how they can gain platform power. The framework outlines platform-level, conglomerate-level, market-level, and national-level sources of power and thereby assists platform owners with formulating their platform strategy and with better understanding the power of rival platforms. Platform owners gain an overview over which levers they can pull to enhance platform power and which levers influence the power of their platform but which they can't influence. Second, the findings of this thesis in the healthcare industry support existing and newly entering healthcare platform owners to analyze their market position in the digital healthcare ecosystem and assess their linkages to other actors. Third, our taxonomy of platform envelopment supports platform owners regarding their decision-making for different strategic trade-offs and involved risks. For instance, the taxonomy illustrates that acquiring a target platform is associated with integration risks while building a platform involves the risk of late entry. A better understanding of strategic trade-offs of platform envelopment practices helps platform owners to choose the right strategy for their organization.

For incumbents, the findings of this thesis have four implications. First, our findings present an overview of different strategies how incumbents can transition into the platform economy. These strategies range from building and joining a platform over investing in and acquiring a platform to using a white-label platform. For each strategy, the findings outline advantages and disadvantages and thereby support incumbents to choose the right strategy for their organization. Our results also encourage incumbents to pursue multiple transition strategies instead of making either-or decisions. Second, our findings of the impact of platformization within healthcare help incumbents, and especially healthcare incumbents, to better understand how digital platforms transform traditional industries and how linear value chains are transformed into platform-mediated markets. Understanding how value proposition, value capture, and value delivery change enable incumbents to better position themselves in the digital and platform-based healthcare industry. Third, healthcare incumbents can apply our digital healthcare ecosystem to identify threats to their market position, opportunities to leverage new trends, and shifts in consumer needs. Fourth, incumbents can use our platform envelopment patterns to evaluate the threat of platform envelopment (e.g. the threat of soft versus radical envelopment) and derive appropriate countermeasures or repositioning themselves in the market.

For European regulators, the findings of this thesis have four implications. First, the findings provide European regulators a framework (see Figure 8) to better understand platform power. The framework assists European regulators to differentiate the power of digital platforms compared to other business models and to assess the sources of power of a platform of interest. Second, regulators can use our platform envelopment taxonomy to identify envelopment cases that might be prone to anti-competitive conduct. For instance, the pattern of radical platform envelopment is often associated with anti-competitive behavior. The taxonomy also supports regulators in determining whether misconduct is occurring between the core platform and the new platform or between the core platform and the target platform. Third, our findings indicate that consumers are differently informed about platform-based business models and their privacy practices. Our findings suggest which groups of consumers should be informed about which topics. In general, it is important to inform consumers about data integration practices, data usage practices, monetization of personal data, and the logic and risks of personalized advertising. Fourth, we discuss why regulatory intervention is necessary and how European regulators can intervene. We encourage European regulators to (1) provide a fertile platform breeding ground, (2) develop ex-ante regulation frameworks, (3) enable collaborations to build European platforms, and (4) inform consumers about the harm of apparently free platforms.

4 Limitations

The findings of the publications embedded in this thesis are limited in several ways. These limitations are the consequence of the research approach, cases, data sources, and scope that we employed within this thesis. Although the embedded publications comprise comprehensive explanations of their limitations, we summarize important limitations in the following paragraphs.

In the embedded publications P1 and P6 we conducted systematic **literature reviews** based on Webster and Watson (2002) and Wolfswinkel et al. (2013). Although we adhered to the proposed guidelines and relied on multiple databases, chose relevant search queries, documented the search and selection process, and conducted backward and forward search, the literature reviews are subject to two limitations. First, the selected search query might not reveal all articles that are relevant due to the choice of keywords and databases. Alternative terms for the keyword stakeholder such as competitor or partner could have identified further relevant articles in P6 and alternative terms to market power such as economic power might have yielded additional articles in P1. Second, the selection of relevant articles is dependent on the researchers' choice. Although we documented inclusion and exclusion criteria it might be possible that not all relevant articles have been selected and that all irrelevant articles have been excluded. Other researchers might have selected different articles. Third, the results might suffer from coding bias which comes into effect when researchers identify open codes and when they aggregated subcategories into more general categories. During these procedures, some insights might not have been extracted or might have been lost and thus, are not included in the result.

The embedded publications P5, P7, P8, and P9 are based on **case studies**. All our case studies are subject to limitations regarding their generalizability (Yin, 2014). Although the sample sizes are small and causal power is limited, we aimed to discuss the generalizability of our results. For example, in P9 we utilize the concepts of asset-heavy and asset-light industries to discuss the generalizability of the findings. P5 is further limited by relying on one interview partner per case and by not contrasting the results from the perspective of large platform owners. In contrast, P7, P8, and P9 build upon data triangulation. By triangulating data, researchers collect data from different sources to establish a chain of evidence (Gioia et al., 2013). Thus, researchers find evidence for a phenomenon of interest because different data sources point, independently, to the same evidence. In P7 we primarily employ Crunchbase data and use a premium account to collect all available data. Scholars argue that Crunchbase is indeed a suitable and reliable database for company data since it is socially curated (Marra et al., 2015). To triangulate the Crunchbase data, we included archival data such as information from the company websites and interview data. In P8 we triangulate data by drawing on different archival sources and in P9 we triangulate data by using multiple interviews and various archival sources.

While data triangulation is largely addressed within the embedded publications, the **conduct of interviews** is subject to several limitations. On the one side, retrospective reporting bias (Eisenhardt & Graebner, 2007) might be significant. For example, in P5 and P7 interview

partners were asked to report on events that had occurred several years and even decades ago. On the other side, interviewer bias may be significant (Bailar et al., 1977). We might have unconsciously guided interview partners into thematic directions we expected them to discuss, or we might have interpreted their statements in ways that supported our expectations. Moreover, participant bias may be significant in that interview partners might have responded in ways they believe represented the answers we expected.

The **coding of data** is also subject to limitations in the sense that the coding is contingent upon researchers' interpretation and focus. To alleviate this issue, we employed the concept of inter-coder reliability in P7 and transparently report the coding process in all embedded publications[8]. Inter-coder reliability refers to the extent to which independent coders reach the same conclusion about how to code the data. We build upon two coders who first compared and discussed their conclusions for calibration purposes and then, after having achieved acceptable inter-coder reliability, we had one coder code the remaining data.

In the embedded publication P8 we develop a **taxonomy** that is also prone to limitations. According to Nickerson et al. (2013), taxonomies cannot be perfectly correct or finished since the phenomenon of interest is usually of dynamic nature whereas taxonomies only capture a static snapshot of the current situation. For example, the platform envelopment taxonomy does not capture envelopment practices that are just beginning to emerge. However, taxonomies should not be perfectly correct but helpful and valuable (Nickerson et al., 2013). Since the taxonomy of P8 is modular and malleable it serves the requirement of being helpful and can be used as a foundation for characterizing future platform envelopment practices.

In the embedded publications P2, P3, and P4 we build on **quantitative methods**. Although less pronounced than qualitative methods, quantitative methods are also limited in their generalizability. In P2 and P3 the sample comprises American and European participants and the case of interest is Google. Hence, the results might differ when examining individuals from different nations and when investigating different cases such as Facebook. Similarly, in P4 we build on a student sample and are therefore not representative of the entire German population. Quantitative methods can also be subject to missing variables. For example, in P4 we do not directly measure disposition to privacy and cultural background which could reveal more nuanced findings. Regarding factor and cluster analysis, we acknowledge that they are limited in their choice of the number of factors and clusters. Although we relied upon multiple statistical tests to make informed decisions, other factor and cluster solutions may be feasible and thus, may have altered our results. In terms of the scales of variables, we treated ordinal variables as ration variables. Hence, assuming that the differences between scale points are equal. Lastly, we acknowledge that in P3 we did not conduct group comparison tests to better illuminate the differences between groups and that the group comparison tests in P4 have limited causal power since we do not examine relationships between variables.

[8] Based on the guidelines of Gioia et al. (2013) examples of each embedded publication can be found in Appendix A: Coding Schema.

5 Future Research

In this section, we outline avenues for future research that arose out of the embedded publications. First, we propose to explore how platform conglomerates and digital conglomerates are organized and how they compete. Second, we encourage future research to conceptualize and evaluate the effect of platform essentiality. Third, we suggest to better understand how consortia can help to gain control over critical platforms. Fourth, we argue to shed more light on the phenomenon of platform cooperatives and democratic governance. Last, we propose to move beyond the role of IS within and across organizations towards the role of IS for regulating organizations and regulatory practice.

Organizing and competitive logic of platform conglomerates and digital conglomerates. In the embedded publications we observed that some platform owners operate multiple digital platforms (P2, P3, P5, and P8) and that some of them are more product-heavy than others (P8 and P9). We discussed that product-light, multi-platform owners can be conceptualized as platform conglomerates and that product-heavy, multi-platform owners can be conceptualized as digital conglomerates (see part C: Chapter 2.1). Although we briefly introduce these two concepts further theoretical and empirical research is needed to understand how they are organized and how they compete. To derive their organizing logic, we suggest conducting multiple case studies and to collect data about the different products, platforms, and services offered by platform and digital conglomerates and how these are linked. Based on such an overview, scholars can illustrate conglomerates as networks and inductively develop a new organizing logic for conglomerates. To better understand the competitive logic of digital conglomerates, we encourage scholars to draw on the theory of related diversification (Hill et al., 1992; Markides & Williamson, 1994, 1996) and to conduct case studies on the competitive dynamics between a platform of a conglomerate (e.g. Apple's Apple Music) and a single platform (e.g. Spotify). While the theory of related diversification can build the groundwork to theorize sharable, strategic assets of conglomerates and their mechanisms to continuously expand the stock of assets, case studies can reveal the competitive strategies and advantages of conglomerates compared to non-diversifiers. Understanding how a platform of a conglomerate leverages other platforms of that conglomerates contributes new knowledge to platform performance and platform power. Although platform-specific factors (e.g. pricing) and market-level factors (e.g. switching costs) have largely been studied, it remains opaque how conglomerate factors (e.g. strategic linkages such as pre-installation) influence platform performance.

Conceptualization and outcomes of platform essentiality.
In the embedded publications, we assessed the sources of power of digital platforms through platform-specific, market-level, and national-level factors (P1, P2, P3, P4, P5). For future research, we propose to further extend market-level factors by incorporating a complementor perspective. Platforms not only gain and sustain power because they can attract and retain consumers or because they benefit from loose regulation or few competitors, but also because they attract and retain complementors. To better understand how complementors' attitudes shape platform power we propose to draw on the concept of essentiality. Essentiality can be defined as: *"a resource is not essential as such; it is essential in relation to 'something' and in*

comparison with the other inputs that can be used in relation to that 'something'" (Colangelo & Maggiolino, 2017, p. 7). Hence, the more complementors perceive that alternatives are less valuable, less time-consuming, or less of some other form of personal criteria, the more essential the digital platform. The concept of platform essentiality moves beyond the concept of platform dependency (no alternative choice exists) and incorporates the idea to evaluate complementors' perception of a platform of interest vis-à-vis alternatives. We argue that platform essentiality is important because the more essential a platform, the more likely it turns into a de facto standard, and thus, the more powerful it becomes (Hermes et al., 2022). Consequently, platform essentiality is a relevant antecedent of complementor contribution behavior such as building a new complement, willingness to switch, or tendency to multi-home. However, it remains unclear what an essential platform is, whether the perception of an essential platform various across developers, and how strong platform essentiality influences complementor behavior. Therefore, we propose future research to engage in scale development procedures to first conceptualize the construct of platform essentiality and then conduct quantitative studies to evaluate its effects and causal power. We also suggest differentiating between transaction platforms and innovation platforms when conceptualizing platform essentiality since both platform types differ regarding their extent of value co-creation.

Consortia to gain control over critical platforms.
In the embedded publication (P9) we studied how incumbents transition to and compete in the platform economy. We thereby assumed that incumbents, and firms more generally, are able to compete on their own. However, this assumption might not always hold as witnessed by recent European and industry consortia such as NetID and Verimi for online login, the European Processor Initiative for European microprocessors, Gaia-X for a European cloud, or the Automotive Grade Linux for an open operating system in the automotive industry. These consortia also indicate that some digital platforms are critical in the sense that they are critical for the proper functioning of entire industries. We propose to study these consortia to better understand whether consortia are an effective mechanism to build viable alternatives that can challenge existing leaders of critical platforms. In case consortia fail, scholars and regulators need to assess if other forms of intervention are necessary to induce competition since single firms and consortia seem to be unable to dethrone existing platform leaders. Alternatively, regulators might accept that some critical platforms hold a dominant position but will need to decide whether they should fall under new forms for regulations. By studying platform consortia, future research can contribute new knowledge on the role of cooperation and co-ownership for digital platforms. Additionally, we propose to draw on Actor-Network theory (Sarker et al., 2006; Walsham, 1997) as a theoretical lens and use the case of consortia to move the theory's focus from intraorganizational phenomena to interorganizational phenomena and thereby contribute new knowledge to the theory's scope, boundaries, and core concepts.

Platform cooperatives and democratic governance.
In the discussion, we explain why regulatory intervention is necessary and how a European strategy for platform regulation may look like. However, the strategy does not address the issue that digital platforms are largely owned and managed by one organization and that they use this position to abuse their power such as exploiting labor in the sharing economy. Hence, we argue to shed more light on the emerging trend of platform cooperatives which represent platforms

that are also owned and governed by their complementors. Better understanding such democratic governance through multiple case studies and how they differ compared to capitalistic platform governance can provide new insights on how to regulate platforms. That is because regulators might require digital platform leaders to offer complementors greater say in the development and conduct of the platform. This can shift the platform towards fairer behavior vis-à-vis its complementors and thus, benefit the entire ecosystem including consumers.

The role of IS for regulatory practice.
In the discussion, we outline a strategy for European platform regulation. However, the strategy does not address how IS can be employed to support regulatory practice. Therefore, we encourage IS scholars to move beyond the role of IS within and across organizations towards the role of IS for regulating organizations and to incorporate the lens of regulators into theoretical and empirical IS research. The cycle of regulation is complex and risks that the interpretation of regulations by organizations leads to ambiguity and noncompliance, and that regulatory intervention does not match the urgency of cases. Both problems can be tackled by emerging technologies. For example, machine-executable regulation shifts the burden of interpretation towards the regulator and can thereby standardize regulatory compliance across organizations and create real-time supervision (Broeders & Prenio, 2018). Regulators could use this technology to supervise data sharing between digital platforms and third parties and assess whether their data-sharing practices violate privacy laws. Regulators could also use this technology to automatically test algorithms and verify whether they discriminate against rivals, manipulate users, or promote illegal content (Feld, 2019). Another regulatory challenge is that regulations are being enforced differently in each country. As a result, digital platforms face different regulations across countries. The increased need for global harmonization can be supported by leveraging emerging technologies like cloud computing, application programming interfaces, or blockchain which can facilitate access and distribution of supervisory data across regulators. However, future research is needed to develop appropriate artifacts and to understand how these artifacts impact regulatory practice.

6 Conclusion

Digital platforms have become ubiquitous and operate in various markets such as online marketplaces, mobility services, social networks, and operating systems. They transformed our daily lives, changed business activities, and even impacted governments and politics. In this process digital platforms created enormous economic surplus for consumers and businesses. However, they also enabled platform owners to gain significant market power which often translated into abuse of power. To address abuse of power in Europe it is vital to understand (1) the sources of power of digital platforms, (2) their impact on consumers and organizations, and (3) to explore how European firms can compete in the platform economy. To this end, we first developed a framework that illustrates how platform-level sources and market-level sources are interconnected and how they shape platform power. Besides, we empirically investigated how national sources, as well as consumer characteristics, behaviors, and biases in the context of privacy, contribute to platform power. Second, we built a framework on the reciprocal impacts between business model innovations such as platform-based business models and stakeholders. Additionally, we demonstrated the impact of platformization in healthcare delivery and the impact of platform envelopment. Third, we revealed which strategies incumbents employ to transition into the platform economy and discuss why regulatory intervention is needed and how a European strategy for platform regulation may look like. Our findings contribute to the literature streams on the sources of power of digital platforms, the privacy paradox, the positive and negative impacts of digital platforms, the platform transition strategies of incumbents, and platform regulation. We hope that our findings spark further research on digital conglomerates, platform consortia, platform cooperatives, and the role of IS for regulatory practice.

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Appendix A: Supplementary Material

Data Material

Table 15. Data of the Embedded Publication 2

Nationality	n	Gender	n	Age	n	Education[1]	n
Germany	274	male	730	18-29	362	Primary education	4
Denmark	274	female	703	30-39	300	Lower secondary education	151
France	299			40-49	280	Upper secondary education	352
United Kingdom	289			50-59	268	Post-secondary non-tertiary education/ short-cycle tertiary education	388
United States	297			60-69	164	Bachelor or equivalent	310
				≥ 70	59	Master or equivalent	146
						Doctoral, postdoctoral or equivalent	47
						Prefer not to answer	35
Total	1433		1433		1433		1433

Pre-study: We conducted a belief elicitation study to solicit the key drivers of each behavior from a convenience sample 19 participants, which included faculty, staff, and students from the Technical University of Munich.

Scale development: We conducted a scale development study (Benlian et al., 2015; MacKenzie et al., 2011) to derive a measurement scale for objective knowledge about information privacy. The scale development procedure includes a literature review, five interviews to determine construct domain and dimensionality, five interviews to examine face validity, and small survey of 28 consumers to assess discriminant validity.

[1]according to the International Standard Classification of Education (https://www.datenportal.bmbf.de/portal/en/glossary-i.html)

Table 16. Data of the Embedded Publication 3

Nationality	n	Gender	n	Age	n	Education[1]	n
Germany	350	male	830	18-29	366	Primary education	13
Denmark	364	female	863	30-39	341	Lower secondary education	166
France	333			40-49	353	Upper secondary education	448
United Kingdom	321			50-59	326	Post-secondary non-tertiary education/ short-cycle tertiary education	480
United States	325			60-69	226	Bachelor or equivalent	356
				≥ 70	81	Master or equivalent	164
						Doctoral, postdoctoral or equivalent	40
						Prefer not to answer	26

Total	1693		1693		1693		1693
Pre-study: We administered an online, self-report survey to students of the Technical University of Munich. Each student collected further responses from colleagues at work, family and friends. In total, 66 individuals participated in the pretest.							

[1]according to the International Standard Classification of Education (https://www.datenportal.bmbf.de/portal/en/glossary-i.html)

Table 17. Data of the Embedded Publication 4

Sample characteristics	Experiment 1	Experiment 2	Experiment 3
Valid responses	235	412	673
Male	88	205	352
Female	87	207	320
Mean Age (SD)	24.96 (6.96)	25.12 (9.02)	26.63 (10.58)

Table 18. Data of the Embedded Publication 5

Interview	Industry	Role	Duration	Case Description
I1	Electronic engineering	CIO*	around 1h	Online consumer-facing markets are largely dominated by American platform owners (Evans & Gawer, 2016). For example, Google dominates online search (Statista, 2019b; Vynck & Roache, 2019), digital advertisement (Enberg, 2019), and mobile operating systems (Khan, 2018) whereas Facebook dominates social networks (StatCounter, 2019; Statista, 2019a) and digital advertisement (Enberg, 2019). Amazon has achieved a dominant position in online shopping (Koch, 2019; Lipsman, 2019) and is continuously expanding into new domains such as smart home and voice-based shopping. Additionally, the market of cloud services is dominated by a small number of American platform owners including Microsoft, Apple, Google, Amazon, and Salesforce (Gartner, 2019; Riasanow et al., 2021). In contrast to the EU, China's firms are not dominated by American platforms. China has its own online market place (Alibaba), its own messaging and social network (WeChat and its mini programs (Cheng et al., 2020)), its own search engine (Baidu), its own ride sharing (DiDi), its own ecommerce (Taobao)
I2	Insurance	Group IT Governance	around 1h	
I3	Mobility Research	Institute chief*	around 1h	
I4	Telecommunication	Senior Project Field Manager*	around 1h	
I5	Open Source Community	Division Manager Public Affairs	around 1h	
I6	Enterprise Software	Cloud Manager*	around 1h	
I7	Manufacturing	CIO*	1h 10 min	
I8	Food and Beverage	Senior VP of IT*	1h 02 min	
I9	Medical Equipment	VP of Corporate IT	1h	
I10	News Publishing	CIO*	58 min	
I11	Academia	Professor	around 1h	
I12	Telecommunication	Senior Manager for Strategic Partnerships	around 1h	
I13	Banking / Finance	CIO*	around 1h	
I14	Broadcasting	CIO*	around 1h	
I15	Aerospace	Head of Data Governance*	around 1h	
I16	Ophthalmic Optics	CIO*	around 1h	
I17	Fashion and Media	CEO*	47 min	
I18	Digital Consultancy	Client Service Director	51 min	
I19	Strategic Communications	CEO	44 min	
I20	Distributor of Steel and Metal Products	Head of Corporate Office*	45 min	
I21	Messenger Application	CEO*	55 min	
I22	Graduate Recruiting	Team Manager DACH*	37 min	
I23	Sales Automation	CEO*	30 min	
I24	Platform Advisory	Senior Manager*	47 min	
I25	Management & Strategy Consultancy	CEO*	54 min	
I26	Mechanical Engineering	Head of Performance Marketing	58 min	

I27	Strategic and Technical Consultancy	Principal Consultant*	58 min	(Clemons et al., 2012) and its own cloud (Alibaba and Tencent) (Cusumano et al., 2019; Jia et al., 2018; Wang & Rhen, 2012).
I28	Advice Community	COO*	56 min	
I29	Digital Service Provider, Technology Consultancy	CEO	55 min	
I30	Financial Software	General Manager DACH and CEE*	36 min	
I31	Car Manufacturer	Developer Infotainment Systems*	33 min	
I32	Regulator	Policy Officer - Lawyer	36 min	
Coding results: Overall, we used 32 expert interviews to derive 210 open codes, 18 axial codes, and 3 selective codes.				

* = first-hand experience with platform domination

Table 19. Data of the Embedded Publication 7

Interview	Interviewee's position	Domain of Employment	Duration	Case Description
I33	Business Development Director	Medical Device Manufacturing	55:29 min	Recent advances in technology and policy as well as increasing amounts of health data and venture capital are rapidly changing healthcare. Taking an ecosystem perspective, we study the case of how the digital transformation unfolds in the healthcare industry and investigate the impact of emerging organizations.
I34	Controlling and Business Analysis	Medical Device Manufacturing	37:59 min	
I35	Incubation Manager Healthcare	Medical Device Manufacturing	28:54 min	
I36	Co-Founder	BioMarker Collector	33:57 min	
I37	Co-Founder	Digital Insurance Company	36:16 min	
I38	Co-Founder	Administration Software	34:15 min	
I39	Founder	Data Science and Business Consulting	25:34 min	
I40	Clinical Consultant	Medical Device Manufacturing	20:36 min	
I41	Manager Digital Healthcare R&D	Medical Device Manufacturing	54:16 min	
I42	Consultant Healthcare	Business Consulting	36:52 min	
Further case data: After conducting two literature reviews we obtained 56 articles for the traditional healthcare industry and 64 articles for the digital healthcare industry. Each article was reviewed for actors, their descriptions, market segments and value streams. Additionally, we used Crunchbase, a comprehensive and curated database of incumbents and startups, to derive market segments from 1830 organizational descriptions of healthcare companies. In cases where Crunchbase did not provide sufficient information, we used the organization's website, press articles, and news articles to derive the according market segment and value streams. **Coding results:** For the traditional healthcare industry, we identified 9 generic roles and 25 market segments of which 3 are not represented by a generic role. For the digital healthcare industry, emerging organizations converted into 15 new market segments and 3 new data collection technologies. Of the 15 new market segments, 9 market segments are represented by three new generic roles, 3 market segments are extending traditional generic roles, and 3 market segments are not represented by generic roles.				

Table 20. Data of the Embedded Publication 8

Iteration	Core Platform	New Entity	Analyzed Sources
Second Iteration: 14	Airbnb	Airbnb Adventures	4
	Amazon Marketplace	Third-party products	6

relevant envelopment cases	Android	Google Photos	6
	LinkedIn	Job Listings	5
	Windows	Internet Explorer	7
	Android	Google Fit	6
	Android	Google Chrome	4
	Google Search	Google Hotel	5
	Google Search	Google Shopping	7
	Facebook	Instagram	6
	App Store	Apple Music	4
	iPhone	Apple Health	5
	Facebook	WhatsApp	4
	Spotify	Ringer	5
Third Iteration: Six relevant envelopment cases	Android	Google Search	6
	Uber	Uber Eats	4
	Google Search	Google Flight	5
	iPhone	Apple Pay	5
	iOS	Apple Music	4
	Fire OS	Prime	4
First iteration: We applied the conceptual-to-empirical approach and derived dimensions and characteristics based on extant literature (e.g. Edelman & Lai, 2016; Eisenmann et al., 2011; Foerderer et al., 2018; Iacobucci & Ducci, 2019). **Sources of case information:** Case studies, business reports, news articles, and websites. **Coding result:** 11 dimensions with two to four distinct characteristics for each.			

Table 21. Data of the Embedded Publication 9

Interview	Interviewee's position	Duration	Case Description
I51	CEO of the Chemical Marketplace	39 min	ChemistryCo is an established, globally operating incumbent, leading a specific area of the specialty chemicals industry.
I52	CDO of ChemistryCo	45 min	
I53	Business Development Manager of the Chemical Marketplace	44 min	
I54	CIO of ChemistryCo	38 min	
I55	CEO of the Product-finder Platform + Head of the Digital Innovation Lab of ConstructionCo	54 min	ConstructionCo is an incumbent enterprise in the construction supply industry, leading the field of building envelopes.
I56	Member of Digital Board of ConstructionCo	57 min	
I57	Head of IoT Business Development of ConstructionCo	46 min	
I58	Leader Business Unit Smart Building of ConstructionCo	27 min	
I59	Head Digital Commercial Offering & Processes of BankCo	42 min	BankCo is an incumbent full-service bank within the banking and financial services industry.
I60	Product manager of Transaction Platform 2 of BankCo	45 min	
I61	Lead of Innovation Platform of BankCo	28 min	
Supplementary data: For the first case, we analyzed two public interviews with the CDO of ChemistryCo and two public blog posts describing platform trends within the industry. For the second case, we analyzed one press release about the company and one blog posts describing platform trends within the industry. For the third case, we analyzed five public interviews with the lead of the innovation platform of BankCo, one public speech of the			

CEO of BankCo, one public interview with the CDO of BankCo, one public interview with the white-label platform CEO, seven press releases on incumbent's platform strategy, and four blog posts describing platform trends within the industry

Coding results: Overall, we retrieved 168 open codes from the interview transcripts and the secondary data. We categorized them into 22 axial and eight selective codes.

Coding Schema

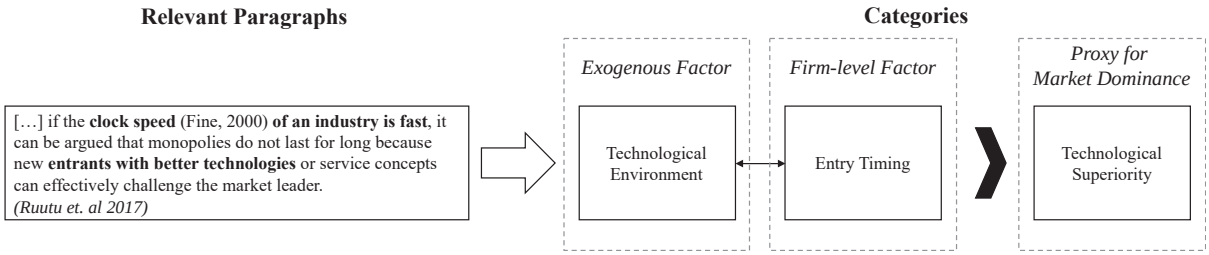

Figure 9. Exemplary Data Representation of Embedded Publication 1

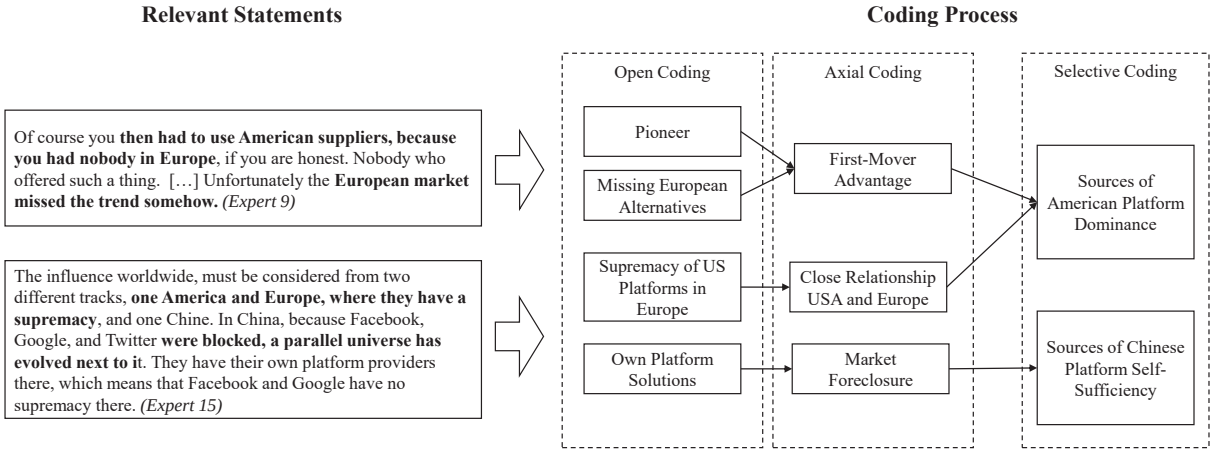

Figure 10. Exemplary Data Representation of Embedded Publication 5

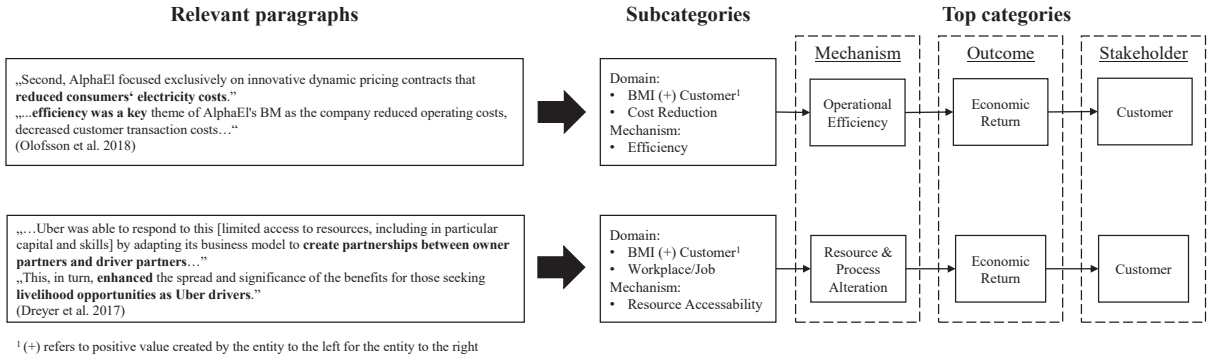

Figure 11. Exemplary Data Representation of Embedded Publication 6

Organization	Crunchbase Description (Extract)	Coded Market Segment
Zava	Zava is an online doctor service in which real GPs prescribe real medicines in real time. Zava offers trustworthy, affordable and regulated medical consultations without the need for a face-to-face visit. (…) And you don't have to see a doctor in person. (…) Simply complete a medical questionnaire, place your order and their doctors will check the treatment you've requested is suitable for you (…) Their service doesn't end when you receive your order. If you have any questions at all about your treatment or condition, you can contact one of their doctors free of charge.	Telemedicine provider

Figure 12. Exemplary Data Representation of Embedded Publication 7

Source	Relevant paragraph	Taxonomy dimension	Taxonomy
(Li & Agarwal, 2016)	• "After the acquisition, Facebook continued to run Instagram as an independent application […]." • "[…] a partial integration was made […] between Instagram and Facebook."	• Origin • Availability • Relationship with the core	• Acquired • Outside of core platform ecosystem • Simple integration

Figure 13. Exemplary Data Representation of Embedded Publication 8

Interview statement and exemplary open codes (underlined)	Subcategories	Categories
In the end, one concluded that it is unlikely that these offers will actually be successful afterwards, it is perhaps more likely that someone like Amazon, eBay, or Google will discover the whole thing for themselves[1)]. Then let's rather build something from within the chemical industry that bundles these areas of expertise, as I said earlier, but then operates independently[2)].	1) Pre-empt external platform companies 2) Industry acceptance	1) Incumbent motivation 2) Reason for spin-off

Figure 14. Exemplary Data Representation of Embedded Publication 9

Appendix B: Embedded Publications in Original Format

Digital Platforms and Market Dominance (P1)

Digital Platforms and Market Dominance: Insights from a Systematic Literature Review and Avenues for Future Research

Completed Research Paper

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Abstract

Companies that take advantage of digital platforms have rapidly gained a dominant position in their respective markets. While research on digital platforms yielded new insights into winner-take-all markets, envelopment, openness, or governance, no study provided a framework that integrates those aspects and links them to market dominance. We, therefore, conduct a literature review to assess how platform owners attain market dominance. We integrated our findings into a framework that depicts the interrelations between environmental factors and firm-level strategies as well as firm-level strategies and their effects for market dominance. The framework conceptualizes platform dominance to help a) attain it from a platform owner perspective, b) cope with it from a competitive perspective, and c) regulate it from a policy perspective. We propose three avenues for future research: (1) the role of national factors in attaining dominance; (2) factors enabling platforms to sustain dominance; and (3) strategies to dethrone dominant platforms.

Keywords: market dominance, digital platform, platform strategies, platform leadership, platform dominance

Introduction

In recent years, companies with digital platform-based business models have increased substantially in number and size (Evans and Gawer 2016), disrupting how people interact (e.g., Facebook), search for information (e.g., Google), and utilize services (e.g., Uber). Digital platforms are also transforming how companies create and capture value (de Reuver et al. 2018). Consequently, companies are forced to re-evaluate established business models, strategies, and organizational structures (Clemons et al. 2019; Hein et al. 2019a; Schreieck et al. 2019). Despite the increasing significance of platform-based business models, we lack a clear understanding of the interplay of platform strategies and ecosystem conditions, for example, the interaction of architectural openness, entry timing, and governance of platforms

(Suarez 2004; Tiwana et al. 2010). Although frameworks that address the management of evolving platforms and battle for technology dominance exist (Suarez 2004; Tiwana et al. 2010; van de Kaa et al. 2011), a more comprehensive understanding of interrelations between the *environmental factors* in platform ecosystems and *firm-level strategies* and their *effects for market dominance* is lacking. Whereas global market dominance of platform leaders has been documented (e.g. Gawer and Cusumano 2002), these studies focus solely on economic models and case studies. To the best of our knowledge, no framework exists that exhaustively integrates findings on platform dominance. However, this is particularly important to companies with linear value chains who are becoming dependent upon digital platforms, and consequently increasingly vulnerable and, therefore, must adopt new coping strategies (Hein et al. 2019a). Automotive manufacturers, for example, are increasingly depend on platforms like Android or Alexa to interact with customers, risking to be marginalized to a hardware provider. In this context, platform strategies become essential, either to become or to defend against platforms (Parker et al. 2016). Should competing companies prioritize flexibility by collaborating with dominant platforms, or build their own systems to avoid lock-in effects?

Furthermore, policymakers must understand how platforms attain market dominance to provide new policies to better regulate abuse of dominance, such as Google's illegal bundling of Google Search and Chrome with Android (European Commission 2018) or Amazon's self-preferencing of own products in its market place (European Commission 2019). Our objective is, therefore, to synthesize previous research and develop an integrated framework of *how digital platform owners attain market dominance.* The relevance of the framework lies in better understanding platform dominance to a) attain it from a platform owner perspective, b) cope with it from the perspective of a linear value chain company perspective, and c) regulate it from a legal and policy perspective.

We conducted a structured literature review (Webster and Watson 2002) to synthesize the interrelations between environmental factors in platform ecosystems and firm-level strategies and their effects for market dominance. We propose a conceptual framework for market dominance in platform ecosystems that will serve as a basis for future research. The research agenda comprises: (1) the role of national factors in attaining market dominance; (2) exploring factors enabling digital platforms to sustain and extend market dominance; and (3) strategies for new entrants to dethrone dominant platforms.

Theoretical Background

Market dominance

Market dominance refers to Article 102 of the Treaty on the Functioning of the European Union. It characterizes a firm that enjoys such an economic strength that it can prevent effective competition in a relevant market by holding power to behave independently from competitors and consumers and by maintaining the possibility to abuse its power. By definition, abuse of power can increase prices above the competitive level, restrict output, and reduce consumer and social welfare (Evans and Schmalensee 2013). The existence of market dominance—usually measured as market share or firm survival—stems from a combination of various factors which, taken separately, are not necessarily decisive (Den Hartigh et al. 2016). Previous research has identified technological, strategic, and network-related factors, as well as the overarching perspective of evolution as critical aspects for gaining and sustaining market dominance (Den Hartigh et al. 2016; Suarez 2004; van de Kaa et al. 2011). *Technological factors* refer to innovativeness and technical architecture comprising modularity, compatibility, and flexibility (Den Hartigh et al. 2016). Cenamor et al. (2013, for example, demonstrate that compatibility positively influences market dominance. *Strategic factors* comprise entry timing, pricing strategy, type of licensing strategy, and marketing form and intensity (Suarez 2004). However, no single factor causes market dominance, rather they interaction, and each factor is usually accompanied by certain trade-offs and opportunity costs. For example, early market entry creates a larger installed base and reputation effects (Carpenter and Nakamoto 1990) but also locks the company into a specific technological trajectory (Dosi 1982) that might not reflect the dominant industry design in the future. *Network-related factors* encompass network size, network diversity, and network structure (Den Hartigh et al. 2016). Network size, for example, refers to the number of actors within the platform ecosystem and indicates the presence or absence of direct and indirect network effects (Eisenmann et al. 2006). Gallagher (2012,

for example, demonstrates that both types of network effects were positively associated with Sony winning the standard battle between Blu-ray and HD-DVD. The *evolutionary perspective* posits that the survival of a company results from natural selection (Arthur 1989; van de Kaa et al. 2011). The core tenet is that technological discontinuities emerge during the industry life cycle, introducing uncertainty and radical change (Tushman and Anderson 1986). Consequently, new paradigms emerge (Dosi 1993), causing new markets and services to emerge (Bower and Christensen 1995) in which companies can gain a dominant position.

Digital Platforms

Whereas linear value chains companies refer to companies that employ a step-by-step arrangement to produce, distribute, and sale a product (Parker et al. 2016), digital platforms transformed this arrangement and leverage the networked relationship of consumers, producers, prosumers (Hermes et al. 2020c) and the platform itself (Hein et al. 2020). Research on digital platforms encompasses four different perspectives. First, the *market perspective*, dating to Rochet and Tirole (2003), who studied the market power of platforms in the presence of external network effects. Such platforms facilitate transactions and match participants, and are referred by Evans (2012 as exchange platforms that "create value by helping two or more different types of users, who could benefit from getting together, find and interact with each other, and exchange value." Second, from a *technical point of view*, digital platforms are seen as software platforms that comprise modular services (Tiwana et al. 2010). Each modular service is a software subsystem capable of extending the functionality of the platform (Baldwin and Woodard 2009). Third, the *socio-technical perspective* investigates how digital platform owners integrate and manage their ecosystem (de Reuver et al. 2018). These innovation platforms offer technological building blocks such as APIs to orchestrate industry innovation by co-creating value with external complementors (Hermes et al. 2019; Schreieck et al. 2016). Fourth, from an *ecosystem perspective* (Riasanow et al. 2020), digital platforms rely heavily on autonomous agents that contribute to the value proposition of the digital platform (Teece 2018). Digital platforms thereby provide digital affordances to leverage the generativity of the ecosystem (Hein et al. 2019b). This basic principle underlines the need for digital platforms to provide and coordinate the autonomous agents while coping with the resulting independencies (Adner 2017; Kapoor 2018). We take all perspectives into account.

Methodology

We conducted a literature review following Webster and Watson (2002) concerning the establishment of platform dominance. Our study covers the intersection of two domains: digital platforms and market dominance. The literature search includes articles from the databases: Web of Science, Scopus, Business Source Complete, and IEEE Explore Digital Library. The search string across all databases included the following keywords: ("platforms" OR two-sided market* OR multi-sided market* OR multisided market*) AND ("market power" OR "dominance" OR "monopoly"). After an initial exploratory review, the search string was refined to include platform-specific concepts and strategies: "network effects" OR entry strateg* OR pric* OR "bundling" OR "openness" OR "envelopment." Figure 1 illustrates the scanning and selection process.

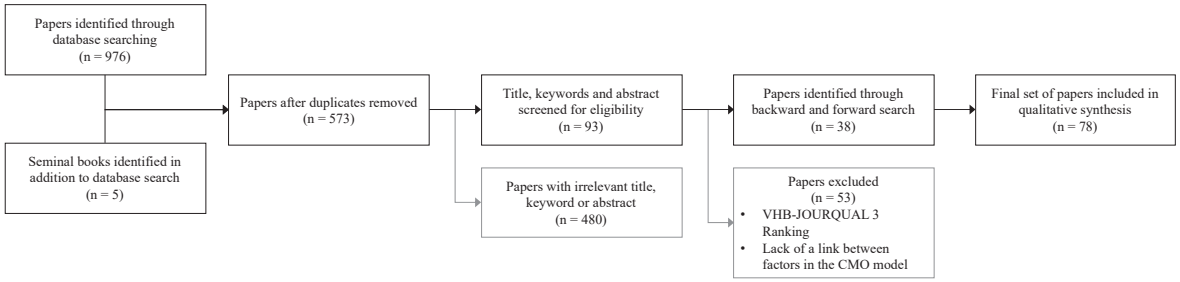

Figure 1: Flowchart Literature Search String

Following the coding process of the Grounded Theory approach, we adhere to the *"open*," *"axial,"* and *"selective"* coding procedure to synthesize the results of the literature review (Glaser and Strauss 1967; Wolfswinkel et al. 2013). Figure 2 depicts an example of the coding schema.

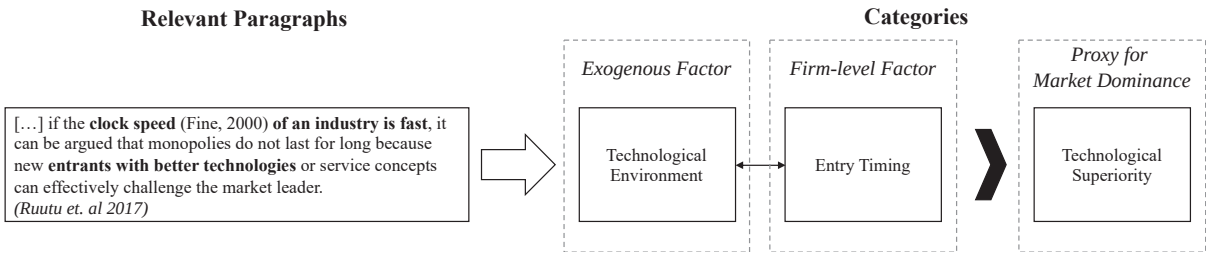

Figure 2: Example of the Literature Coding Schema

Towards a Conceptual Framework

Since our goal is not only to investigate the effects of firm-level strategies for market dominance but also to gain deeper insights about the interrelations between firm-level strategies and environmental factors, we built on the context-mechanism-outcomes (CMO) configuration model (Hermes et al. 2019; Linsley et al. 2015). According to Linsley et al. (2015), a CMO model is concerned "with understanding causal mechanisms (M) and the conditions (C) under which they are activated to produce specific outcomes (O)." Within our conceptual framework, context refers to environmental factors in platform ecosystems. Mechanisms cover firm-level strategies in a given context, while outcome reflects the effects for market dominance produced by mechanisms (see Figure 3). The Appendix provides an overview of the relationships identified in the literature.

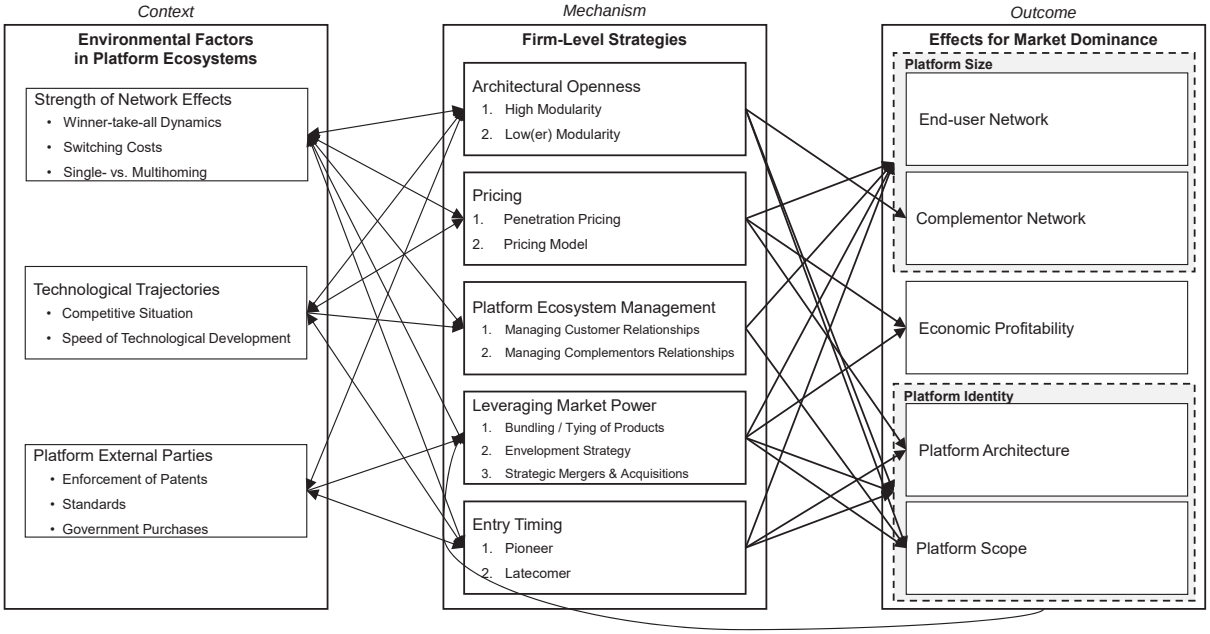

Figure 3: Framework for Digital Platforms and Market Dominance

Platform Environmental Factors and Firm-Level Strategies

Network Effects. When evaluating and developing strategies in multi-sided markets, platform owners must determine the prevailing network effects in the respective market and consider how to exploit them (Zhu and Iansiti 2019). Here, it is crucial to differentiate between direct network effects (within-group network effects) and indirect network effects (cross-group network effects) (Eisenmann et al. 2006). Although often abstracted away in literature, network effects can also be negative (Belleflamme and Peitz 2019). Network effects are impacted by the degree of multi-homing tendencies. These homing tendencies depend on the costs of adaption, operation, and other expenses incurred by platform affiliation, also known as switching costs (Armstrong 2006). Low homing costs imply that the systems are easy to use and adopt, and consequently, users will often multi-home increasing network effects. Thus, the higher the *Architectural Openness* of a platform, and the more support provided to developers,

the lower the multi-homing costs (Staykova and Damsgaard 2015). Homing costs can differ for different sides of a platform; while one group may be single homing, another group may be multi-homing. This is particularly relevant for *Pricing Strategies* that exploit platform dependencies of different market sides (Caillaud and Jullien 2003). Finally, network effects are also impacted by the degree of fragmentation of the network into local clusters. The more isolated each cluster is, the lower the strength of the network effects on a global scale, and hence, businesses in these networks are easier to challenge (Zhu and Iansiti 2019). The *Leveraging Market Power* mechanism suggests that if network effects are strong and positive, and multi-homing costs are high combined with low differentiation requirements of platform users, then there is a tendency for a winner-take-all (WTA) market (Den Hartigh et al. 2016; Eisenmann et al. 2006; Ruutu et al. 2017). Nevertheless, negative within-group effects may allow competing platforms to coexist (Belleflamme and Peitz 2019).

Technological Trajectories. Tiwana et al. (2010 describe technological trajectories as "the rapidity, unevenness, scope, and unpredictability with which complementary and substitutive technologies are emerging." Consequently, these competing technologies impact the evolution of a platform's ecosystem and the future development of modules (Tiwana et al. 2010). When multiple alternative technologies compete for dominance, this will impact the *Platform Ecosystem Management*. The level of complexity to reach an agreement with ecosystem actors such as complementors or customers depends on the number of actors in the same technological field, and the industry level of cooperation/competition (Suarez 2004). This means that more technological trajectories imply that a firm must devote greater effort and means to manage customer and complementors relationships which affects their incentives to pursue more or less aggressive competitive measures such as *Pricing Strategies* (Cennamo 2019). For *Entry Timing*, the speed of development in the technological environment is crucial. If the technological development cycles in the respective industry are fast, this implies that new entrants with superior quality or better service concepts are more likely to successfully challenge the market leader; hence, decreasing the duration of WTA situations (Ruutu et al. 2017).

Platform External Parties. Concerning *Architectural Openness* decisions, an important environmental factor is the appropriability regime established by the government. This allows firms to capture the benefits associated with innovation; it is determined by the efficacy of legal mechanisms, e.g., the enforcement of patents (Suarez 2004; Teece 1986). A tight appropriability regime makes it relatively easy to protect a firm's technology, while the opposite holds for a weak appropriability regime (Teece 1986). Additionally, the degree of openness might also be impacted by direct intervention by the government regarding the use of a certain technology. In some cases, regulators force platforms to be compatible among networks to enhance social welfare and to avoid the dominance of an inefficient technology standard. For instance, the European Union (EU) established a supranational and uniform standard among networks in the mobile communications industry (Fuentelsaz et al. 2015). For strategies based on *Leveraging Market Power*, the scope, content, and strictness of competition laws should be thoroughly assessed. Recent examples of companies failing to meet these laws are found in the files charged by the EU against Google for bundling their products in the Android operating system (European Commission 2018), and open investigations of Amazon for self-preferencing their products (European Commission 2019). Governments can also support the emergence of new technology, especially in the early stages, and, therefore, influence *Entry Timing* decisions. Government purchases may help a technology gain acceptance and hence make it more likely to become dominant in the market. At the same time, industry associations and standards organizations, e.g., the American Nation Standards Institute, can influence the evolution of a technology or a firm's timing of market entry (Suarez 2004). Finally, the power of service providers must be considered: Apple, for example, must consider AT&T's provision of network bandwidth in selling its iPhones (Tiwana et al. 2010).

Firm-level Strategies and Their Effects for Market Dominance

In the literature reviewed, most studies do not further specify the concept of market dominance in digital platform markets. To gain a more precise understanding of the effects of firm-level strategies for market dominance, we draw on the framework of Cennamo (2019), linking the dimensions of platform value to market dominance. Cennamo (2019) describes two main dimensions: (1) *Platform Size*, comprising the platform's *End-user Network* and the size of the *Complementor Network*, and (2) *Platform Identity,*

including *Platform Architecture*, referring to "the technological capabilities of a platform […]" and how its components interact with complements and *Platform Scope*, describing the distinctiveness of complements and the "different markets that the platform serves […]." We added the dimension of *Economic Profitability* to capture the economic rationale of platform owners. However, the effects for market dominance also result from the interaction of all dimensions.

Architectural Openness. We refer to architectural openness as (a) the access openness of a platform: the degree to which complementors can contribute to the platform; and (b) the resource openness: the rights associated with the use of open-source code (Karhu et al. 2018). The decision, whether a platform should be open or closed is usually not binary, but rather, a question of how much modularity a platform should offer, how open the interfaces should be, and to what extent information about the platform and interfaces should be disclosed (Cusumano and Gawer 2002). Especially, the level of modularity is a preponderant decision to be made concerning architectural openness.

Modularity refers to the technological architecture, which consists of building-block components that can be separated and combined according to the platform rules (Baldwin and Woodard 2009). Hence, this affects the development of the *Complementor Network* and the *Platform Scope* (Den Hartigh et al. 2016; Inoue 2019). In general, a managerial trade-off arises between: (1) a platform's high modularity that increases a complementor's incentive to innovate and allows to cope with *Technological Trajectories* such as new, technically superior platforms or increasing demand for open standards; and (2) low modularity that reduces competition and prevents platform imitation, also known as forking (Eisenmann et al. 2009). For instance, Apple maximized its returns from its proprietary resources by limiting platform openness and hence, avoided outbound spillover rents. In contrast, Google focused on maximizing relational returns from app complements by designing an open-source platform, but it also increased the risk of outbound spillover rents in form of forks (Karhu et al. 2018).

Successful platforms show that in principle, this rule applies: Protect the platform's core technology while at the same time use modular architecture and disclose information about interfaces to support and encourage the development of complementary goods. Eisenmann et al. (2009 argue that platforms must be able to lock-in customers to a certain degree and, therefore, excessive openness that decreases switching costs for users and increases competition might not be ideal. Apart from that, platform owners must decide about interoperability and backward-compatibility. Interoperability describes cross-platform transactions between users, achieved by adapters or gateways. Limiting interoperability between platforms can maintain or improve the *Platform Identity* and hence improve its value proposition. However, if user growth rates are decreasing, interoperability could eliminate incentives for users to multi-home, thus decreasing industry unit volumes. Decisions on backward-compatibility should be based on the industry's technological trajectories. If the clock of technological development is fast, platform owners should make their platform incompatible with next-generation platforms. The opposite applies if the rate of technological development is modest or slow (Eisenmann et al. 2009). Furthermore, architectural openness not only defines the platform's entrance and exit rules, but it also encompasses the provision of boundary resources, from APIs and SDKs to metadata (de Reuver et al. 2018; Hein et al. 2019c). A platform owner should assume the role of ecosystem curator by proactively offering boundary resources to increase and improve the *Platform Scope* and to promote the growth of the *Complementor Network* while reactively preventing competitive approaches to using these resources (Ghazawneh and Henfridsson 2013; Tiwana 2015).

Pricing. Researchers agree that pricing for platforms should follow a divide-and-conquer strategy, meaning that one side of the market is subsidized (divide) while the other side is priced at a premium to recover losses from the other side (conquer) (Caillaud and Jullien 2003; Rysman 2009). The objective here is to exploit cross-side network effects. Thus, determining which side of the platform should be subsidized and how much mark-up the other side is willing to pay to gain platform access is a critical success factor for a platform's revenue model (Eisenmann et al. 2006). Overall, this means that as platforms compete for single-homing users, they pass on, to a large extent, the profits earned from the multi-homing side to the single-homing side by charging lower prices or even zero prices (Armstrong 2006). Even in the absence of profits on the premium side, platforms are often willing to set very low prices, i.e., predatory pricing. This pricing strategy results in considerable losses for a platform to scale quickly, undercut competitors, and, hence, build up market dominance by increasing the *Platform Size*.

Subsequently, once competitors are driven out of the market and the platform's installed base is sufficiently large, a platform can leverage this base by charging higher prices to the platform's premium side (Cennamo and Santalo 2013). Here**,** platforms can use transaction fees as a further mechanism to *Generate Profits* and avoid consumers' coordination failures. Additionally, transaction fees are a powerful instrument for platforms to gain market share and enable platforms to differentiate their *Platform Architecture*. While one platform offers a low registration fee combined with high transaction fees, another offers a high registration free combined with low transaction fees, i.e., mirror-pricing (Caillaud and Jullien 2003). Sometimes platforms even increase their access fees to further distinguish themselves from the competition, provided that it incorporates distinct technologies (Cennamo 2019). Belleflamme and Peitz (2019 argue that different membership fees allow a platform to create greater product variety and increase *Economic Profitability*.

Platform Ecosystem Management. Users tend to form their self-fulfilling expectations regarding which platform will ultimately dominate the market and accordingly, adapt to this platform, which makes it necessary to manage customer expectations. This can lead to a monopoly equilibria situation, where all consumers and developers adapt to one platform because they expect this platform to be dominant in the future (Zhu and Iansiti 2012). Accordingly, the expected size of the network determines the platform's success or failure rather than actual network size (Sun and Tse 2007). Platform owners should, therefore, have a strong interest in pursuing strategies that positively influence user expectations, thus growing the *End-user Network*. These strategies can be either quantitative, for example, the current size of the network and the respective market share, or qualitative, by focusing on brand value, reputation, strategic commitments, and pre-announcements (Den Hartigh et al. 2016; Fuentelsaz et al. 2015). In general, marketing strategies should be closely linked to pricing strategies because cross-network effects are decisive about which platform side should be addressed by marketing strategies (Eisenmann et al. 2006). Consequently, marketing efforts are influenced by the strength of network effects: the stronger and more positive the network effects, the more important and effective the marketing efforts (Eisenmann et al. 2006). Additionally, by effectively managing customer relationships, the network intensity can also be strategically manipulated by (a) increasing customer participation through product ratings (e.g., Amazon's review system fosters direct *Network Effects*) or (b) creating better opportunities for users to interact with other users (e.g., as in online gaming) (McIntyre and Chintakananda 2014).

Besides managing customer relationships, platforms need to cope with complementor relationships. This dimension concerns the allocation of the platform- and app-based decision rights between the platform owner and the developer community and the design of incentive structures. Concerning decision rights, management must find a way to adequately bind complementors without excessively constraining the level of innovation. As the Nintendo Wii demonstrated, even a technologically superior platform ecosystem cannot sustain in the long run without the development of innovative and high-quality complements (Inoue 2019). To avoid this, management must first assess how dependent the platform is on complementors to conceptualize its strategic maneuvering. This means knowing to what extent complementary products are developed internally versus by external developers.

Management must also decide on the level of competition established among their complementors, which can be orchestrated through the platform's licensing policy (Gawer and Cusumano 2002). A liberal licensing policy is associated with a higher level of competition and often results in a partial loss of control over the platform's technological development (Suarez 2004). Boudreau (2012 also shows that, while on the one hand, adding more complementors to a platform increases the *Complementor Network* and hence, leads to increased attraction for end-users due to positive cross-*Network Effects*. On the other hand, more complementors will reduce the incentives for other complementors, due to the negative within-group network effects, resulting in crowding-out of complementors. This implies that if strong negative indirect network effects are present, management should consider granting exclusive rights to certain complementors and ensure that it does not exploit its monopoly market power on the other side of the market (Eisenmann et al. 2006). Another aspect of the management of complementors is that it allows a platform to increase and differentiate its *Platform Scope* by choosing how a portfolio of complementary products differs vis-a-vis competitors. Encouraging and supporting complementors in a certain niche market (e.g., small app category) or controlling the quality of complements

(Constantinides et al., 2018) allows a distinctive positioning of the platform and hence, increases its market dominance (Cennamo and Santalo 2013).

Leveraging Market Power. Tying occurs when one good is sold (tying good) under the obligation of buying another good (tied good). Bundling strategies are differentiated into pure and mixed bundling. Pure bundling occurs when two goods are only sold as a package, and it is impossible to buy them separately. In contrast, mixed bundled goods can be purchased either individually or as a package. Because digital markets are particularly vulnerable to leveraging practices, where shared user relationships (demand-side economies of scope) and common components (supply-side economies of scope) are exerted, they are also especially prone to tying and bundling practices (Gawer 2014). A popular tying example is Google that ties additional services to search results and places them in highlighted positions. Furthermore, Google grants these services free traffic and hence, reduces start hurdles (Edelman 2015). Moreover, by reducing heterogeneity in the consumers' aggregated valuation of a package, bundling enables a platform to gain a higher share of surplus than selling goods separately (Eisenmann et al. 2009). A famous example is Microsoft bundling its operating system with a media player and browser (Amelio and Jullien 2012).

Platform envelopment is defined as the "entry by one platform provider into another's market by bundling its own platform's functionality with that of the target's so as to leverage shared user relationships and common components" (Eisenmann et al. 2011). Key success factors for envelopment are either: (a) that the user base of the attacker and the target market overlap significantly; (b) that the enveloper can achieve price discrimination advantages; or (c) economies of scope are high in the targeted market (Eisenmann et al. 2011). Three different types of platform envelopment strategies must be differentiated. First, the envelopment of complementary platforms, where a high overlap of the user base is an important prerequisite for success. A special case in this context concerns platforms that are enveloping into their own third-party developer markets. The example of Google's unanticipated expansion into the photography app market shows that due to the greater attention, innovation in these markets can be fostered in the form of enhancing the *Platform Scope* (Constantinides et al. 2018; Foerderer et al. 2018). Additionally, this tactic allows platforms to generate higher revenues (*Economic Profitability*) by imitating successful complementary products, e.g., Amazon providing high-rated products on its own (Hermes et al. 2020b), or to improve the *Platform Identity* by enveloping into complementary markets that offer low-quality complements (Wan et al. 2017). Second, envelopment of substitute platforms wherein high economies of scope have to be achieved to offer deep discounts in the targeted market. Finally, the envelopment of platforms with unrelated functions which leverages common components and the user base to unify "in a single device the functions performed by previously distinct products" (Eisenmann et al. 2011).

Over the last decade, the largest platforms have engaged in numerous mergers and acquisitions (M&As): Apple acquired Shazam, Facebook acquired WhatsApp, and Google acquired Doubleclick. Often, dominant platforms acquire start-ups with fast-growing user bases, intending to eliminate potential future competitors. Since targets usually had relatively low turnover and competition authorities do not consider data or user bases for M&A reviewers, dominant platforms could easily extend their scope and competitive advantage. Alongside these competitive benefits, platforms also try to increase user loyalty by offering new services from the acquired companies (Crémer et al. 2019). For example, Cisco builds very little of its end-user applications; rather, it acquires applications when it wants to expand its product offering capabilities. Hence, M&A is a powerful method to influence *Platform Size* and *Platform Scope* (Gawer and Cusumano 2002).

Timing of Market Entry. Early mover advantages can be achieved by quickly scaling the business in the absence of competitors and allows the platform to build an early installed base. This helps to create reputational effects and hence, positively influence customers' expectations. Here, the advantage of an early installed base is further strengthened by the herding effect of online users, because later users tend to follow the choices made by previous users. Moreover, an early market entry allows a firm to secure access rights to specific key resources, e.g., protect innovations with patents, gain technological expertise, and exploit behavioral demand-side factors by shaping customer preferences (Suarez 2004; Wang et al. 2016). These factors help early movers to increase switching costs, lock-in existing customers, establish *Network Effects*, and deter potential rivals from entering the market (Bamberger

and Lobel 2017). Furthermore, launching a platform faster than rivals can differentiate a firm from its competitors in terms of *Platform Identity* and *Platform Size* (Staykova and Damsgaard 2015). Successful examples for early movers are eBay and YouTube, which were able to defend their leading market positions against late entrants such as the Yahoo auction site or Google Video (Zhu and Iansiti 2012).

Being an early mover, however, involves several risks and disadvantages that lead to four main reasons why platform owners might choose to postpone their market entry. First, early movers are often forced to alter their existing business models, as they face a greater uncertainty regarding their users' needs, and might lock into a particular technology that later proves to be obsolete (Eisenmann 2006; Suarez 2004). Second, a pioneer must educate the market about the new product. Consequently, considerable marketing spending compared to non-pioneers is necessary to build the requisite market awareness (Den Hartigh et al. 2016; Eisenmann 2006). Third, a late entrant can incorporate the latest technology on its platform and beat the incumbent on costs by reverse-engineering its products and entering the market with a superior *Platform Architecture* (Eisenmann et al. 2006)**.** Finally, once an early mover faces increased competition, they are less likely to pursue accelerated growth strategies due to less flexible organizational structures and already gained market shares. Summing up, early movers pave the way for others by reducing the amount of uncertainty and by creating the required market awareness. Therefore, while the pioneer bears all the risks and costs, latecomers can free-ride (McIntyre and Srinivasan 2017; Rothe et al. 2018). Google, for instance, entered the web-search market several years later but became so successful by replacing a cluttered portal with a simple and fast home page. Also, Google copied and optimized Overture's paid listing model for revenue generation from searches (Eisenmann et al. 2006).

Limitations and Future Research

Our research has several limitations. First, the chosen keywords for the literature search may be incomplete, thus not capturing all relevant studies. Second, to classify and compare all sample papers, a fixed coding schema was applied, which may risk excluding or simplifying certain aspects and insights covered in the present literature. Third, in the course of the model construction process, we regard platforms from a global perspective, not accounting for industry-specific factors and risks. Consequently, this research proposes overall strategic considerations, however, their application might vary from one industry to another. Moreover, the reviewed articles mainly investigated digital platforms from western and industrialized domains which limits the generalizability of our results since digital platforms from eastern or growing domains might employ different CMO configurations.

We propose three areas for future research: (1) the role of national factors in attaining market dominance; (2) exploring factors that enable digital platforms to sustain and extend their market dominance; and (3) strategies for new entrances to dethrone dominant platforms.

While prior work focuses on the interplay of environmental and firm-level factors for attaining market dominance, it neglects more general and historical aspects such as capital access, state interventions, or legacy systems. These aspects are, however, important to better understand the breeding grounds of digital platforms, and can help develop a theoretical framework to understand why American platforms largely dominate the EU in online consumer-facing markets and why China has mainly escaped American domination to establish a self-sufficient platform economy (Evans and Gawer 2016). A more comprehensive understanding of national discrepancies enables making important practical contributions such as deriving strategies for the EU to become a dominant driver of digital platforms. That is highly important if the EU wants to remain competitive and sovereign in the platform economy (Parker et al. 2016) and to regain control over new forms of critical platforms (e.g., Facebook in elections; Google in consumer access; and Amazon in cloud computing). While some initial work for American platform domination and China's self-sufficiency exists (Hermes et al. 2020a), we suggest conducting a comparative analysis of American and European platform equivalents. Comparing equivalent platforms between both continents, such as Facebook and StudiVZ, will provide a more nuanced understanding of the role of national factors.

The second avenue suggests that future research moves beyond the question of how digital platforms *attain* dominance, toward investigating how they *sustain and extend* dominance. This is particularly important to the regulatory perspective of digital platforms since long-term dominance poses a realistic threat of abuse of power compared to ephemeral dominance. On the one side, some factors, such as network effects, might account for both attaining and sustaining dominance, while other factors, such as platform envelopment (Eisenmann et al. 2011) or inappropriate M&A rules (e.g., Facebook acquiring WhatsApp without being thoroughly scrutinized), might only contribute to sustaining and extending dominance. The benefit of platform envelopment is that the platform harvests rents from superadditive value (Jacobides et al. 2018; Schreieck et al. 2019) and expands its architectural control across multiple industries (Cennamo 2019). Google, for example, controls the platform core (Android) and complementary apps (e.g., YouTube, GoogleMaps, Search), and thereby generates superadditive value. In other words, the value of Android plus YouTube plus Google Maps plus Search is greater than the sum of their values as standalone offerings (Clemons 2018). Moreover, the owner of the core can deliberately limit interoperability, thereby defending its complementary apps such as Google did with the Mobile Application Development Agreement (Edelman and Geradin 2016; European Commission 2018); hence, further restricting competing offers and further extending and sustaining dominance.

Particularly important will be the envelopment of new technological paradigms such as voice-based digital assistants and operating systems for smart devices. The current market development shows that giant American platform operators are going to control or even dominate these paradigms as well (think of Google Home, Siri, Alexa, and Cortana as well as Google's WearOS, Android Auto, and Android TV. In this context, we not only encourage investigating how giant platform operators have enveloped and, thereby, extended their dominance; we especially call to explore the implications of controlling such an ecosystem of platforms. Controlling both operating systems and digital assistants might critically impact (European) B2C businesses. While control over operating systems allows the platform owner to deliberately limit access and interoperability, digital assistants provide the platform owner with a highly important interface to capture consumer needs. Hence, controlling those two technologies might increase businesses' dependency on a small set of giant platform operators. As an example, an autonomous car manufactured by BMW will only be useful to consumers if Google shares the GPS location of the users and the place she would like to go as well as an initial request for the autonomous car that has been triggered through Google's voice assistant. Even if Google shares this information, it places BMW at a significantly vulnerable strategic dependence. That is because Google could decide to have an autonomous car by Audi pick up the user instead. Assuming that future consumers care less about the brand of their autonomous car, this places Google in a powerful position since Google could decide to forward all transportation requests to Audi instead of BMW, significantly reducing BMW's customer base.

Investigating how to counteract the situation described above represents the theme of the third avenue for future research: How can new entry dethrone existing platform leaders? We propose to theorize and empirically study two approaches. First, engaging in *industry consortia* to build alternative solutions (Hermes et al. 2020d). In contrast to single firms, consortia can leverage synergies between multiple, well-established partners. On the one hand, partners can merge financial and human resources to overcome, for example, the chicken-and-egg problem by leveraging their joint installed customer base. On the other hand, consortia of incumbents enjoy detailed know-how about markets and technologies and are, therefore, well-suited to building valuable alternatives. However, consortia have also significant downsides such as longer decision-making processes and conflicting interests, e.g., IP rights. Second, shifting toward decentralized decision-making such as in *platform cooperatives* (e.g., Stocksy, Partago, Fairmondo). Cooperatives, in general, refer to autonomous associations of persons united voluntarily to achieve their common economic and social goals through jointly-owned and democratically-controlled companies. Future research may extend knowledge in this domain to better understand the outcomes for consumer welfare and total welfare, the ability and willingness to abuse power and violate laws, and the possibility of granting actors of platform ecosystems decision rights in the future development of the platform. Hence, rejecting the idea of the sharing economy (abandoning ownership) and exploring the counterargument (ownership for all) might reveal novel insights into appropriate legal structure and regulation of digital platform leaders.

Conclusion

While research on digital platforms and market dominance has explored economic models, single and multiple case studies, to the best of our knowledge, no study synthesized the various findings into an integrated framework. Therefore, we conducted a systematic literature review to synthesize previous research and drew on CMO configurations to develop an integrated framework of *how digital platform owners attain market dominance*. Our study thereby contributes to theory by (1) explaining the interrelations between environmental factors in platform ecosystems and firm-level strategies as well as firm-level strategies and their effects for market dominance and (2) outlining three fruitful avenues for future research. In terms of practical contribution, our framework supports both, linear value chain companies and policymakers, to better understand how digital platform owners attain market dominance. While linear value chain companies can use this knowledge to develop appropriate coping strategies, policymakers can provide new policies to better regulate abuse of dominance.

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Appendix

Table 1: Overview over the interrelations identified in the literature

Links between Context (C) and Mechanisms (M)		Links between Mechanisms (M) and Outcome (O)	
Network Effects ↔ Architectural Openness	▪ Armstrong, 2006 ▪ Staykova & Damsgaard, 2015 ▪ Eisenmann et al., 2009	Architectural Openness → Complementor Network	▪ Den Hartigh et al., 2016 ▪ Evans & Gawer, 2016 ▪ Inoue, 2019
Network Effects ↔ Pricing	▪ Armstrong, 2006 ▪ Eisenmann et al., 2006	Architectural Openness → Platform Identity	▪ Eisenmann et al., 2009
Network Effects ↔ Platform Ecosystem Mgmt.	▪ Boudreau, 2012 ▪ Karhu et al., 2018 ▪ Inoue, 2019 ▪ McIntyre & Chintakananda, 2014	Architectural Openness → Platform Scope	▪ Ghazawneh & Henfridsson, 2013 ▪ Tiwana, 2015
Network Effects ↔ Leveraging Market Power	▪ Den Hartigh et al., 2016 ▪ Ruutu et al., 2017 ▪ Eisenmann et al., 2006	Pricing → Economic Profitability	▪ Eisenmann et al., 2006 ▪ Armstrong, 2006 ▪ Cennamo & Santalo, 2013
Network Effects ↔ Entry Timing	▪ Zhu & Iansiti, 2012	Pricing → Platform Architecture	▪ Caillaud & Jullien, 2003 ▪ Belleflamme and Peitz, 2019 ▪ Cennamo, 2019
Technol. Trajectories ↔ Architectural Openness	▪ Ruutu et al., 2017 ▪ Eisenmann et al., 2009	Pricing → Platform Size	▪ Bamberger & Lobel, 2017 ▪ Eisenmann et al., 2006 ▪ Cennamo & Santalo, 2013
Technol. Trajectories ↔ Pricing	▪ Rysman, 2009	Leveraging Market Power → Platform Scope	▪ Constantinides et al., 2018 ▪ Gawer & Cusumano, 2002
Technol. Trajectories ↔ Platform Ecosystem Mgmt.	▪ Cennamo, 2019 ▪ Suarez, 2004	Leveraging Market Power → Economic Profitability	▪ Wan et al., 2017
Technol. Trajectories ↔ Entry Timing	▪ Ruutu et al., 2017	Leveraging Market Power → Platform Size	▪ Eisenmann et al., 2011 ▪ Zhang and Duan (2012
Platform External Parties ↔ Architectural Openness	▪ Fuentelsaz et al., 2015 ▪ Suarez, 2004 ▪ Teece, 1986	Leveraging Market Power → Platform Identity	▪ Wan et al., 2017
Platform External Parties ↔ Leveraging Market Power	▪ Bamberger & Lobel, 2017	Platform Ecosystem Mgmt. → Platform Scope	▪ Constantinides et al., 2018 ▪ Boudreau (2012) ▪ Cennamo & Santalo, 2013 ▪ Tiwana et al., 2010 ▪ Wan et al., 2017 ▪ Inoue, 2019
Platform External Parties ↔ Entry Timing	▪ Suarez, 2004	Platform Ecosystem Mgmt. → Platform Size	▪ Den Hartigh et al., 2016 ▪ Fuentelsaz et al., 2015
		Entry Timing → Platform Architecture / Platform Identity	▪ Staykova & Damsgaard, 2015
		Entry Timing → Platform Size	▪ Eisenmann et al., 2006

Who Quits Privacy-Invasive Platform Operators? (P2)

Who Quits Privacy-Invasive Online Platform Operators? A Segmentation Study with Implications for the Privacy Paradox

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Abstract

Although individuals are concerned about their privacy, it is increasingly difficult to withdraw from privacy-invasive platform operators and keep activities private. IS research has identified the privacy paradox as a phenomenon and information asymmetries as one critical reason behind users dichotomy between privacy concern and behavior. However, prior work neglected to investigate (1) the characteristics of consumers caught in the privacy paradox, (2) new areas of information asymmetries such as knowledge about alternative services, and (3) new privacy-decision processes such as quitting privacy-invasive platform operators. To close these gaps, we conducted a representative segmentation study of Google and its services across five countries guided by the theory of planned behavior. Our results identify three clusters and indicate that the privacy paradox is only prevalent in two of them. Consumers in these two clusters lack knowledge about data integration, data usage, and alternative services.

1. Introduction

Privacy concerns are one of the key challenges that organizations, policymakers, and society face in the contemporary digital era [1, 2] and are especially prevalent for digital platforms. This is why Yun et al. (2018) [3] called to "investigate the PIP [personal information privacy] concerns toward the unknown or hidden fifth parties [such as] data crawling/data mining companies, business intelligence companies, and [...] big data companies ([...] SAP, Amazon, Google, etc.)." Their call is also supported by Lowry et al. (2017) [4], stating that exciting opportunities arise when we put "privacy at the center of the IS artefact by focusing on (1) online platforms, (2) the IoT, and (3) big data." Investigating these digital platforms is a pressing matter, because from a privacy perspective, it is nowadays easy to de-anonymize a person using information from various sources [5], and big data companies are doing just that [4]. By developing extremely specific user profiles [6], big data companies also create novel, highly ambitious privacy issues. Google' services are incorporated into most systems worldwide, including mobile operating systems, search, e-mail, and mapping applications [4]. As a result, it is becoming more and more difficult to withdraw from these global systems or keep our activities private.

In this context, research has identified an inconsistency between consumers attitudes and actual behavior. This so-called privacy paradox refers to consumers indicating a high level of privacy concern while simultaneously neglecting their privacy and data disclosure protections [7]. For example, consumers emphasize their concerns about their data, the willingness to protect their data, and their control over who has access to it [8], while at the same time disclosing a variety of personal data, often without reviewing the privacy policy of the service provider [9]. Therefore, the question arose of how this was able to occur. One explanation for the privacy paradox are information asymmetries. Information asymmetries refer to information that is relevant to privacy-decision making, but not known to all actors involved in the privacy-decision process [10].

Research on information asymmetries has largely investigated information such as privacy risks (e.g. identity theft) or protection techniques (e.g. privacy-enhancing technology) [11, 10]. To better understand the role of these different areas of information asymmetries for the privacy paradox, prior work has mainly study the privacy-decision process of disclosing information (giving privacy away). From an empirical point of view prior work primarily studied students in the context of e-commerce and social networks [11].

Research has, to the best of our knowledge, neglected to investigate (1) characteristics of consumers caught in the privacy paradox (exception: [12], (2) new areas of information asymmetries such as

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objective knowledge about data collection, integration, and usage as well as knowledge about alternative services, and (3) new privacy-decision processes such as quitting privacy-invasive online platform operators (taking privacy back).

To close these gaps, we conducted a representative segmentation study of Google and its services such as Search and Chrome across five countries guided by the theory of planned behavior with the aim of answering the following two overarching research questions: *Which users are willing to quit privacy-invasive online platform operators and what are the implications for the privacy paradox?*

The remainder of this paper is structured as follows. Section 2 first reviews the literature on the privacy paradox and current explanations for it and then describes the theory of planned behavior (TPB). Section 3 describes our methodology. In Section 4 we present the results of the cluster analysis and in Section 5 we present differences between clusters. Section 6 discusses the theoretical and practical implications. The paper concludes and presents limitations and future research in Section 7.

2. Theoretical Underpinnings

2.1. Privacy Paradox

Recent privacy laws in the European Union and the US have adopted the standpoint that privacy is a matter of autonomy and control over the collection, storage, and use of information [13, 14]. With the rise of online platforms and lack of transparency, users' control over their personal information has become more difficult. Thus, users may develop concerns about how their personal data are processed when they use online platforms. In fact, research has shown that users are highly concerned about their privacy [11]. Supposedly, users try to protect their privacy. However, research has also demonstrated that this might not always be the case. Despite being exposed to potential privacy threats, such as unwanted contracts or advertisements or identity theft, users are willing to disclose their data by using online platforms [15]. This dichotomy between privacy concern or privacy attitude and users' actual behavior is known as the "privacy paradox" [11].

In the effort to explain the dichotomy between privacy attitude or concern and user behavior, several theories and interpretations have been developed. The theory of information asymmetries and incomplete information indicates that missing information hinders consumers from making rational decisions. However, the concept of bounded rationality demonstrates that even if individuals had access to complete information, they might not be able to process the information to make a rational privacy decision [10]. Hence, individuals' bounded rationality limits their ability to obtain, remember, and process all information. As a consequence, individuals relay on mental models and heuristics. Furthermore, the knowledge gap hypothesis addresses privacy literacy and indicates that users' lack of privacy literacy, such as users' lack of knowledge about technical aspects of online data protection, prevents them from behaving according to their attitudes and concerns [16]. A further theory is the privacy calculus theory, which implies that consumers conduct a rational calculus of losses and gains before disclosing their personal information, wherein the final outcome is determined by the privacy trade-off [17, 11]. Thus, users might weight the gained benefits more than the risks of disclosing their personal information. There are also other interpretations and assumptions regarding human behavior that might explain the privacy paradox, such as optimism or affect bias.

2.2. Theory of Planned Behavior

Given that online platforms are fueled by user data, privacy is a concern that directly affects users. For this purpose, it is important to understand whether there is a difference in the ways different users handle these privacy concerns. Furthermore, it is important to understand what users do about their privacy concerns. To explain user behavior, we draw on the TPB. The TPB, developed by Ajzen (1985) [18], is a common theory used for developing models that explain human behavior with respect to various phenomena. It incorporates three key determinants (attitude toward the behavior, subjective norms, and perceived behavioral control) that form an intention, which, given a sufficient degree of actual control, results in behavior [19].

Just as intentions are held to have determinants, so do attitude, subjective norms, and perceived behavioral control. All three variables are an expectancy-value function of salient beliefs. Attitude toward the behavior, which can be either favorable or unfavorable, is composed of the multiplicative combination of the perceived likelihood that performance of the behavior will lead to a particular outcome and the evaluation of that outcome [20, 21]. Subjective norms explain a persons belief about the extent to which significant others think that a person should engage in a behavior or not, which incorporates a social pressure and the motivation to comply with these referents [22, 19]. Perceived behavioral control (PBC) denotes a subjective degree of control over the performance of a behavior

[23]. The more resources and opportunities individuals perceive to have and the fewer obstacles or impediments that they encounter, the greater their PBC over the behavior should be [20]. Figure 1 illustrate the causal model of the TPB[1]

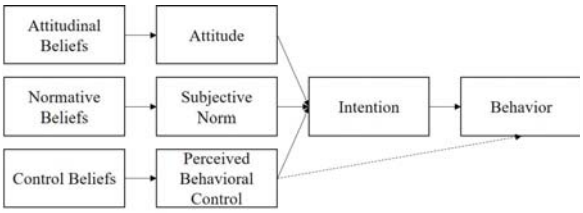

Figure 1. The Causal Model of the TPB adpated from [20, 23]

3. Methodology

3.1. Eliciting External Beliefs and Deriving the Objective Knowledge Scale about Information Privacy

We conducted a belief elicitation study (pre-study) using an open-ended questionnaire, following the approach by Ajzen (2002) [24]. The objective was to freely elicit the most salient attitudinal, normative, and control beliefs. We solicited the key drivers of each behavior from a convenience sample of 19 participants, which included faculty, staff, and students from the Technical University of Munich. Their responses are sorted based on the frequency mentioned. We then chose the beliefs that indicated a high frequency.

Regarding the knowledge scale, we generated and evaluated items and the corresponding dimensions based on a literature review, interviews, and a pretest. First, we conducted a review of information privacy and generated 23 items and 3 dimensions (data collection, data integration, and data usage) that were suitable for measuring an individuals knowledge about information privacy. Second, we interviewed two faculty members, two privacy consultants, and one online marketing executive to confirm the construct domain and dimensionality. Third, we interviewed three IS undergraduates and two consumers to evaluate face validity. Fourth, we conducted a Q-Sort with six IS doctoral students to assess content validity. During the second, third, and fourth steps we reworded and deleted items and converged on 15 multiple choice questions. Lastly, we conducted a small online questionnaire with 28 consumers and used the results to eliminate additional six questions since they were unsuitable for distinguishing between novice and expert knowledge and therefore failed discriminant validity.

[1]Note that our objective is not to reveal the causal model for quitting privacy-invasive platform operators. Instead we use the constructs of the TPB to determine clusters of individuals that are affine, torn, and non-affine across three different behaviors.

3.2. Data Collection

A representative online survey was conducted among consumers in five countries exploring their knowledge and opinions about Google and its services. The survey was distributed by a market research institute which had partner organizations in each country. The partner organizations recruited respondents and compensated them for participation. We chose Google's service ecosystem as an example of a company operating privacy-invasive online platforms [25, 26]. For example, Google disclosed search queries to third parties without user consent and merged privacy policies without user consent [27]. The survey results were obtained from 1,433 individuals: 274 in Denmark, 299 in France, 274 in Germany, 289 in the UK, and 297 in the US. 730 individuals were male and 703 female.

3.3. Measurements

The survey instrument was adopted from Conner and Sparks (2005) [28] and translated into Google's online platform context. According to the TPB, each behavior must be defined within a well-specified target, action, context, and time frame [24, 23]. In total, we used three different behaviors to better assess quitting a service provider completely, not only a specific service of that service provider. The three behaviors were (1) using (action) a different browser (target) than Google Chrome (context) in the next six months (time frame), (2) using a different search engine than Google Search in the next six months, and (3) being signed off my personal Google account while using Google Search in the next six months. The survey questions were designed to cover the TPB constructs such as behavioral beliefs (e.g. Me using a different browser than Google Chrome would increase the loading time of websites I want to access), normative beliefs (e.g. Privacy experts think I should use a different browser than Google Chrome.), control beliefs (e.g. For me to use a different browser than Google Chrome in the next 6 months will be very difficult to very easy), attitude (e.g. Me using a different browser than Google Chrome in the next 6 months would be very impractical to very practical), subjective norms (e.g. Most people who are important to me use a different browser than Google Chrome), perceived behavioral control (e.g. I am confident that I can use a different browser than Google Chrome in the next 6 months), behavioral intention,

and actual behavior. Additionally, we measured privacy concerns [29] (e.g. I am concerned that online service providers may keep my private information in a non-secure manner), subjective information privacy knowledge [30, 31] (e.g. In general, I am quite knowledgeable about how online companies collect, manage and use my personal information), and objective information privacy knowledge (self-developed) (e.g. Online companies use cookies to collect information from your hard drive). All items were measured on a 7 point Likert scale except objective information privacy knowledge which was conducted as multiple choice questionnaire.

3.4. Data Analysis

To perform a cluster analysis on the survey data, an exploratory factor analysis (EFA) was conducted first to find underlying factors and reduce the dimensionality of the dataset. Studies have shown that "given a sufficiently large number of response categories (e.g. seven), and absence of skewness, and equal thresholds across items, it seems possible to obtain reasonable results", so factor analysis can be performed without the assumption of normality within the data [32]. Thus, given that the survey data were ordinal, we neglected this assumption. The EFA processes began with a test of absence of multicollinearity and singularity within the variables. Provided that no items had a squared multiple correlation close to 0 or close to 1, the test indicated no issues. To complement these results, a Bartletts Test of Sphericity was performed. The test showed that the correlations between items were sufficiently large ($X^2(3655) = 104051.67, p < 0.01$). Next, the Kaiser-Meyer-Olkin verified the sampling adequacy of the analysis (0.96) [33]. After these tests showed the appropriateness of using EFA to process the data, the number of factors had to be chosen. To do so, using eigenvalues is suggested, based on the Kaisers criterion [34] as well as Horn's parallel analysis [35], which suggested 13 and 15 factors, respectively. After testing the suggested numbers of factors, i.e., examining how variables loaded onto factors using different factor extractions and rotation methods, it was decided to use 15 factors. For further analysis, it was decided that the maximum principal axis factor extraction method should be used, which is suggested for data that do not follow a normal distribution [36]. Furthermore, the oblique rotation method, specifically the promax rotation, was used, given that a factor correlation could not be excluded. Factors below the factor loading criterion of 0.40 were removed one by one, based on the number of factors and the loading intensity [37]. Table 5 in the Appendix demonstrates the factor loadings. For the retrieved factor solution Cronbach's alpha was evaluated to test the internal consistency reliability of each factor, which is provided in Table 1 along with the factor naming. The Root Mean Square of the Residuals of 0.02 and the factoring reliability of 0.873 indicated a good model fit. To use the EFA results for the cluster analysis, factor scores were computed using Bartletts approach. These scores were centered at zero such that a positive score indicated that the items belonging to the factor had an above average loading, while a negative score indicated that the items had a below average loading onto those factors.

Factor name	Cronbach's Alpha
control belief power	0.94
privacy concerns	0.95
behavioral belief strength	0.93
subjective knowledge	0.90
attitude toward Google Search	0.94
intention toward using alternatives	0.93
perceived behavioral control	0.90
evaluation of outcome	0.78
attitude toward Google Chrome	0.92
perceived norms	0.90
attitude towards sign-in behavior	0.93
normative belief strength	0.92
motivation to comply	0.93
control belief strength	0.78

Table 1. Factor Names and Cronbach's Alpha

To cluster the data, k-means was used. The elbow method, the average silhouette width, and the gap statistic were used to examine the number of clusters needed for the clustering algorithm. However, these methods yielded different results. After some testing, including different randomizations of cluster centroids, three clusters turned out to be the most reasonable number for further analysis. The clusters produced by k-means were then appended to the dataset of factor scores to serve as classification labels. A multiclass classification using the XGBoost algorithm was performed to find the most influential factors. XGBoost is an optimized distributed gradient boosting machine learning algorithm [38]. The most influential factor was control belief power, followed by PBC, intention toward privacy protection behavior, attitude toward Google Chrome, attitude toward sign-in, and motivation to comply with experts. K-means was then run again on the dataset, including only the most influential factors. The results of this run were taken as the final clustering solution. The overall average silhouette coefficient was equal to 0.23 and only a few observations were mis-clustered. Furthermore, analysis of variance (ANOVA) test of the factors and the clusters showed a statistical significance ($p < 0.01$).

4. Cluster Analysis Results

Cluster 1 encompasses factor scores that are above the average zero mean. The cluster included 308 users. These users had a particularly high intention to use a browser other than Google Chrome, a search engine other than Google Search, as well as to avoid being signed into their Google account during the next six months. Furthermore, these users indicated that they would find it rather easy to use services other than Google or their Google account. These users also indicated that, for them, knowing alternatives and reading about data leaks and privacy violations would make using a different browser and search engine other than those provided by Google reasonable. They also had a positive attitude about using a browser other than Google Chrome and avoiding their Google account over the next six months. Similarly, these users were highly motivated to do what privacy experts recommended. Overall, these users did not a have high affinity toward Google services, thus they were named non-affine users.

Cluster 2 contained users that had the opposite preferences and therefore shared no similarities with cluster 1. These users had, on average, lower factor scores. The cluster included 367 users; slightly more than cluster 1. Thus, these users had a relatively low intention to leave Google services over the next six months. They would also find it rather difficult to leave Google Search and Chrome and their account. These users also indicated that, for them, knowing alternatives and reading about data leaks and privacy violations would not make using a different browser and search engine other than those provided by Google likely. Moreover, they had a rather negative attitude about using a browser other than Google Chrome or to avoid being signed into their Google account over the following six months. They also had a rather low motivation to comply with the opinion of privacy experts. In summary, cluster 2 included users that had a high affinity toward Google services. Hence, they were called affine users.

Cluster 3 included users that held a rather neutral standpoint. It included 758 users, the vast majority of the survey participants. The factor scores were all centered around zero, meaning that these users represented the average response. It seems that these users had a minor positive tendency to use different services. However, in general, these users were undecided and are therefore named torn users. A summary indicating the average factor scores per cluster is given in Table 2.

Factor	Non-affine	Affine	Torn
control belief power	1.1211	-1.0013	0.02925
PBC	1.1407	-1.0896	0.06403
behavioral intention	1.1858	-0.9471	-0.02327
attitude toward Google Chrome	1.0117	-0.8672	0.008772
attitude toward sign-in behavior	1.0496	-0.8520	-0.01399
motivation to comply	0.9483	-0.9387	0.06920

Table 2. Factor Score Averages by Cluster

5. Analysis of Cluster Differences

The segmentation of clusters across countries and gender involved several tests. The chi-squared test indicated that countries and clusters had a dependency ($p < 0.01$), but that gender and the clusters are not related ($p > 0.05$). A Bonferroni test to assess which clusters contributed to the significance between the different countries indicated that only affine and non-affine users significantly differed among countries ($p < 0.05$). The distribution of each cluster across all countries is listed in Table 3. It should be noted that in Denmark, affine users are more than twice as frequent than non-affine users. In comparison to other countries, Denmark has the most affine users and the least non-affine users. Generally, platform torn users are more frequent than other users in all countries, with France having the most in comparison to the other countries.

	Non-Affine	Affine	Torn
UK	23.38%	17.44%	20.18%
USA	23.38%	20.71%	19.66%
France	20.78%	15.26%	23.61%
Denmark	11.36%	27.25%	18.34%
Germany	21.10%	19.35%	18.21%

Table 3. Proportion Table of Countries and Clusters

Differences with respect to age were tested using an ANOVA test, given that age is a continuous variable. Lavenes test for homogeneity of variances and Shapiros test for normality were also conducted. The latter test showed that age was not normally distributed. Given that there is some controversy regarding whether ANOVA should be run on non-normally distributed data, the test was run but also complemented with a Kruskal-Wallis test. The results for both tests show that there exists significance between the clusters ($p < 0.05$ and $p < 0.05$). The Tukey test was conducted to observe which clusters dragged the significance. It showed only a significance ($p < 0.05$) between affine and torn users. A box plot in Figure 2 shows the differences in the age variable across clusters. The median age of the torn users is the highest, while the median of the affine users is the lowest. This indicates that younger participants tend to neglect privacy issues and continue using Google

services.

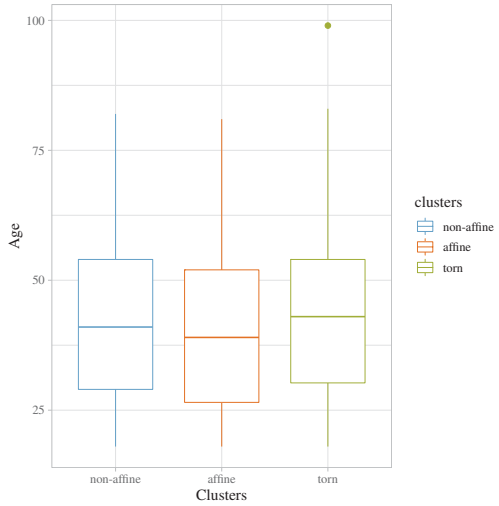

Figure 2. Boxplot for Age

The segmentation of clusters across objective knowledge of information privacy included the testing of how clusters differed based on user responses to questions regarding data collection, data integration, and data usage. A chi-squared test indicated a significant dependency between the individual items and the clusters. The Bonferroni test for the data collection dimension indicated that only the difference between non-affine users (mean of 0.32) and torn users (mean of 0.28) was significant ($p < 0.05$). The same type of test indicated that data integration and data usage had differences between non-affine users (mean of 0.39 and 0.76) and affine users (mean of 0.32 and 0.70) ($p < 0.01$ and $p < 0.05$) and non-affine users and torn users (mean of 0.31 and 0.69) ($p < 0.01$ and $p < 0.01$). The proportion contingency in Table (4) for the three variables shows that affine users almost twice as frequent as non-affine users answered all three question blocks related to objective knowledge incorrectly.

The segmentation of clusters based on knowledge about alternatives was performed to see if users from different clusters considered themselves knowledgeable about alternatives to Googles services. To do so we draw on the construct control belief strength which basically covers items such as I know alternatives to Google Chrome. Both a Kruskal-Wallis ($p < 0.01$) and ANOVA ($p < 0.01$) test demonstrated that there exists significant difference between clusters. The Bonferroni test indicated that only the difference between non-affine users (mean of 5.8) and torn users (mean of 4.9) as well as non-affine users (mean of 5.8) and affine users (mean of 4.8) were significant ($p < 0.01$). To visualize the differences, a box plot is displayed in Figure 3.

Data Collection	Non-affine	Affine	Torn
0%	19.81%	29.97%	29.16%
33%	65.91%	54.22%	58.84%
66%	12.66%	14.44%	10.82%
100%	1.62%	1.36%	1.19%
Data Integration	Non-affine	Affine	Torn
0%	17.21%	30.79%	29.95%
33%	50.97%	45.23%	48.28%
66%	29.87%	22.34%	19.92%
100%	1.95%	1.63%	1.85%
Data Usage	Non-affine	Affine	Torn
0%	3.90%	6.81%	9.23%
33%	13.96%	15.53%	15.17%
66%	32.14%	38.96%	35.22%
100%	50.00%	38.69%	40.37%

Table 4. Proportion Table of Objective Knowledge and Clusters

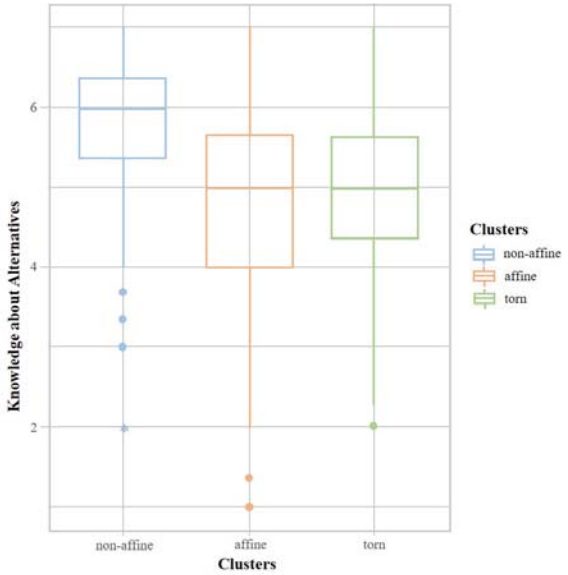

Figure 3. Boxplot for Knowledge about Alternatives

The segmentation of clusters based on general privacy concerns was performed to see if there is any deviance in the way different users were concerned about online providers' practices. The factor included concerns about keeping private information in a non-secure manner, not taking measures to prevent unauthorized access to user information, divulging user information to unauthorized parties without user consent, using and selling user information for other purposes without authorization or notification, and using user information for other purposes. From the descriptive statistics, it was already evident that all participants were rather concerned. Thus, the data were skewed and therefore were not normal. This was confirmed by a Shapiros test. Lavenes test indicated

homogeneity of variances between clusters. Thus, a Kruskal-Wallis and an ANOVA test were performed and indicated significance between the clusters ($p < 0.01$). To visualize the differences, a box plot is provided in Figure 4. It can be seen that non-affine users are the most worried, which is in accordance with their negative attitude toward Google. In comparison to the other two clusters, affine users are less worried. Given that the

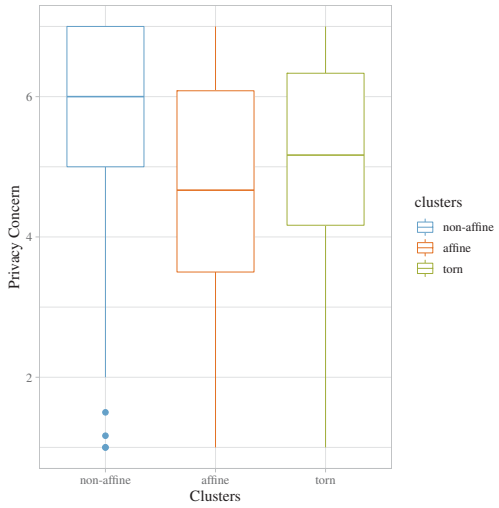

Figure 4. Boxplot for General Privacy Concern

three **behavioral items** related to Google services, i.e. *"How often do you use a different browser than Google Chrome?"*, *"How often do you use a different search engine than Google Search?"*, and *"How often do you avoid to be signed in to your personal Google account before using Google service that don't require to be signed in?"* were not used in the final cluster analysis, differences were tested for these items. Both chi-square and Kruskal-Wallis tests were performed and yielded statistical significance ($p < 0.01$) for all three items). Furthermore, the post-hoc Bonferroni test also showed significant differences across all clusters for all variables ($p < 0.01$). There were no unexpected patterns found in the contingency tables for these variables. Non-affine users tend to use browsers other than Google Chrome and search engines other than Google Search, as well as sign out of their Google account. Affine users behave the opposite, while torn users do not commit to using either different services or Google services.

6. Discussion

6.1. Key Findings

Our results indicate three clusters. The first cluster often uses alternative services to those offered by Google. Cluster members mainly come from the United Kingdom (UK) and the United States (US) and, the fewest, from France. Members rate themselves highly knowledgeable about information privacy. However, the objective multiple choice test demonstrated that the cluster lacks knowledge about data collection in contrast to data integration and data usage. Moreover, the cluster claims to largely know alternatives to Google services. Members demonstrate high privacy concerns and a high-level of using alternative services to Google which indicates that this cluster is characterized by a low degree of privacy paradox.

The second cluster does not use alternative services to those offered by Google. Cluster members stem from Denmark and the fewest are from France. This cluster has the lowest average age. While cluster two lacks knowledge about data collection and integration, it performed good about data usage. However, compared to cluster one, cluster two is significantly less knowledgeable about data integration and usage. Moreover, the cluster does somewhat know alternatives to Google services. As it demonstrates a medium level of privacy concerns and a low level of using alternative services this cluster is characterized by a medium degree of privacy paradox.

The third cluster somewhat uses alternative services to those provided by Google. Cluster members mainly come from France and the fewest from Germany and Denmark. This cluster has the highest average age. While cluster three lacks knowledge about data collection and integration, it performed good about data usage. However, compared to cluster one, cluster three is significantly less knowledgeable about data integration and usage (just as cluster two). Moreover, cluster two only somewhat knows alternatives to Google services. As it demonstrates high privacy concerns and medium levels of using alternative services this cluster is characterized by a medium degree of privacy paradox.

6.2. Theoretical and Practical Implications

Our study makes two theoretical contributions to the privacy literature. The results show that all clusters have medium to high general privacy concerns and low to high levels of using alternatives to Googles services. Hence, the degree of privacy paradox is not primarily influenced by variations in privacy concerns (or variations in disagreeing with Google's practices according to [12]), but largely by variations in the use of alternative services (the actual behavior). As a consequence, we demonstrate that the privacy paradox can exhibit varying degrees and is not a dichotomous phenomenon. Second, we extend research

on information asymmetries [10] by demonstrating that objective knowledge about data integration and data usage as well as knowledge about alternative services are new areas of information asymmetries that contribute to consumers privacy paradox.

The second theoretical contribution also triggers two practical implications for regulators. First, regulators need to enforce online service provider to better inform consumers about their data integration and data usage practices. To cope with these regulations, service providers usually develop more transparent privacy policies. However, as consumers' dont read privacy policies , we argue that the enforcement should focus on triggering service provider to develop new tools instead. Tools that can be easily accessible, readable, and comprehensible by consumers such as visual signs on the initial screen (e.g. certifications or warning labels). Second, as Google can easily deny its competitors access to customers (e.g. by pre-installing Search on Android or setting it as default on Chrome), consumers are dissuaded from finding, and therefore knowing about, alternative services. We encourage regulators to level the playing field (such as triggering Google to allow other search engine to be available during Android setups) and help consumers get to know alternative services.

7. Conclusion

Consumers indicating a high level of privacy concern while simultaneously neglecting their privacy and data disclosure protections are defined as being caught in the privacy paradox [7]. However, prior work neglected to investigate (1) the characteristics of consumers caught in the privacy paradox, (2) new areas of information asymmetries such as knowledge about alternative services, and (3) new privacy-decision processes such as quitting privacy-invasive platform operators. To close these gaps, we conducted a representative segmentation study of Google and its services across five countries guided by the theory of planned behavior. Our results identify three clusters and indicate that the privacy paradox is only prevalent in two of them. Consumers in these two clusters lack knowledge about data integration, data usage, and alternative services.

We contribute to the privacy literature by identifying clusters with varying degrees of the privacy paradox (in contrast to assuming that it is a dichotomous phenomenon) and by demonstrating that knowledge about alternative services to privacy-invasive ones are a new area of information asymmetry that contributes to consumers privacy paradox.

Our study has several limitations. First, the results reflect consumer attitudes towards Google which limits the generalizability of our findings. We encourage future research to explore other cases such as Facebook to enhance the generalizability of our findings. Second, the research context is limited to the US and some European countries. Thus, results might differ when assessing other countries or continents such as Asia. Third, the authors decided that three clusters were most suitable to make sense of the data. However, statistical tests also identified other cluster solutions and therefore, our results might differ when choosing a different number of clusters. Lastly, we encourage future research to assess the effect of regulation on the lack of knowing alternatives. Especially the recent regulation of Google, which forces the company to allow other search engines to be selectable as default when initially setting up an Android phone, reflects a promising case.

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8. Appendix

GC stands for Google Chrome. GS for Google Search. SI for being signed-in into one's Google account. SK for subjective knowledge. BI for behavioral intention. ATT for attitude. SN for subjective norm and II for injunctive influence and DI for descriptive influence. BB for behavioral beliefs and BS for belief strength and EoO for evaluation of outcome. PBC for perceived behavioral control. NB for normative belief and MtC for motivation to comply. CB for control beliefs and BP for belief power. PC for privacy concerns.

	PA1	PA3	PA2	PA7	PA11	PA8	PA12	PA5	PA6	PA10	PA13	PA9	PA4	PA15	PA14
SK1	0.04	-0.03	-0.02	0.03	-0.01	-0.01	-0.02	0.01	-0.04	0.02	0.09	0.02	**0.80**	0.05	-0.01
SK2	0.02	0.01	0.05	0.00	-0.04	-0.01	0.04	-0.00	-0.04	0.01	0.00	-0.01	**0.91**	0.02	-0.02
SK3	0.01	-0.00	0.03	0.04	-0.07	-0.01	0.02	-0.01	-0.01	0.01	0.08	-0.05	**0.91**	0.04	0.00
BI-GC1	0.01	-0.01	-0.02	**0.81**	0.02	0.01	-0.04	-0.01	-0.12	0.25	-0.04	0.00	0.03	-0.02	-0.02
BI-GC2	0.01	-0.00	-0.03	**0.79**	0.05	0.05	-0.02	0.01	-0.12	0.22	-0.03	-0.04	-0.00	-0.01	-0.04
BI-GC3	-0.01	0.00	-0.04	**0.79**	0.05	-0.01	-0.05	0.03	-0.12	0.27	-0.04	0.00	-0.00	-0.04	0.00
BI-GS1	0.02	-0.01	0.01	**0.72**	0.07	0.07	-0.08	0.04	0.25	-0.13	-0.04	0.06	0.01	-0.03	-0.03
BI-GS2	0.05	0.01	-0.03	**0.79**	0.08	-0.03	-0.04	0.02	0.24	-0.17	-0.02	0.00	0.01	-0.01	0.02
BI-GS3	0.01	0.00	-0.01	**0.74**	0.07	0.03	-0.02	0.03	0.21	-0.14	-0.04	0.01	0.04	-0.02	0.03
BI-SI2	-0.05	0.04	0.01	**0.46**	0.11	0.06	0.35	0.03	-0.10	-0.07	-0.08	0.06	-0.00	-0.06	0.03
ATT-GC1	-0.01	0.02	0.03	0.13	-0.05	-0.05	0.08	0.01	0.14	**0.71**	0.07	-0.01	0.03	-0.02	-0.00
ATT-GC2	-0.01	-0.02	0.04	0.04	-0.07	0.02	0.08	0.01	0.15	**0.77**	-0.05	-0.03	0.05	-0.02	0.04
ATT-GC3	0.04	0.04	0.03	0.02	-0.01	-0.13	0.09	0.01	0.25	**0.60**	0.07	0.05	-0.04	0.07	-0.01
ATT-GC4	-0.04	-0.01	0.01	0.04	0.04	0.06	0.13	-0.00	0.14	**0.70**	-0.07	-0.00	-0.02	0.02	0.00
ATT-GS1	0.04	-0.03	-0.01	0.07	-0.05	-0.02	0.19	0.00	**0.74**	0.12	0.12	-0.00	-0.00	-0.00	-0.03
ATT-GS2	0.01	-0.03	0.01	0.01	-0.06	0.08	0.19	0.02	**0.71**	0.17	0.02	-0.02	-0.00	-0.01	0.01
ATT-GS3	0.01	0.02	-0.02	0.02	-0.06	-0.07	0.20	0.01	**0.70**	0.16	0.13	0.02	-0.06	0.07	-0.01
ATT-GS4	0.01	-0.03	-0.00	-0.02	0.01	0.10	0.21	0.02	**0.67**	0.16	-0.07	-0.00	-0.03	0.01	-0.02
ATT-SI1	-0.01	0.02	-0.00	-0.00	-0.02	-0.03	**0.80**	-0.04	0.18	0.08	0.06	-0.02	0.01	-0.00	0.03
ATT-SI2	0.01	-0.00	0.01	-0.07	0.03	0.03	**0.80**	-0.05	0.19	0.11	-0.04	-0.02	0.05	-0.02	-0.02
ATT-SI3	0.00	0.03	-0.01	-0.01	-0.00	-0.13	**0.74**	-0.01	0.21	0.08	0.11	0.01	-0.03	0.06	-0.01
ATT-SI4	0.04	-0.03	0.01	-0.08	0.13	0.06	**0.77**	-0.05	0.18	0.07	-0.12	-0.01	0.01	-0.02	-0.06
SN-II-GC	-0.06	0.03	0.08	0.19	**0.84**	-0.15	0.02	-0.10	-0.07	0.05	0.08	-0.00	0.02	0.07	0.01
SN-II-GS	-0.03	0.04	0.07	0.14	**0.85**	-0.18	0.02	-0.06	0.05	-0.08	0.08	0.01	0.00	0.07	-0.00
SN-II-SI	-0.09	0.03	0.09	0.11	**0.79**	-0.12	0.16	-0.06	-0.07	-0.07	0.09	0.01	0.04	0.03	0.06
SN-DI-GC	0.10	-0.02	0.01	0.00	**0.69**	0.14	-0.09	0.01	-0.11	0.16	0.10	-0.05	-0.11	0.08	-0.06
SN-DI-GS	0.09	-0.04	-0.02	-0.05	**0.71**	0.09	-0.05	0.05	0.12	-0.07	0.10	-0.00	-0.07	0.04	-0.04
SN-DI-SI	0.15	-0.02	-0.04	-0.07	**0.69**	0.11	0.16	0.03	-0.11	-0.06	0.08	-0.04	-0.04	0.01	-0.05
BB-BS-GC1	0.07	**0.76**	0.01	0.01	0.03	0.05	-0.04	-0.07	0.06	0.00	0.06	-0.05	0.02	-0.02	0.05
BB-BS-GC2	0.00	**0.65**	0.00	-0.13	0.17	-0.08	-0.06	0.10	0.05	-0.04	-0.03	-0.00	0.04	-0.03	0.01
BB-BS-GC3	-0.03	**0.74**	0.03	-0.03	0.09	-0.05	-0.12	0.05	0.04	-0.04	-0.02	0.03	0.01	-0.01	-0.05
BB-BS-GS1	0.05	**0.78**	-0.04	0.06	-0.04	0.04	0.02	-0.05	0.05	-0.02	0.01	-0.04	0.00	0.01	0.05
BB-BS-GS2	-0.00	**0.71**	0.00	-0.05	0.04	-0.06	-0.04	0.03	-0.13	0.09	-0.02	-0.01	0.01	0.05	-0.09
BB-BS-GS3	0.11	**0.74**	0.01	0.01	-0.03	0.04	-0.02	-0.04	0.04	0.06	0.01	-0.03	0.00	-0.03	-0.01
BB-BS-SI1	-0.07	**0.81**	-0.00	0.06	-0.15	0.11	0.14	-0.01	-0.05	-0.01	0.04	-0.04	-0.03	-0.01	0.05
BB-BS-SI2	-0.01	**0.80**	0.01	0.07	-0.10	0.05	0.09	0.01	-0.04	-0.05	0.02	0.01	-0.05	0.02	-0.01
BB-BS-SI3	-0.03	**0.80**	-0.04	0.04	-0.03	0.03	0.09	-0.03	-0.04	-0.02	-0.00	0.05	-0.03	0.03	0.01
BB-EoO-GC/GS/SI1	0.13	0.03	0.13	0.04	-0.19	-0.05	0.01	-0.04	-0.06	-0.06	0.17	**0.58**	-0.04	0.12	-0.05
BB-EoO-GC2	-0.02	0.02	-0.07	-0.08	0.16	0.10	-0.07	0.03	0.07	0.07	-0.14	**0.46**	0.08	-0.16	0.00
BB-EoO-GC3	-0.05	0.02	-0.04	-0.06	0.14	0.10	-0.05	0.01	0.02	0.08	-0.12	**0.56**	0.00	-0.07	0.06
BB-EoO-GS2	-0.10	0.05	-0.11	-0.04	0.24	0.03	-0.10	0.04	0.08	0.10	-0.15	**0.46**	0.02	-0.10	0.07
BB-EoO-GS3	0.09	-0.04	0.14	0.04	-0.13	-0.07	0.02	-0.02	-0.03	-0.04	0.12	**0.59**	-0.07	0.10	-0.06
BB-EoO-SI2	0.01	-0.05	0.01	0.04	0.03	-0.07	0.10	-0.02	0.00	-0.09	0.06	**0.69**	-0.02	0.09	-0.02
BB-EoO-SI3	0.03	-0.01	0.02	0.05	-0.07	0.01	-0.03	-0.02	-0.04	0.00	0.15	**0.65**	-0.01	0.04	-0.01
PBC-GC1	0.01	0.03	0.04	0.09	-0.07	**0.72**	-0.11	-0.02	-0.06	0.21	0.04	-0.01	-0.04	0.06	0.00
PBC-GS1	0.02	0.03	0.06	0.09	-0.05	**0.72**	-0.10	-0.04	0.22	-0.09	-0.03	0.02	-0.01	0.06	0.03
PBC-SI1	-0.07	0.02	0.02	-0.02	-0.02	**0.66**	0.28	0.01	-0.11	-0.07	0.00	0.09	0.00	-0.01	0.03
PBC-GC2	0.09	-0.04	0.02	0.08	-0.09	**0.71**	-0.13	-0.04	-0.04	0.14	0.14	-0.04	-0.01	0.08	-0.02
PBC-GS2	0.04	-0.00	0.06	0.05	-0.03	**0.74**	-0.10	-0.04	0.26	-0.12	0.10	-0.04	0.01	0.07	-0.03
PBC-SI2	0.07	0.01	0.01	-0.12	0.03	**0.71**	0.26	0.01	-0.09	-0.09	0.08	-0.00	0.03	-0.04	-0.04
NB-BS-GC	-0.03	0.00	-0.07	-0.06	0.17	0.10	-0.06	0.04	0.08	0.05	**0.89**	0.02	0.06	-0.13	0.01
NB-BS-GS	-0.05	0.02	-0.07	-0.06	0.18	0.09	-0.05	0.05	0.12	-0.02	**0.89**	0.06	0.06	-0.13	0.02
NB-BS-SI	-0.04	0.04	-0.06	-0.07	0.13	0.09	0.11	0.04	-0.02	-0.04	**0.77**	0.04	0.04	-0.09	0.06
NB-MtC-GC	0.10	-0.03	0.02	0.01	-0.05	0.01	-0.06	-0.01	-0.02	0.06	0.04	-0.02	-0.01	0.02	**0.87**
NB-MtC-GC	0.12	-0.02	0.02	-0.01	-0.01	0.02	-0.06	0.00	0.04	-0.02	0.04	-0.02	-0.01	0.03	**0.83**
NB-MtC-SI	0.09	0.00	0.01	-0.03	0.01	-0.05	0.07	0.00	-0.09	0.01	0.04	0.03	-0.02	0.05	**0.81**
CB-BP-GC1	**0.63**	-0.01	-0.03	0.00	0.14	0.02	-0.10	-0.04	-0.07	0.17	0.04	0.03	0.02	0.02	0.00
CB-BP-GC2	**0.68**	-0.02	-0.01	0.04	0.00	0.02	-0.08	-0.03	-0.10	0.20	0.11	-0.03	-0.01	0.01	0.03
CB-BP-GC3	**0.68**	0.04	0.02	-0.06	0.00	0.01	-0.03	0.07	-0.01	0.09	0.03	0.02	-0.02	0.03	-0.01
CB-BP-GS1	**0.85**	-0.00	0.01	0.01	0.08	0.01	-0.08	-0.03	0.12	-0.05	-0.10	-0.01	0.04	-0.03	0.01
CB-BP-GS2	**0.84**	-0.00	0.02	0.05	0.01	-0.00	-0.11	0.01	0.17	-0.09	-0.02	-0.02	-0.02	0.01	-0.00
CB-BP-GS3	**0.86**	-0.00	0.03	-0.01	0.04	-0.00	-0.04	0.00	0.13	-0.12	-0.01	-0.06	-0.01	0.03	0.01
CB-BP-SI1	**0.76**	0.02	-0.07	-0.01	-0.04	0.01	0.17	0.01	-0.06	-0.01	-0.08	0.08	0.04	-0.08	0.01
CB-BP-SI2	**0.80**	0.02	-0.01	0.05	-0.05	-0.01	0.19	-0.02	-0.08	-0.06	-0.10	0.05	0.04	-0.09	0.02
CB-BP-SI3	**0.79**	0.04	-0.03	-0.02	-0.07	-0.01	0.19	0.03	-0.04	-0.05	-0.05	-0.00	-0.01	-0.03	0.03
CB-BS-GC	-0.09	0.01	-0.06	0.05	0.04	0.13	-0.06	0.02	-0.01	0.08	-0.05	0.01	-0.03	**0.82**	-0.00
CB-BS	0.02	0.04	0.05	-0.10	0.02	-0.12	-0.02	-0.01	0.02	0.01	-0.03	0.04	0.04	**0.53**	0.03
CB-BS-GS	-0.02	-0.02	-0.08	0.04	0.06	0.12	-0.02	0.01	0.05	-0.06	-0.11	-0.01	0.01	**0.85**	0.03
CB-BS-SI	-0.02	-0.02	-0.06	-0.07	0.12	0.12	0.12	0.05	0.00	-0.01	-0.15	0.03	0.08	**0.61**	0.01
PC1	0.01	-0.03	**0.91**	0.00	0.05	-0.02	-0.01	0.02	0.03	0.03	-0.05	-0.02	0.00	-0.03	0.01
PC2	-0.02	0.00	**0.84**	-0.03	-0.00	0.04	0.01	0.06	-0.02	0.01	-0.03	0.01	0.05	-0.05	0.04
PC3	-0.01	-0.01	**0.93**	-0.04	0.03	0.06	-0.02	0.02	-0.01	0.05	-0.05	-0.01	-0.01	-0.03	0.02
PC4	-0.01	0.01	**0.93**	0.00	0.06	0.04	-0.01	-0.03	-0.02	0.03	-0.05	0.02	0.00	-0.01	-0.00
PC5	-0.04	0.03	**0.94**	-0.03	0.01	0.09	0.02	-0.01	-0.00	-0.00	-0.04	0.01	0.03	-0.04	-0.02
PC6	0.01	-0.00	**0.87**	-0.02	0.09	0.01	0.01	0.03	0.01	0.01	-0.03	-0.00	-0.02	-0.01	-0.01

Table 5. Factor Loadings

Consumer Attitudes towards Firms that Monetize Personal Information (P3)

Consumer Attitudes towards Firms that Monetize Personal Information: A Cluster Analysis and Regulatory Implications

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Abstract

The EU is seeking to develop new regulatory frameworks for online privacy. This entails a complex set of tradeoffs, since regulatory policy must be informed by consumers' preferences, and if regulatory policy contravenes consumer preferences, regulators might need to explain the hidden sources of harm to consumers. To increase our understanding of consumers' attitudes towards firms that monetize privacy, we surveyed 1693 individuals from Denmark, France, Germany, the UK, and the USA about Google. Our cluster analysis confirms the privacy paradox – although consumers disapprove of Google's practices, they still use it – in four out of five clusters but indicates two different explanations: some consumers cannot locate a viable alternative, whereas others lack the information needed for their privacy calculus. We explore regulatory implications and draw upon the theory of newly vulnerable markets to discuss whether market entry may be feasible.

Keywords: Consumer attitudes towards privacy, informed consent, privacy paradox, privacy regulation, theory of newly vulnerable markets

Introduction

We are reporting on a set of consumer surveys that seek to examine consumers' attitudes towards firms that monetize consumers' personal information by leveraging data mining and personalized ads. The surveys assessed consumers' knowledge of Google's current business practices, as well as their approval/disapproval of those practices, independent of their belief that those practices currently incurred. This allowed us to determine *implicit informed consent;* individuals who both *knew of* and *approved of* these practices. We also investigated their willingness to switch to alternative *safer* services, that is, services that do not violate privacy or monetize private information. We studied their

degree of regulatory satisfaction, including the belief that regulators were taking adequate steps to inform consumers about potential privacy risks online and to protect them from these risks. We saw very little differences between consumers in France, Germany, the UK, and the USA. When compared with previous studies (Clemons et al. 2014; Clemons and Wilson 2015), we found a slight increase in *informed consent*; this was not due to an increase in the number of consumers who approved of Google's practice, rather by a slight increase in the number of consumers who are now aware of Google's practices

Others researchers have established the presence of real, measurable harm from Google, suggesting that the current levels of regulatory protection may be inadequate (e.g. Edelman 2015; Edelman and Geradin 2016; European Commission 2017; European Commission 2018; European Commission 2019; European Parliament 2019; Iacobucci and Ducci 2019; Zhu and Liu 2018). Our study contributes to the design of regulatory policies to improve consumer welfare and decrease the present and future harm created by firms that monetize personal information that fall outside existing regulatory frameworks.

Thereby, we were guided by the following research question: *What clusters of informed consent exist and how should regulators intervene?* We surveyed 1693 individuals in Denmark, France, Germany, the UK, and the USA regarding Google. Our cluster analysis confirms the privacy paradox – although consumers disapprove of Google's practices, they still use it – in four out of five clusters but indicates two different explanations: some consumers cannot locate a viable alternative, whereas others lack the information needed for their privacy calculus.

Moreover, we draw on the theory of newly vulnerable markets (NVM) to discuss whether market entry may be feasible. Our results indicate that market entry is feasible for cluster 5 (willing to use and somewhat willing to pay for safe alternative and disapproving of Google's practices), rather difficult for cluster 2 (approving Google's practices and willing to grant it a GDPR waiver but somewhat willing to pay for safe alternative), rather difficult for cluster 1 and 3 (willing to use but unsure about paying for safe alternative and disapproving Google's practices), and completely unfeasible for cluster 4 (unwilling to use and pay for a safe alternative although disapproving Google's practices). We discuss which form of regulatory intervention might be necessary for each cluster. We argue that no intervention might be necessary for cluster 5 and 2, whereas clusters 1 and 3 and cluster 4 need different interventions in form of being better informed through regulation. Cluster 1 and 3 need to be better informed about the logic and advantages of safe alternatives to cope with their disapproval of Google's practices and their undecidedness to pay for a safe alternative. Cluster 4 needs to be better informed in two areas. First, about the hidden costs of apparently free services as it indicates not to be well informed about Google's practices. Second, about the logic and advantages of safe alternatives to cope with its disapproval of Google's services and its unwillingness to use and pay for safe alternatives. In contrast, cluster 5 is willing to use and somewhat willing to pay for safe alternatives and, therefore, might render regulatory intervention unnecessary. Since cluster 2 provides, on an aggregated level, informed consent for Google's practices and is willing to use and pay for safe alternative, no regulatory intervention might be necessary for this cluster neither.

This paper makes two contributions. The first is *practical*: The EU is seeking to develop new regulatory policies with multiple objectives. These include providing adequate (privacy) protections for consumers and providing a fair and level playing field that protects competition and limits the abuses created by firms that monetize personal information. Developing new regulatory policies entails a complex set of tradeoffs since regulatory policy must be informed by consumers' preferences, and if regulatory policy contravenes consumer preferences, it may be necessary for regulators to explain the hidden sources of harm to consumers. This study provides an input to the EU regulatory process. The second is *theoretical*: The privacy paradox indicates that consumers' online behavior often contradicts their expressed preferences for safe, secure, and private online interactions. We observed that while consumers express a preference for safer alternatives, they may be (a) unaware of the hidden costs of using existing Google offerings, (b) unable to find potentially safer alternatives with all the functionality they now obtain from Google, or (c) unwilling to pay for safer alternatives. This last point suggests that while consumers may have a real preference for privacy, the value placed on privacy may be quite low.

Theoretical Underpinnings

Monetization of Personal Information: Price Discrimination, Data Mining, and Personalized Advertising

Service providers who are well informed about their customers can engage in price discrimination (Phlips 1983). That means service providers are using customer information (Weking et al. 2018) to determine which type of customer is willing to pay which type of price for the service offered. As illustrated by Clemons and Wilson (2015), airlines, for example, seek to determine whether a customer is a business or leisure traveler to charge higher prices to the former since they assume that business travelers have to travel and do not need to cover the costs themselves. Thus, under an situation of complete price discrimination, service providers could exactly charge the customer's surplus.

Since service providers are aiming to maximize profits, they are looking to leverage new information technologies such as data mining to move towards complete price discrimination (Clemons et al. 2014). We refer to data mining as the systematic application of statistical methods to large data sets to identify new links and trends. Data mining, therefore, helps the service provider to move beyond identifying sheer customer types towards identifying specific needs and characteristics of each customer at a particular point in time. Although firms do not have sufficient data for complete price information, the work of Shiller (2014) indicates how big data in combination with data mining is approximating complete price discrimination.

Online advertising companies, such as Google, have specialized in creating detailed profiles of consumers and can help service providers to charge individual prices (Clemons and Wilson 2015; Zuboff 2019). Due to Google's vast amount of services such as search, video streaming, email, maps, or cloud services, Google can mine various forms of online and offline behavior and integrate different data sources into one comprehensive consumer profile (Clemons 2018). In addition, Google even engages in illegal conduct and violates consumers' privacy to improve further its personal profiles (FTC 2019; Porter 2018). Due to Google's comprehensive consumer profiles, service providers (advertisers) draw on Google ads because it allows them "to know not only *who* wants *what*, but *how badly they want it*, and by inference, *how much they are willing to pay*" (Clemons and Wilson 2015). That is, while consumers may be anonymous to the advertiser before they click an ad, they can be associate by the advertiser with specific attributes and characteristics after they clicked an ad. Hence, consumers are not anonymous anymore and advertiser can determine individual prices. Consequently, consumers might associate themselves to certain behaviors, attributes, or characteristics with which they would not want to be associated or would not want advertisers to know, creating a source of consumer harm.

The Privacy Paradox

The privacy paradox refers to consumers indicating that they have high levels of privacy concerns, while simultaneously engaging in unsafe practices and ignoring the risk of losing control over their personal data (Gerber et al. 2018). In other words, a contradiction between consumers' stated preferences and their actual behavior (Kokolakis 2017). Many consumers express concerns about their data, their desire to protect it, and their desire to maintain control over its access. These same consumers, however, disclose a variety of personal data, often without reviewing the privacy policy of the service provider (Chakraborty et al. 2013). There are three possible explanations:

Privacy calculus theory postulates that individuals perform a calculus between the expected cost of loss of privacy and the potential gain of their unsafe behavior. Their final behavior is determined by the outcome of this privacy calculus (Dinev et al. 2006; Dinev and Hart 2006; Xu et al. 2011). Thus, it is assumed that individuals consciously and rationally decide to disclose personal information when potential gains exceed expected losses.

However, research in behavioral economics demonstrates that human decision-making is affected by **cognitive biases and heuristics** (Acquisti et al. 2012; Adjerid et al. 2018). These authors claim that privacy decisions are often affected by the same biases and heuristics.

Moreover, **bounded rationality and incomplete information** are also significant. Human decision-making, even executive decision-making, is seldom fully informed and seldom fully rational (Simon 1997). Individuals make privacy decisions with incomplete information about risks and benefits and seldom perform complex calculations, enabling them to make rational decisions (Acquisti and Grossklags 2005).

Informed Consent

The concept of informed consent can mostly clearly be seen in the domain of medical treatment. Its underlying idea is that patients have to be informed and approve of the suggested medical treatment (Schenker et al. 2011). Hence, informed consent provides patients some level of control over medical decision-making by requiring that they be fully informed about the risks and benefits of treatment, delaying treatment, and alternative treatment. Obtaining informed consent is necessary for doctors to avoid litigation if medical complications arise during treatment. Informed consent is thus a legal construct, with clearly defined terms and conditions. Terms and conditions are essential to informing users in the process of obtaining informed consent. They provide the description of future actions that cannot be performed without users' prior agreement. Understanding the terms and conditions is critical.

Informed consent is also significant when users are offered unsafe products or products with a known degree of risk, such as scuba instruction. Before engaging in such activities, the instructor ensures that users are aware of and accept the risks. This is critical in protecting service providers in case of an accident.

Understanding the terms and conditions is likewise critical in agreements between users and online service providers. Individuals must fully understand what they are agreeing on when considering to submit their personal data to the processing purposes of others (Luger et al. 2013). Something as simple as ticking the box to indicate that a user accepts the terms and conditions must be based on a clear understanding of what exactly is going to be done. Without this understanding, the user is not *truly* informed, and the consent offered cannot reasonably be called informed consent.

However, informed consent has previously not played a significant role in privacy research in the information systems literature, despite the fact that that informed consent is a core aspect of data protection. Exceptional is the work of Clemons et al. (2014) and Clemons and Wilson (2015). The General Data Protection Regulation (GDPR) explicitly requires companies to obtain informed consent before collecting and processing personal data and to be explicit about what will be done with the data (European Parliament and the Council of the EU 2016). Often, obtaining consent is usually not much more than the ritual of scrolling down business conditions and checking the box in order to access a digital service. Most users are well known to neither completely read privacy policies nor completely understand them (Chakraborty et al. 2013; Zuboff 2019). Nonetheless, the GDPR continues to adhere to the principle of informed consent. Despite this discrepancy, research has not investigated how much users know about the ways that companies use their data at an atomic, function-by-function level and whether the approve of these practices or not.

We refine the concept of informed consent used by Clemons et al. (2014) by introducing the concept of *implicit informed consent*, which is implicitly given by users who are aware that their online service provider performs a specified activity using their data *and* approve of that use. Users who accept the terms and conditions without fully understanding the actions that an online service provider is allowed to perform cannot be considered to have provided implicit informed consent. Contrarily, users who are fully informed about the actions of an online service provider and approve of them indeed have provided implicit informed consent. We believe that a user who agrees to a policy, is aware of it, and does not approve of it but accepts only because she cannot locate an acceptable alternative has not provided implicit informed consent.

Theory of Newly Vulnerable Markets

The theory of newly vulnerable markets explains changes in competition, in which new competitors are capable of attacking stronger incumbents, even when incumbents enjoy reputational advantages,

economies of scale, and superior market share (Clemons 2018; Clemons et al. 2002). The NVM theory builds on the theory of contestable markets (Baumol 1982), which posits that in monopolies or oligopolies that are under continuous threat of new entry, prices are similar to perfect competition to eliminate the incentives of new entrants to enter the market. The three components of the NVM theory are as follows.

Newly easy to enter: This occurs when technological or regulatory changes reduce entry barriers or when changes in consumer preferences weaken the competitive advantage of previously dominant firms.

Attractive to attack: This implies the presence of a strong customer profitability gradient, that is, extreme differences in profitability across customers. This usually occurs when existing firms in an industry charge the same prices to all customers, even when customers differ substantially in terms of willingness to pay for goods and services, or in their costs to serve. New entrants generally choose to target the most profitable customers.

Difficult to defend: This occurs when the incumbents experience barriers in changing their strategy to imitate the attacker's strategy. This may be caused by asymmetric regulation that favors new entrants, existing contracts that require continued service to less attractive customer segments, or other factors that restrict incumbents' ability to adopt the practices of new entrants.

We will explore whether changes in customers' attitudes towards privacy create the conditions for newly vulnerable markets.

Methodology

Data Collection. We administered an online survey to consumers in Germany, the UK, the USA, France, and Denmark, exploring their knowledge and approval of Google's business practices. We chose Google as an example for monetizing and violating privacy (Porter 2018; Zuboff 2019). We obtained survey results from 1693 individuals, 364 in Denmark, 333 in France, 350 in Germany, 321 in the UK, and 325 in the USA[1]. The survey instrument was an extension of the survey that we previously used (Clemons et al. 2014; Clemons and Wilson 2015), with questions added to reflect some of the uses of private information that have emerged since our prior studies. To ensure that the questions were clear and that the subjects were able to respond to them, we conducted a pretest. These pretest results were not included in the final data. Participants were ensured anonymity.

Survey Measurements. Participants were asked to answer questions on their personal attitudes towards Google, safer alternatives, and regulatory protections. To eliminate sequence effects, the order of questions was shuffled between the subjects. Our first construct, implicit informed consent, was measured by asking participants to indicate their awareness and degree of approval of 24 tracking and privacy-related practices of Google.

The first subconstruct explored simple tracking, e.g., "Does Google track your GPS location history?" The second was tracking integration across services, e.g., "Does Google create a composite profile involving your search history, and the content of your emails and texts?" Finally, we addressed implications, e.g., "Does Google maintain enough information about you to infer your political affiliation?" Each awareness question was measured on a 3-point Likert scale (They do, do not know, they do not) and each consent question on a 5-point Likert scale (Strongly object to strongly approve).

For the analysis, we computed an awareness score and a consent score. A participant's awareness score was incremented by one if he/she answered an awareness question with "They do" and decremented if they answered, "They don't." Similarly, the consent score was incremented with the answer "Agree" or "Strongly Agree" and decremented with the answer "Object" or "Strongly Object." Consequently, the awareness and consent scores have a theoretical range of -24 to 24.

The second area of interest: the attitudes towards alternative online service providers covered four

[1] Our sample sizes were large enough to be significant, and to allow a significant participation in enough demographic groups to ensure that we are representative of each nation surveyed. A copy of the survey instrument and participant demographics will be provided in the final paper.

questions. First is whether participants would grant startups a GDPR waiver if they offered the same service as Google; second, whether they would be more comfortable using an EU alternative; third, whether they would use a safe alternative in preference to Google; and finally, whether they would pay for a safe alternative in preference to Google. The answers were provided on a 5-point Likert scale.

The third area of interest covered participants' history of usage of Google Search, Gmail, Maps/Waze, and alternatives. Participants indicated which applications they routinely use. Fourth, we explored participants' attitudes towards the level of regulatory protection they currently receive. Moreover, we evaluated their satisfaction with the degree to which regulation ensured that they were aware of how online data is used and the potential forms of harm, as well as the degree to which regulators protected them from online harm caused by service providers' use of data. Again, we calculated a composite score. This regulatory satisfaction score was incremented if the participant answered "Agree" or "Strongly Agree." It was decremented if the participant answered "Disagree" or "Strongly Disagree." This enabled a theoretical range of −3 to 3.

Finally, we asked participants sociodemographic questions and also asked them to indicate their level of technological sophistication and whether they have encountered online privacy violations.

Data Analysis. We first report simple statistics, aggregate levels of Awareness of Google's activities, and aggregate levels of Acceptance of Google's activities. We found very little variation across countries, although the levels of acceptance were slightly higher in the USA and slightly lower in Germany. Since there was little variation, we do not separate our results by subjects' nationality. We then report simple cross-tabulations, showing the percentages of subjects who were aware and approved of Google's practices. This is our measure of implicit informed consent.

We next applied exploratory factor analysis to merge potentially similar items into a smaller set of first-order constructs and to assess whether the awareness, consent, and regulatory items could be represented by one composite score for each construct. We used principal axis factor as extraction method and varimax as rotation method. The Gorsuch–Nelson interpretation of the scree plot suggests the extraction of three factors. Each of the three resulting factors distinctively represented awareness, consent, or regulatory satisfaction, as they only exhibited relevant loadings on those respective questions (see Appendix). Each item loaded only on one factor (cutoff = 0.3).

Our clustering method used the following variables: awareness, consent, GDPR waiver for startups, usage of a European alternative, usage of clean alternative, paying for clean alternative, and regulatory satisfaction. In order to determine the number of clusters, we ran multiple statistics, such as silhouette plots, the Krzanowski–Lai index, and the gap statistic. Most statistics suggested two, three, or five clusters. We used five clusters to increase the explanatory power and to account for reasonable content-based segmentation. The data was then clustered using a hierarchical k-means approach, which is also known as two-step clustering. In the first step, the data was clustered hierarchically. This process was stopped when five clusters had been formed. The centers of these hierarchical clusters were then used as a starting point for the k-means algorithm. The distances were calculated based on the Euclidean distance.

Results

Descriptive Analysis of Awareness and Consent

The descriptive analysis reveals the following insights about awareness of Google's practices (- 24 not aware at all to +24 completely aware). More people were found to be aware (0 to 24) than unaware (−24 to 0). The majority has a score of 0 (they are aware of 50% and unaware of 50%).

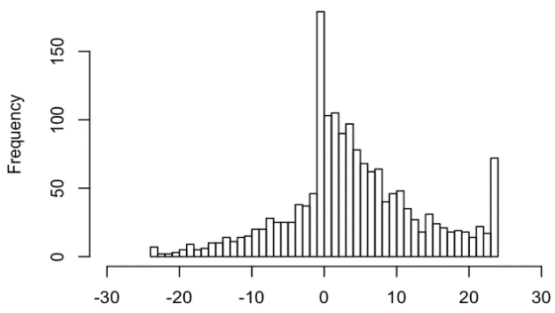

Figure 1: Histogram Awareness

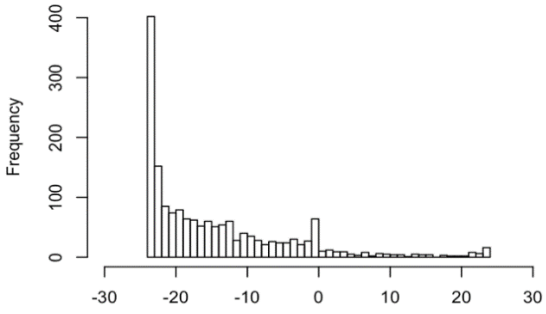

Figure 2: Histogram Consent

Regarding consumers' level of approval (- 24 completely disapprove to 24 completely approve), we obtained the following results: the far-left bar indicates that most individuals are providing no consent at all; the majority of individuals are not providing consent (-24 to 0).

In summary, people have positive levels of awareness and very low levels of approval of Google's practices.

Descriptive Analysis of Informed Consent

Table 1 presents the cross-tabulations of awareness and approval of 24 Google activities. The three highest levels of informed consent were for tracking GPS location history (10%), retaining and using search history (9,7%), and controlling search to provide better placement for Google's own offerings (6,8%). In part, these items scored higher on informed consent because more subjects were aware of them. The four lowest levels of informed consent were for Google's permitting data to leave the subject's home country and to use it in ways not level in the home country (2,5%); determining the user's religious affiliation (2,5%); estimating the user's net worth (2,5%), and retaining this data for as long as Google believes it will be valuable (2,4%).

We found that only 6 out of 24 of Google's activities had levels of informed consent of 5% or above. No activity had informed consent level above 10%. This cannot be explained solely by the levels of awareness. Users generally disapprove of almost all of Google's activities.

Table 1: Degree of Informed Consent

Category	ID[1]	Business conduct	Informed Consent
Individual Practices	Q19/Q20	Does Google track, retain, and use your GPS location history? If they did, would you care?	10,00%
	Q9/Q10	Does Google track, retain, and use your search history? If they did, would you care?	9,70%
	Q11/Q12	Does Google track, retain, and use the contents of the emails sent to a Gmail account? If they did, would you care?	3,90%
	Q17/Q18	Does Google's technology allow it to track, retain, and use the actual words in the contents of the voice messages left on an Android device? If they did, would you care?	3,90%
	Q13/Q14	Does Google track, retain, and use the contents of the emails sent from a Gmail account? If they did, would you care?	3,80%
	Q21/Q22	Does Google data mine your contact list and your calendar? If they did, would you care?	3,80%
	Q15/Q16	Does Google track, retain, and use the contents of text messages sent to or from an Android device? If they did, would you care?	3,30%
	Q23/Q24	Does Google data mine your doc files and spreadsheets? If they did, would you care?	2,90%
Integration of Practices	Q25/Q26	Does Google integrate information from numerous sources to create a composite profile of each of their hundreds of millions of users? If they did, would you care?	5,60%
	Q37/Q38	Does Google use the information it collects to know your daily routines, including where you are now and where you are going to be next? If they did, would you care?	4,90%
	Q27/Q28	Does Google use the information it collects to understand your health? If they did,	4,30%

Category	ID[1]	Business conduct	Informed Consent
		would you care?	
	Q33/Q34	Does Google use the information it collects to determine your political affiliation? If they did, would you care?	4,00%
	Q35/Q36	Does Google use the information it collects to know your daily routines, including the names of the people you see and where you see them? If they did, would you care?	3,30%
	Q29/Q30	Does Google use the information it collects to understand your sexual orientation? If they did, would you care?	2,80%
	Q31/Q32	Does Google use the information it collects to determine your religious affiliation? If they did, would you care?	2,50%
	Q39/Q40	Does Google use the information it collects to estimate your net worth? If they did, would you care?	2,50%
Implications of Practices	Q56/Q57	Does Google use its control over search to promote its own products, perhaps by placing them at the top of search results? If they did, would you care?	6,80%
	Q58/Q59	Does Google use its control over Android devices to promote its own products, perhaps by ensuring them preferred locations on the screens of smartphones and tablets? If they did, would you care?	5,30%
	Q45/Q46	Does Google share the information it collects in ways that allow a travel services provider to infer how urgently you need to travel and what you are willing to pay for a specific flight or hotel? If they did, would you care?	5,00%
	Q43/Q44	Does Google share the information it collects in ways that allow a merchant to make inferences about your willingness to pay for a specific item? If they did, would you care?	3,90%
	Q47/Q48	Does the information Google shared remain with a service provider even after you have cleared your search history or your GPS history? If they did, would you care?	3,80%
	Q41/Q42	Does Google share the information it collects in ways that allow a medical service provider to make inferences about your health? If they did, would you care?	2,80%
	Q51/Q52	Does Google permit the information it gathers to leave your home country and to be used in ways that might not be permitted in your home country? If they did, would you care?	2,50%
	Q49/Q50	Does the information Google shared remain with a service provider even after you have requested that information be removed from Google search results under your Right to be Forgotten Online? If they did, would you care?	2,40%

[1] *= ID of Informedness Question / ID of Consent Question*

Cluster Analysis

Table 3 presents the quantitative results of the cluster analysis, presenting construct values and demographical differences by cluster. **Cluster 1** accounts for the highest values regarding the usage of alternatives to Google, being aware of Google's practices and capabilities and disapproving of these practices and capabilities. Similar to the other clusters, cluster 1 is unsure about being more comfortable about using a European alternative, unsure about providing startups a GDPR waiver, willing to use but unsure to pay for a safe alternative, and indicates low frequencies of using alternatives to Google. Moreover, the cluster demonstrates strong dissatisfaction with regulators.

Cluster 2 distinguishes itself from the first one, particularly regarding its approval of Google's practices and capabilities. The second cluster is actually the only cluster that approves rather than disapproves of Google's practices. Interestingly, the cluster still indicates willingness to use and to pay for a safe alternative. However, the cluster is unsure or does not care if the alternatives stem from Europe. Moreover, the cluster shows the same frequencies of using Google services as the other clusters and is not sure whether or not to provide a GDPR waiver to startups. Similar to cluster 5, cluster 2 is largely satisfied with regulators.

Table 2: Construct characteristics by cluster

Variable	Measure	Cluster 1	2	3	4	5
Size	Count	345	205	459	314	370
Age	Selection	45,14	37,78	46,44	42,26	44,16
Sex	Selection	1,47	1,38	1,50	1,58	1,57
Google search	Frequency of selection	90%	83%	88%	87%	89%
Other search	Frequency of selection	16%	11%	15%	7%	12%
Gmail	Frequency of selection	60%	66%	53%	52%	49%
Email services other than Gmail	Frequency of selection	43%	38%	50%	39%	41%
Facebook	Frequency of selection	61%	70%	61%	67%	68%
Twitter	Frequency of selection	22%	35%	18%	20%	17%
Google Maps, including Google WAZE	Frequency of selection	62%	50%	63%	53%	51%
Other mapping programs	Frequency of selection	11%	7%	13%	5%	9%
Other apps on an Android device	Frequency of selection	33%	23%	31%	26%	24%
Other apps on an iPhone or iPad	Frequency of selection	18%	20%	26%	18%	21%
Average Google use	Search+Gmail+Maps / 3	70%	67%	68%	64%	63%
Average Google alternative use	Sum of alternatives to Google / 3	23%	19%	26%	17%	21%
Technological sophistication	1 Low, 3 High	1,27	1,60	1,35	1,32	1,31
Experience online privacy violation	1=yes; 2=no	1,82	1,80	1,82	1,85	1,89
GDPR waiver Google	1=Yes, 2=I'm not sure, 3=No	1,77	1,39	2,44	1,87	2,02
Awareness	- 24 (not aware) to 24 (completely aware)	7,85	6,02	6,89	0,27	0,65
Consent	- 24 (no consent) to 24 (max. consent)	-18,38	5,89	-19,13	-12,86	-16,86
GDPR waiver for startups	1=Yes, 2=I'm not sure, 3=No	1,83	1,86	3,00	2,39	2,35
Comfortable using an EU alternative	1=Yes, 2=I'm not sure, 3=No	1,87	1,97	1,91	2,55	1,94
Usage of safe alternative	1=Certainly Not, 5=Certainly	4,08	3,84	4,39	2,18	4,00
Paying for safe alternative	1=Certainly Not, 5=Certainly	3,28	3,66	3,24	1,92	3,58
Regulatory satisfaction	-3 (dissatisfaction) to 3 (satisfaction)	-2,29	1,65	-2,39	-0,40	1,87
Education not yet completed	Selection	4%	6%	4%	6%	10%
Secondary education completed	Selection	30%	34%	26%	35%	34%
Some university or vocational diploma	Selection	12%	10%	10%	12%	8%
Vocational certification completed	Selection	16%	13%	15%	18%	16%
University degree completed	Selection	35%	31%	42%	25%	27%
Doctorate, post-doctorate	Selection	3%	3%	2%	2%	2%
Prefer not to answer	Selection	1%	3%	1%	1%	2%
UK	Selection	18%	22%	19%	23%	14%
USA	Selection	22%	21%	21%	18%	14%
France	Selection	19%	24%	17%	17%	24%
Denmark	Selection	20%	15%	24%	22%	23%
Germany	Selection	21%	18%	19%	20%	25%

Cluster 3 indicates similar characteristics to cluster 1. It has the second-highest value regarding the use of alternatives to Google and the highest value for not giving a GDPR waiver to startups and for regulatory dissatisfaction. Cluster 3 is rather aware of Google's practices and capabilities and does not approve of them. However, while cluster 3 is also willing to use a safe alternative, it is unsure about paying for it and whether to feel more comfortable if the alternative stems from Europe.

Cluster 4 differs from the others in two important ways. One, it indicates no willingness to use a safe alternative, and two, it is also not willing to pay for a safe alternative in preference to Google. It is the only cluster that demonstrates these characteristics. Interestingly, the fourth cluster strongly disapproves of Google's practices and capabilities. In addition, this cluster shows a consistent tendency towards the middle, indicating around 50/50 percent of awareness of Google's practices and capabilities, undecidedness towards providing a GDPR waiver for startups, and regulatory satisfaction. Cluster 4 has the lowest value on the use of alternatives to Google, but similar scores on the use of Google services compared with the other clusters.

Cluster 5 is unsure about giving startups a GDPR waiver, unsure about a European alternative, and indicates a 50/50 percent awareness of Google's practices and capabilities. Interestingly, the cluster is satisfied with regulators and does not approve of Google's practices and capabilities. Instead, it is willing to use a safe alternative and somewhat willing to pay for it. The usage of alternatives to Google is low, whereas the usage of Google's services is high.

Discussion

All in all, four of the five clusters indicate that they disapprove of Google's practices and capabilities. All are at least aware of 50% of the 24 listed practices and capabilities. However, extremely high scores on awareness are missing in clusters, indicating the lack of transparency and information. Four out of five clusters are willing to use a safe alternative, but only two are somewhat willing to pay for it. Thus, indicating the lack of understanding of digital and, more specifically, ad-based business models. And finally, we find evidence for Google's monopolistic position since all clusters demonstrate high usage of Google services and low usage of alternative services.

Privacy Paradox

Clusters 1, 3, 4, and 5 indicate the contradiction between disapproving of Google's practices and capabilities, but still using Google's services more frequently than alternative services. This contradiction confirms the privacy paradox in such a way that attitudes towards Google do not align with the actual behavior. Previous work argues that information asymmetries and incomplete information (Acquisti and Grossklags 2005; Buck et al. 2014), as well as the privacy calculus (Dinev et al. 2016; Xu et al. 2011) contribute to the explanation of the privacy paradox. We confirm both perspectives and also propose a complementary perspective. Hence, some consumers lack the information required for their privacy calculus (cluster 4 and 5), whereas others cannot locate a viable alternative (cluster 1 and 3). We propose that the lack of a valuable alternative provides a complementary explanation for the privacy paradox, especially in near-monopolistic markets. That is, cluster 1 and 3 disapprove of Google's practices and are willing to use a safe alternative but do not actually use it since it may not represent a viable alternative. Hence, consumers are behaving paradoxically, not because they are insufficiently informed or less aware of the privacy risks; contrarily, consumers are indeed informed and aware. However, they may continue using Google because they either (1) lack a valuable alternative, (2) lack access to alternatives because of Google's control over Android, Search, and Chrome, or (3) are unwilling to pay for alternatives.

Feasibility of new entry and possible regulatory response

Clusters 1 and 3 strongly value privacy as they are at least not sure whether they would provide Google or startups a GDPR waiver and are willing to use safe alternatives. In addition to consumer preference for privacy, new regulatory changes, such as the launch of GDPR, provide a fertile ground for easily entering the market according to the theory of NVM. However, the clusters indicate uncertainty about paying for safe alternatives, rendering it unattractive to enter. Hence, entry might be easier, but not attractive to attack, suggesting that consumers need to be better informed. Moreover, as conversions of

weak personalized ads perform significantly worse compared with highly personalized ads by Google, advertisers have a strong incentive to stay with Google. Thus, further rendering new market entry unattractive. Regulators could intervene in this context by better informing consumers about digital business models, monetization of personal data, and the logic and risks of personalized advertising. Understanding that a free and safe alternative might not be competitive to Google can help consumers change their minds about payments, especially since they generally disapprove of Google's practices.

Cluster 2 differs in three important ways. First, it provides Google a GDPR waiver; second, it is somewhat willing to pay for a safe alternative; and third, it mainly approves of Google's practices. However, as the cluster is undecided about granting startups a GDPR waiver, new entry might not be easy, as the startup would need to compete on different terms. But the market might be attractive to attack as new entry can monetize its safe business model. At the same time, it will be difficult to defend for Google because it cannot easily imitate safe business models without limiting its advantage of using vast amounts of personal data for highly personalized ads. Since this cluster provides, on an aggregated level, informed consent for Google's practices and is willing to use and pay for safe alternatives, no regulatory intervention might be necessary.

Although cluster 4 also strongly values privacy and strongly disapproves of Google's practices, it is not willing to use and pay for a safer alternative. This renders market entry difficult and unattractive and thereby unfeasible. It suggests to better inform consumers about the hidden costs of apparently free services, especially as this cluster indicates not to be well informed about Google's practices, and the logic and advantages of safe alternatives.

Cluster 5 exhibits similar characteristics to clusters 1 and 3. However, cluster 5 is also somewhat willing to pay for a safe alternative. This indicates that market entry is easy and attractive, and thereby, less or no regulatory intervention might be necessary.

Conclusion

We are reporting on a set of consumer surveys to examine consumers' attitudes towards new business models and towards firms that monetize consumers' personal information. Surveys assessed consumers' knowledge of Google's current business practices and their approval or disapproval of those practices, independent of their belief that those practices currently incurred. This allowed us to determine implicit informed consent: individuals who both knew and approved of these practices. We also studied their willingness to switch to alternative safer services, that is, services that do not violate privacy or monetize private information. We studied their degree of regulatory satisfaction, including the belief that regulators were taking adequate steps to inform consumers about potential privacy risks online and to protect them from these risks.

We collected survey responses from 1693 individuals about Google from Denmark, France, Germany, the UK, and the USA. Our cluster analysis confirms the privacy paradox – although consumers disapprove of Google's practices, they still use it – in four out of five clusters but indicates a new explanation: the lack of alternatives. Moreover, we draw on the theory of NVM to discuss whether market entry is feasible. Our results indicate that market entry is feasible for cluster 5 (willing to use and somewhat willing to pay for safe alternative and disapproving of Google's practices), rather difficult for cluster 2 (approving Google's practices and willing to grant it a GDPR waiver but somewhat willing to pay for safe alternative), rather difficult for cluster 1 and 3 (willing to use but unsure about paying for safe alternative and disapproving Google's practices), and completely unfeasible for cluster 4 (unwilling to use and pay for a safe alternative although disapproving Google's practices). We discuss which form of regulatory intervention might be necessary for each cluster. We argue that no intervention might be necessary for clusters 5 and 2, whereas clusters 1 and 3 and cluster 4 need different interventions in form of being better informed through regulation. Cluster 1 and 3 need to be better informed about the logic and advantages of safe alternatives to cope with their disapproval of Google's practices and their undecidedness to pay for a safe alternative. Cluster 4 needs to be better informed in two areas. First, about the hidden costs of apparently free services as it indicates not to be well informed about Google's practices. Second, about the logic and advantages of safe alternatives to cope with its disapproval of Google's services and its unwillingness to use and pay for safe alternatives. In contrast,

cluster 5 is willing to use and somewhat willing to pay for safe alternatives and, therefore, might render regulatory intervention unnecessary. Since cluster 2 provides, on an aggregated level, informed consent for Google's practices and is willing to use and pay for a safe alternative, no regulatory intervention might be necessary for this cluster neither.

This paper makes two contributions. The first is *practical*: The EU is seeking to develop new regulatory policies with multiple objectives. These include providing adequate (privacy) protections for consumers and providing a fair and level playing field that protects competition and limits the abuses created by firms that monetize personal information. Developing new regulatory policies entails a complex set of tradeoffs since regulatory policy must be informed by consumers' preferences, and if regulatory policy contravenes consumer preferences, it may be necessary for regulators to explain the hidden sources of harm to consumers. This study provides an input to the EU regulatory process. The second is *theoretical*: The privacy paradox indicates that consumers' online behavior often contradicts their expressed preferences for safe, secure, and private online interactions. We observed that while consumers express a preference for safer alternatives, they may be (a) unaware of the hidden costs of using existing Google offerings, (b) unable to find potentially safer alternatives with all the functionality they now obtain from Google, or (c) unwilling to pay for safer alternatives. This last point suggests that while consumers may have a real preference for privacy, the value placed on privacy may be quite low.

Our research has three limitations. First, we measure *expressed preferences*, what users claim to value, as opposed to what consumers actually value as revealed by their actions. This can introduce a significant level of inaccuracy, which must be considered before considering regulatory action. Second, because of the nature of the survey, we are exploring *what* users believe, but not *why* they believe it. Thus, while the results may be useful in explaining to regulators the situation they are facing, it offers little or no guidance on how to change this situation by altering what individuals know or believe. It is not a study of individual behavior but aggregate national beliefs. Third, the results reflect consumer attitudes towards Google and thereby limit the generalizable of our findings.

We propose three avenues for future research. First, examining informed consent for different empirical cases and to investigate which clusters emerge and which forms of regulation might be necessary in these cases. These investigations help to better understand and generalize consumer attitudes toward firms that monetize personal information and to theorize about appropriate forms of regulatory intervention. Second, when regulating in form of informing consumers, future research can shed more light on the effect of information on actual behavior. Research suggests that information alone does not always change behavior. Therefore, future work can explore which further forms of regulation are necessary to change consumer behavior and to provide a level playing field in among firms that monetize personal information. Third, moving beyond what users believe towards why they believe it. Hence, identifying the reasons why consumers didn't discontinue using the services given that they have expressed privacy concerns and willingness to use or pay for a safe alternative.

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Appendix

Table 3: Factor Loadings Part 1

ID	Consent	Awareness	Regulatory Satisfaction
Q48	**0,793**	0,040	0,076
Q36	**0,791**	-0,048	0,120
Q26	**0,787**	0,049	-0,019
Q38	**0,778**	0,024	0,001
Q24	**0,772**	-0,051	0,164
Q28	**0,769**	-0,039	0,133
Q22	**0,761**	-0,036	0,113
Q46	**0,755**	0,040	0,017
Q40	**0,755**	-0,083	0,108
Q14	**0,753**	-0,053	0,168
Q12	**0,752**	-0,047	0,151
Q44	**0,752**	0,025	0,035
Q34	**0,750**	0,022	0,018
Q18	**0,746**	0,000	0,131
Q30	**0,742**	-0,008	0,044
Q42	**0,739**	-0,059	0,171
Q16	**0,733**	-0,058	0,176
Q50	**0,728**	-0,033	0,195
Q52	**0,721**	-0,044	0,159
Q32	**0,716**	0,023	-0,018
Q20	**0,708**	0,134	-0,046
Q10	**0,686**	0,117	-0,036
Q59	**0,656**	0,120	-0,014
Q57	**0,635**	0,124	-0,055
Q31	-0,003	**0,757**	-0,021
Q29	0,020	**0,746**	-0,007
Q33	0,003	**0,745**	0,075

Table 4: Factor Loadings Part 2[2]

ID	Consent	Awareness	Regulatory Satisfaction
Q27	-0,009	**0,741**	-0,062
Q39	0,034	**0,735**	-0,026
Q41	0,005	**0,730**	-0,104
Q35	0,000	**0,698**	-0,024
Q21	-0,022	**0,692**	0,036
Q23	-0,055	**0,676**	-0,110
Q13	-0,026	**0,660**	-0,032
Q51	0,051	**0,658**	0,088
Q11	-0,020	**0,651**	-0,033
Q15	-0,020	**0,648**	-0,044
Q37	-0,009	**0,624**	0,148
Q45	0,022	**0,607**	0,142
Q43	0,016	**0,607**	0,167
Q49	0,033	**0,586**	-0,013
Q17	0,005	**0,576**	0,046
Q25	0,030	**0,553**	0,244
Q47	0,011	**0,548**	0,189
Q58	0,009	**0,461**	0,309
Q19	0,020	**0,383**	0,273
Q56	0,039	**0,379**	0,359
Q9	-0,021	**0,329**	0,273
Q67	0,324	0,060	**0,679**
Q68	0,324	0,082	**0,652**
Q66	0,311	0,087	**0,636**

[2] Q66 = Do you believe that regulators do an adequate job ensuring that you are aware of the way your online data is used and reused by your service providers? Q67 = Do you believe that regulators do an adequate job ensuring that you are aware of the way you may be harmed by the use of your online data by your service providers? Q68 = Do you believe that regulators do an adequate job ensuring that you cannot be harmed by the use of your online data by your service providers?

Objective versus Relative Risk in Privacy Decision Making (P4)[9]

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Objective versus Relative Risk in Privacy Decision Making: A Replication Study from Germany

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Abstract:

This study reinvestigates the effects of normative and behavioral factors on privacy decision making by conducting a methodological replication of Adjerid, Peer, and Acquisti (2018). While the normative perspective regards consumers with stable preferences making rational choices, the behavioral perspective regards consumers with unstable preferences making irrational choices due to heuristics and biases. In three experiments, we demonstrate that normative and behavioral factors influence hypothetical but not actual choice. Our results, therefore, confirm the findings of the original study that objective differences in privacy protections influence hypothetical choice. However, in contrast to the original study, we found that relative changes in privacy protection did not influence actual but hypothetical disclosure as well. We argue that individuals have developed a stronger disposition toward privacy since the original study and that our German student sample represents a more privacy-sensitive case than the American Amazon Mechanical Turk sample. As a consequence, participants may have not been willing to indicate their true choice in the actual setting. In other words, effects may exist in the actual setting, but may not be elicitable from privacy-sensitive individuals. Future research is encouraged to explore other biases and the moderating effect of disposition to privacy.

Keywords: Privacy, privacy decision making, behavioral economics, prospect theory, methodological replication

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1 Introduction

The desire to understand consumer data and privacy preferences has sparked interest in research, practice, and legislation in equal measure. While firms need personal information to personalize their services and improve the effectiveness of their marketing campaigns (Farahat & Bailey, 2012), policymakers seek to reduce consumer harm and protect social and economic welfare from privacy violations. Understanding the factors and mechanisms of consumer privacy decision making has therefore become a vital topic across multiple research domains. However, previous IS research has focused on either normative (rational decision making) or behavioral (irrational decision making) aspects to account for changes in privacy choices but has neglected to explore both perspectives simultaneously.

One work aiming to understand how behavioral and normative aspects simultaneously influence privacy decision making is the study of Adjerid et al. (2018) published in Management Information Systems Quarterly: "Beyond the Privacy Paradox: Objective versus Relative Risk in Privacy Decision Making". The study incorporates a behavioral perspective of privacy decision making by building upon prospect theory (Kahneman & Tversky, 1979) in which heuristics and biases are accounted for. The authors operationalize their objective by investigating how differing degrees of privacy protection influence consumers' willingness to disclose personal information. In three experiments, the authors compare the impact of objective risk of disclosure and relative perceptions of risk of disclosure on both hypothetical and actual information disclosure in English-speaking subjects recruited on Amazon Mechanical Turk and Prolific. The three experiments conducted in the original study were driven by normative and behavioral theories such as the privacy calculus (Dinev & Hart, 2006) for the former and prospect theory (Kahneman & Tversky, 1979) for the latter. While normative factors refer to rational and stable preferences of utility-maximizing agents (Mullainathan & Thaler, 2000), behavioral factors refer to unstable and irrational preferences that stem from limitations in consumers' cognitive ability such as reference dependencies and heuristics in the case of a survey's look and feel (John, Acquisti, & Loewenstein, 2011).

Since previous IS privacy research struggles to simultaneously study the impact of normative and behavioral factors and, to the best of our knowledge, no work that replicates the study of Adjerid et al. (2018) exists, this paper aims to fill this gap. Therefore, we conduct a methodological replication wherein the theories, methods, and hypotheses are adopted from the original study of Adjerid et al. (2018). There are two reasons why we selected this paper for replication. First, it focuses on behavioral factors (reference dependency), which remains a scarce endeavor in the IS community, although some initial work exists and the subfield continues to develop (Herrmann, Kundisch, & Rahman, 2014; Keith, Babb, & Lowry, 2014). Second, this paper adopts an experimental methodology, which is beneficial for replication, because experiments allow for a greater degree of control than other behavioral approaches (Dennis & Valacich, 2015). We now present the research overview and hypotheses adopted from the original study (see Figure 1 and Table 1).

Objective Differences in Privacy Protection

Consumer privacy decision making can be affected by changes in perceived privacy benefits and risks. For example, individuals might provide personal information if they expect to receive more personalized products or services (Adjerid et al., 2018; Ansari & Mela, 2003). Similarly, individuals might conceal information if they believe their disclosure will pose significant risks (Dinev & Hart, 2006; Malhotra, Kim, & Agarwal, 2004) such as price discrimination (Viswanathan, Kuruzovich, Gosain, & Agarwal, 2007). Following this line of thought, Adjerid et al. (2018) propose that privacy protections influence privacy decision making via their impact on perceived risks of information misuse. Hence, *Hypothesis 1* proposes that manipulating normative factors such as objective levels of privacy protection will affect privacy decision making such as information disclosure (Table 1).

Relative Changes in Privacy Protection

Previous work on behavioral factors indicates that privacy decision making can also be relative in nature (Acquisti, John, & Loewenstein, 2012). For example, heuristics, biases, and emotions such as joy and fear have been found to influence how consumers perceive privacy protection and privacy risk (H. Li, Sarathy, & Xu, 2011). A fruitful theoretical lens for analyzing the relative nature of privacy decision making has been offered by Kahneman and Tversky (1979). The authors introduced Prospect Theory in 1979 and challenged

the expected utility theory developed by Neumann and Morgenstern (1944) by demonstrating that individuals also make irrational choices, such as making decisions based on perceived gains instead of perceived losses. However, the proposition that individuals' decision making can also be influenced by reference points is of particular interest for this study. Outcomes above or below the reference point are considered as gains or loses. Acquisti, John, and Loewenstein (2013), for example, demonstrate that individuals are more likely to keep their data private if their data has already been kept private compared to individuals whose data has not been kept private in the first place. Hence, *Hypothesis 2* proposes that behavioral factors such as relative changes in privacy protection influence privacy decision making such as information disclosure (Table 1).

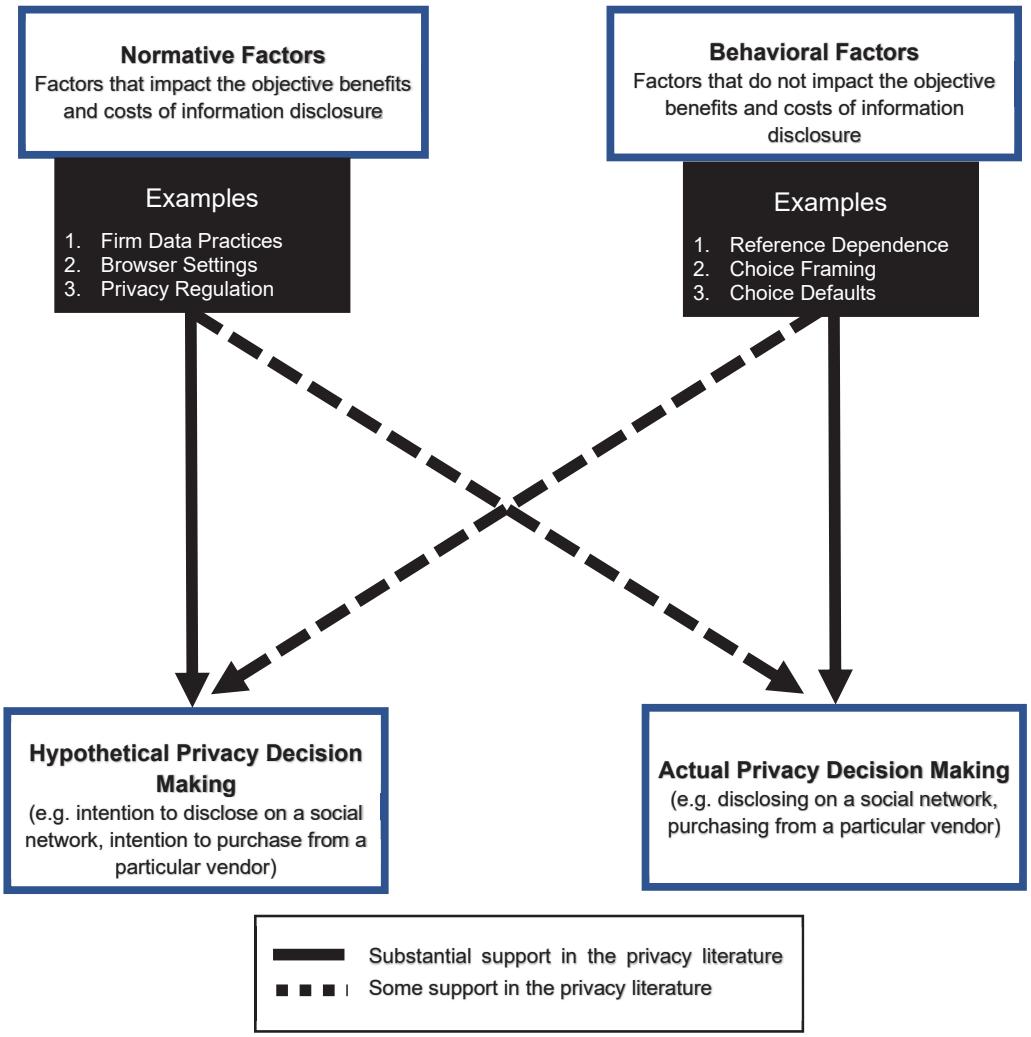

Figure 1. Research Overview (Adjerid et al., 2018)

Privacy Decision Making in Actual Versus Hypothetical Disclosure Contexts

Although comprehensive evidence exists for the normative and behavioral perspectives, it remains unclear how normative and behavioral factors influence hypothetical and actual information disclosure (Adjerid et al., 2018). On the one side, there may be no difference between the two and on the other, the influence of both factors may vary across hypothetical and actual disclosure settings. If normative factors vary across both disclosure settings, this is would constitute a hypothetical bias, indicating a gap between behavioral

intentions and actual behavior. LaPiere (1934) was the first to observe this bias by studying race prejudice. The author found that 92% of the respondents stated that they would not accommodate members of the Chinese race, while in reality, 95% actually did accommodate them. Hence, hypothetical bias refers to the phenomenon that individuals may indicate an intention that they fail to live up to in practice. Empirical studies support that this phenomenon is prevalent (Ajzen, Brown, & Carvajal, 2004; FeldmanHall et al., 2012). Adjerid et al. (2018) further argue that the intention-behavior gap occurs due to more positive attitudes toward a behavior in a hypothetical rather than actual disclosure setting. In other words, if positive attitudes toward protecting privacy exist, these attitudes are going to influence hypothetical rather than actual disclosure. Hence, *Hypothesis 3* proposes that normative factors are stronger in hypothetical compared to actual disclosure settings.

The influence of behavioral factors may also vary across hypothetical and actual disclosure settings. Previous work suggests that behavioral factors have at least some impact in actual disclosure settings (Knetsch, Tang, & Thaler, 2001) and may play a stronger role in actual than in hypothetical settings. Kang and Camerer (2013) and Loewenstein (2000), for example, show that individuals are state-dependent and fail to anticipate the actual choices they will make in future hot states (state in which they are impacted by visceral drivers such as hunger) when considering the same choice context hypothetically. Put simply, individuals in a hot state do not fully understand how much their behavior is influenced by their current state and individuals in cold states find it difficult to imagine themselves in hot states. Translated to privacy decision making, these results indicate that individuals may be unable to anticipate their hot state (e.g., how privacy choice contexts are framed) when considering hypothetical disclosures as opposed to actual disclosures. Hence, *Hypothesis 4* proposes that behavioral factors are weaker in hypothetical than in actual disclosure settings.

Table 1. Research Hypotheses

H1	Changes in objective levels of privacy protection will affect disclosure: lower levels of privacy protection will lead to lower levels of disclosure of personal information.
H2	One's relative perception of the level of privacy protection will influence individual privacy decision making: levels of privacy protection perceived to be higher relative to a reference point will result in higher levels of disclosure of personal information.
H3	The impact of normative factors (i.e., objective changes in privacy protection) will be stronger on hypothetical intentions to disclose compared to actual disclosures.
H4	The impact of behavioral factors (i.e., relative changes in privacy protection) will be weaker on hypothetical intentions to disclose compared to actual disclosures.

However, in contrast to the original study, we do not draw upon a sample of American and English-speaking participants recruited on Amazon Mechanical Turk and Prolific. Instead, we recruited German students and ask them to forward the survey to their families, friends, and colleagues from work. This sample provides the opportunity to identify whether the results presented in the original study are generalizable to populations beyond those in the USA and English-speaking realms and whether the results hold multiple years later.

We chose to focus on German students and their social entourage for three reasons. First, we expect that Americans and German perceive privacy differently (Fromholz, 2000) and that Germans' high levels of uncertainty avoidance (Hofstede-Insights, 2019; Hofstede, 2001) translates into high levels of need for privacy which can affect information disclosure (Y. Li, 2014). Second, the public and scholarly debate of the General Data Protection Regulation (GDPR) in Europe is likely to have increased Germans' privacy sensitivity (especially among students). Moreover, we expect that the increasing exposure to privacy scandals (Clement, 2019a, 2019b) has also increased the privacy sensitivity of our sample and that such individuals will be more restrictive about information disclosure compared to the individuals of the original study. Third, we focus on students and their social entourage to address the limitations that come with pure student samples and thereby aimed for more robust and generalizable results.

The remainder of this paper is organized as follows: First, we present our methodology and summarize and discuss our results; next, we outline practical and theoretical implications; and finally, we highlight limitations for our work and illustrate fruitful avenues for future research.

2 Methodology

This replication study follows the methodology and the three experiments conducted in the original study of Adjerid et al. (2018). In the original study, online pools from Amazon Mechanical Turk and Prolific Academic were used to gain a sufficient sample size. Unlike the original study, this study conducts the three experiments with German students in the field of business administration. The students voluntarily participated and received a 10-point bonus in their course for doing so. To increase the sample population, we requested the students to ask family members, friends, and colleagues from work to participate in the study. Students obtained 1 point for each referral who completed the survey (no more than 3 points were granted in total). We instructed the students to not provide any further information about the experiments to their friends, colleagues, or family before they shared the survey to ensure students did not influence response behavior. We also instructed students to not recruit participants from the course. Participants had 2 weeks (June 14, 2019, to June 28, 2019) to complete the experiments. The students were randomly assigned to one experiment based on their last name[1]. To match the sample size of the original study, we matched more students to Experiment 3, since the sample size of this experiment in the original study was larger than that in the other two experiments. LimeSurvey, an online statistical survey web app, was used to create the experiments.

Our variables are exact replications of the original study. The only exceptions are the questions' intrusiveness (a control variable to assess the effect of questions that had been judged in Acquisti et al. (2012) as highly intrusive on disclosure) and the survey's visual design (a control variable to assess the effect of the survey's visual design on disclosure). We did not consider those two control variables since they were only used in Experiment 2 of the original study. The original study revealed that the survey's visual design has no effect on disclosure. Intrusiveness, however, had mainly a negative effect confirming prior working on information sensitivity (Malhotra et al., 2004). The manipulations that we are interested in are captured by the different groups of participants, which differ regarding their privacy protection levels. We evaluated the impact of manipulations on non-repeating dependent variables (e.g., privacy concerns and protection satisfaction) to assess whether the manipulations led to different perceptions of privacy protection. To this end, we used t-tests and chi-square tests. For all experiments, we relied on either actual or hypothetical willingness to disclose as dependent variables. Both disclosure settings asked participants to make a series of disclosure decisions. To appropriately analyze this experimental setup, we conducted random-effects regression analysis. We considered a participant-specific random effect.

3 Experiment 1: Hypothetical information disclosure

3.1 Methodology

For the first experiment, we randomly assigned participants to each treatment. The experiment investigated hypothetical willingness to disclose personal information. Participants were told at the beginning of the study that they had to complete two separate surveys (named Survey A and B), which included hypothetical sensitive and ethical questions. Then, in the first part of Experiment 1 participants received either high or low levels of privacy protection. After protection recall questions and manipulation checks (see Appendix B, Table B1), both groups answered ten questions about their hypothetical willingness to disclose ethically sensitive information (see Appendix B, Table B2.). We added an attention check between Survey A and Survey B.

[1] The randomization based on the last name was successful. There were no significant differences in the demographic distributions, in Experiment 1, for age (t(232.31) = .229, p = .81), and gender (X^2 (3, N = 235) = .488, p = .485), in Experiment 2, for age (F(3,415) = .145, p = .93) and gender (X^2 (3, N = 419) = 2.412, p = .491), and in Experiment 3, for age (F(1,684) = .92, p = .338) and gender (X^2 (3, N = 686) = 1.679, p = .641).

In the second part of Experiment 1, both groups perceived either an increase or decrease in relative privacy protection, while the actual privacy level was held constant between the two groups in the second part (at a medium privacy level). Protection recall questions and manipulation checks were presented again. Both groups had to answer the same questions about their willingness to share sensitive information as in the first part. Finally, there were follow-up questions about general online privacy concerns and demographic questions (age and gender). Figure 2 illustrates the process of Experiment 1 in a flow chart.

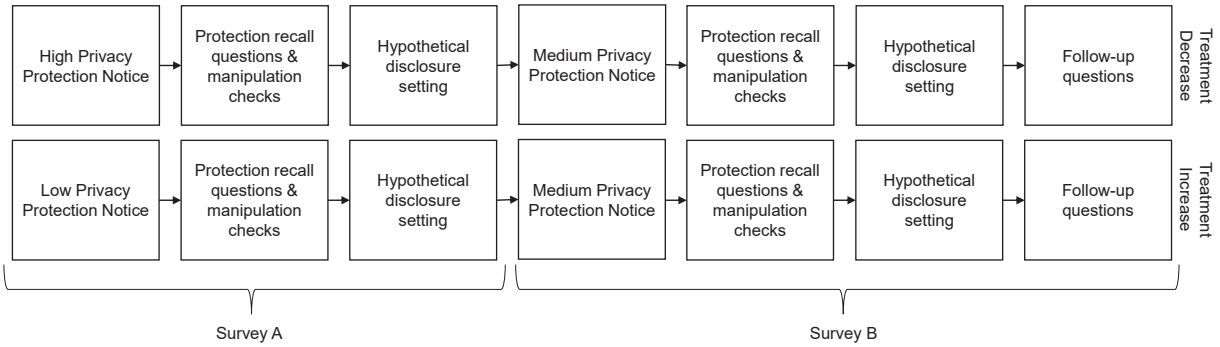

Figure 2: Flow Chart of Experiment 1

We included some reverse answer options for the Likert scales of the sensitive questions to improve the validation of the study by comparing two additional groups with and without reverse answer options. We compared the two groups with a t-test to assure that both indicated similar responses. To indicate the privacy protection level of each survey, we used a graphical representation (see Appendix B, Figure B1) as described in the original study.

Table A1 in Appendix A shows the demographic data of all participants who successfully completed Experiment 1. In the original study, the total sample size for the first experiment was 221 (37.56% female and a mean age of 29.16, SD of age is 9.76) (Adjerid et al., 2018). Our sample size was 235 (46.6 % female and a mean age of 24.96, SD of age is 6.96).

3.2 Results

By and large, we found that participants were able to understand the privacy protection notices provided in the experiment. Although for Surveys A and B only 67.2% and 40.0% correctly recalled at least four of the five dimensions, our manipulation of objective risk was indeed effective in influencing the perception of privacy protection levels in the first survey (Survey A). Participants in the high protection group were significantly more satisfied with those protections ($M_{High} = 3.84$, $M_{Low} = 2.85$), $t(219.65) = 7.12$, $p < .001$, $d = 1.64$, significantly less concerned about privacy ($M_{High} = 2.65$, $M_{Low} = 3.58$), $t(232.89) = -5.7284$, $p < .001$, $d = -1.64$, and significantly less concerned about harm that would come to them as a result of disclosing personal information ($M_{High} = 2.50$, $M_{Low} = 3.00$), $t(232.35) = -3.11$, $p < .01$, $d = -1$ (see Table 2).

Table 2. Experiment 1, Summary Results						
	Survey A			Survey B		
Conditions	High Protection	Low Protection	p-value	Increasing	Decreasing	p-value
Our results						
Privacy Concern	2.65	3.58	p<.001	3.05	3.42	p<.016
Protection Satisfaction	3.84	2.85	p<.001	3.12	2.90	p<.15
Harm Perception	2.50	3.00	p<.001	2.82	3.08	p<.068
Original results						
Privacy Concern	2.39	3.87	p<.001	2.76	3.29	p<.01
Protection Satisfaction	3.36	1.56	p<.001	2.86	2.41	p<.01
Harm Perception	2.86	4.02	p<.001	3.37	3.68	p = .04

We used random-effects regression to estimate the effects of the manipulation. Participants reported their likelihood of disclosure for a given question on a five-item scale (1 = “Very Unlikely” to disclose, 5 = “Very Likely” to disclose). We found that the objective differences in privacy protection levels in Survey A had a significant effect on participants’ predicted behavior. Participants that were given a low level of privacy protection said that they were significantly less likely ($\beta Low = -.32$, $p < .01$) to disclose personal information (Table 3, column 1). This was consistent ($\beta Low = -.32$, $p < .001$) when question type (descriptive versus ethical), participants’ age, and gender were included as control variables (Table 3, column 2). These results provide strong support for the hypothesis that objective risk will affect consumer privacy choices in a hypothetical disclosure setting (H1 is supported).

For the second survey (Survey B), which had an objectively identical medium level of privacy protection for both conditions, participants in the increasing-protection condition reported being more, but not significantly more, satisfied with the protections provided ($MInc = 3.12$, $MDec = 2.90$), $t(228.44) = 1.42$, $p = .16$, $d = 0.40$, not significantly less concerned that their responses might be used in ways that could harm them ($MInc = 2.82$, $MDec = 3.08$), $t(232.55) = -1.83$, $p = .07$, $d = -0.47$, but significantly less concerned about privacy ($MInc = 3.05$, $MDec = 3.42$), $t(232.92) = -2.42$, $p < .05$, $d = -0.47$. Different from the original study, the relative change in privacy protection in Survey B *did* have a significant effect on participants’ predicted disclosure behavior. Specifically, we found that increasing privacy protection did have a significant effect ($\beta Increasing = .28$, $p < .05$) on overall predicted disclosure levels (Table 3, column 3). This result is robust ($\beta Increasing = .28$, $p < .05$) when controls for question type and participant age and gender were included (Table 3, column 4). Hence, in the hypothetical disclosure setting, our results support the hypothesis that the relative perception of privacy protection influences disclosure behavior (H2 is supported).

Table 3. Experiment 1, Regression Results								
	Admission (1 Very Unlikely – 5 Very Likely)							
	Our results				Original Study			
Variables	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Low Protection	-0.324**	-0.320**			-0.669**	-0.650**		
	(0.118)	(0.118)			(0.120)	(0.118)		
Increasing			0.278*	0.282*			0.0925	0.109
			(0.129)	(0.128)			(0.123)	(0.120)
Descriptive		0.053		0.096*		-0.494**		-0.565**
		(0.049)		(0.047)		(0.0607)		(0.0601)
Age		-0.012		-0.016		-0.0132*		-0.0100
		(0.008)		(0.009)		(0.00651)		(0.00680)
Gender		-0.126		-0.129		0.130		0.196
		(0.118)		(0.129)		(0.124)		(0.129)
Constant	3.229**	3.666**	2.776**	3.402	3.631**	4.173**	3.328**	3.772**
	(0.084)	(0.249)	(0.092)	(0.268)	(0.0701)	(0.229)	(0.0784)	(0.249)
Observations	2,350	2,350	2,350	2,350	2,210	2,210	2,210	2,210
Number of id	235	235	235	235	221	221	221	221
Robust standard errors in parentheses; **p < 0.01, *p < 0.05, +p < 0.1.								

3.3 Discussion

Our results suggest that both objective differences and relative changes in privacy protection levels influence privacy perception. More precisely, we found that perceived risk of harm, satisfaction with privacy measures, and privacy concerns were significantly different between objectively high and low privacy protection levels. We also found evidence that privacy concerns are significantly different when privacy protections increase or decrease. However, perceived risk of harm and privacy satisfaction were not significantly different in relative privacy protection changes.

We found effects on hypothetical information disclosure for both objective and relative changes in privacy protection levels. Thus, supporting both H1 and H2. Experiment 1 also provides initial support for H3, as the impact of normative factors (objective change) on hypothetical intentions to disclose information may be more pronounced in hypothetical settings. However, given that there was no comparison with data on actual disclosure, this is only suggestive. Experiment 1 does not seem to support H4, since we identified that relative changes have a significant effect on hypothetical disclosure. The subsequent experiment investigated how normative and behavioral factors influence actual disclosure.

4 Experiment 2: Actual information disclosure

4.1 Methodology

The second experiment was conducted with a different group of students than the first experiment. Unlike the first experiment, where hypothetical disclosure was examined, this experiment focused on actual disclosures while manipulating objective and relative changes in privacy protection. The survey was a 2 x 2 between-subject design and participants were randomly assigned to one of the four groups. Participants were manipulated in such a way that they perceived either an increase, decrease, or the same level of privacy protection for two different surveys (named Survey A and B). At the beginning of the experiment,

participants were told that they would have to participate in two separate surveys and would receive confirmation codes for each survey via email. The confirmation code was needed to prove that they collected data so that participants could receive the course bonus.

At the beginning of the first survey, participants provided their email address, age, and gender. Thereafter, the privacy protection notice was displayed, which conveyed either a high or low level of privacy protection (see Appendix C, Table C1). As in the original study, we used the same text-based privacy level notices. We included additional protection recall questions and manipulation checks (see Appendix C, Table C2). In the next step participants had to answer six questions about ethically questionable behavior (Acquisti et al., 2012) (see Appendix C, Table C3.). As in the first experiment, we placed an attention check between the first and the second survey. Then, we included a reverse answer scale for one of the six personal questions.

Identical to the original study, the second part of Experiment 2 looked and felt different from the first part (see Appendix C, Figure C1 and Figure C2). Again, all participants had to provide their email address and some demographic information (age and gender). After the privacy protection notice and protection recall question and manipulation checks, participants were asked six different questions about ethically questionable activities (Acquisti et al., 2012) (see Appendix C, Table C3.). At the end, some exit questions were presented (e.g., whether the privacy level had changed between the two parts) (see Appendix C, Table C4)[2]. Figure 3 illustrates the process of Experiment 2 in a flow chart.

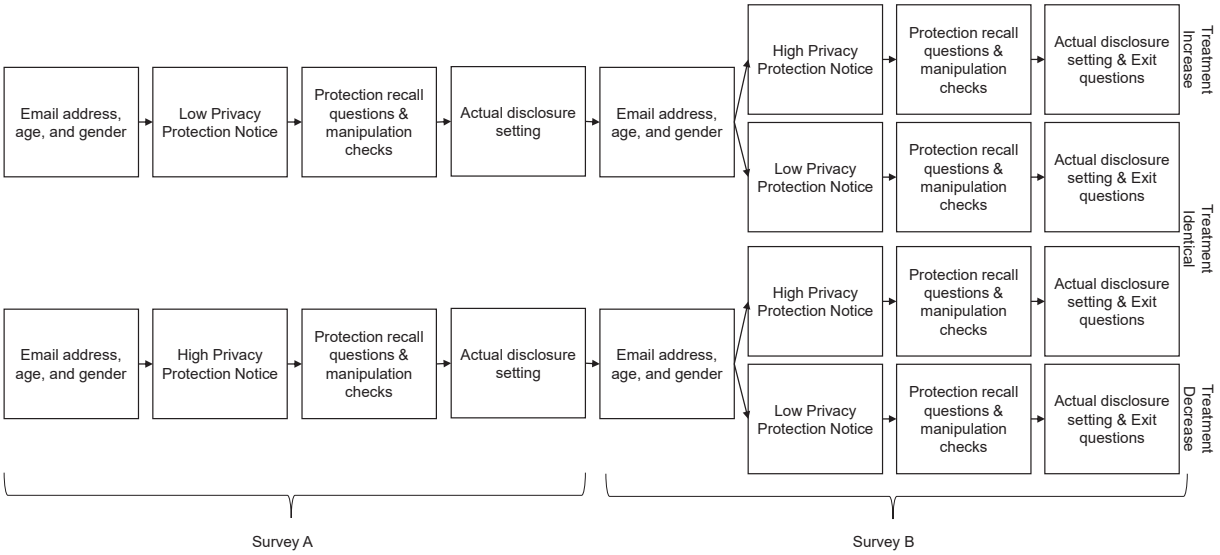

Figure 3: Flow Chart of Experiment 2

Table A2 in Appendix A shows the demographic data of all participants who successfully completed the experiment. In the original study, the total sample size for the second experiment was 415 (51.61% female and a mean age of 31.27, SD of age is 10.72) (Adjerid et al., 2018). Our sample size was 412 (50.02% female and a mean age of 25.12, SD of age is 9.02).

4.2 Results

In the second experiment, our manipulations of high, and low privacy protection levels again elicited the hypothesized effect. Participants in the low protection condition reported significantly higher beliefs that their

[2] Of the participants who answered the exit questions, 76.99% indicated they had participated in more than one study and 90.21% reported differences existed between both studies. Results do not differ when we exclude these participants.

responses would be linked back to them (MLow = .82, MHigh = .42, t (370.84) = 8.9794, p < .001, d = 1.86) relative to participants in the high-protection condition.

We first evaluated the disclosure rates of participants in the first survey. We found that participants were not more likely to disclose information (βHigh = .01 p = .74) when they were provided with a high level of protection in the first survey (see Table 4, column 1). Our results were consistent (βHigh = .01 p = .73) when we included controls for participant demographics (see Table 4, column 2). However, we did not control for the questions' intrusiveness or varying survey designs.

Next, we evaluated disclosure behavior in the second survey of the experiment, in which participants were presented with increasing, decreasing, or identical privacy protection levels compared to the first survey. We first compared participants who had high levels of protection in both surveys with participants who had low levels of protection in both surveys (see Table 4, columns 3 and 4). We included an additional control variable to account for the possibility that high disclosure in the first survey influenced second survey disclosures, using Survey1Sharing, which ranged from a value of 0 (for participants who did not admit to any of the behaviors in Survey 1) to a value of 6 (for participants who admitted to all behaviors in Survey 1). In line with our results for the first survey, we found no effect of high protection versus low protection on disclosure (βHigh = .01, p = .70) in the second survey (see Table 4, column 3). This result was robust (βHigh = .01, p = .71) when including controls for participant demographics (see Table 4, column 4). All in all, our results did not provide evidence that changes in objective privacy protection levels influenced actual information disclosure (H1 is not supported). However, the control variable capturing Survey1Sharing turned out to be significant. This pointed toward a person-specific level of disclosure. We will discuss this in Section 6.

Second, we evaluated the impact of relative changes of privacy protection levels on disclosure compared to conditions, in which participants did not perceive an increase or decrease (participants received objectively equivalent privacy protection notices). We found *no* increase in the propensity to disclose information (βIncreasing = .02, p = .57) for participants who perceived an increase in protection relative to those whose protections stayed constant. This result was robust when controls for participant demographics were included (see Table 4, columns 5–6). We also found no significant decrease in the overall propensity to disclose (βDecreasing = -.03, p = .30) for participants who perceived a decrease in protection relative to those whose protections stayed constant (see Table 4, column 7). Again, this result was robust when controls for participant demographics were included (see Table 4, column 8). These results suggest that participants' relative perceptions of privacy protection did not impact actual disclosure behavior (H2 is not supported).

4.3 Discussion

Experiment 2 further differentiated the findings from Experiment 1 by investigating actual disclosure settings. However, in contrast to the proposed hypothesis, we did not find any significant impact of either normative or behavioral factors on actual information disclosure (H1 and H2 are not supported). The combined results of Experiment 1 and 2, therefore, indicate that normative factors are stronger in hypothetical disclosure settings than in actual disclosure settings (H3 is supported). The combined results, however, do not demonstrate that behavioral factors are weaker in hypothetical disclosure settings than in actual disclosure settings (H4 is not supported). This phenomenon may be explained by the significant effect of the Survey1Sharing variable, which indicates a person-specific level of disclosure.

Table 4. Experiment 2, Regression Results

	Probability of Admission															
	Our results								**Original results**							
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
High Protection	0.009	0.009	0.014	0.013					0.0499*	0.0423+	-0.00336	0.0001				
	(0.027)	(0.027)	0.036	(0.035)					(0.0240)	(0.0231)	(0.0278)	(0.0278)				
Increasing					0.018	0.02							0.0605*	0.0604*		
					(0.032)	(0.032)							(0.0292)	(0.0292)		
Decreasing							-0.034	-0.031							-0.075**	-0.071**
							(0.033)	(0.033)							(0.0269)	(0.0271)
Intrusive		-		-		-		-		0.076**		-0.111**		-0.113**		-0.086**
		-		-		-		-		(0.0178)		(0.0271)		(0.0259)		(0.0288)
Age		0.003+		0.000		-0.001		-0.003+		-0.005**		0.00139		0.0032*		0.00057
		(0,002)		(0,002)		(0.002)		(0.002)		(0.0009)		(0.0016)		(0.0014)		(0.0016)
Male		-0.002		-0.084*		-0.105*		-0.018		0.0493*		0.0512+		0.0633*		0.0483
		(0.027)		(0.035)		(0.032)		(0.033)		(0.0232)		(0.0301)		(0.0303)		(0.0307)
Survey Design		-		-		-		-		0.0379		-0.0120		0.00729		-0.0234
		-		-		-		-		(0.0231)		(0.0300)		(0.0305)		(0.0276)
Survey 1 Sharing			0.074**	0.077**	0.081**	0.085**	0.087**	0.086**			0.105**	0.105**	0.095**	0.097**	0.110**	0.109**
			(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)			(0.0093)	(0.0099)	(0.0102)	(0.0105)	(0.099)	(0.0103)
Constant	0.858*	0.938	0.693**	0.720**	0.668**	0.724**	0.711**	0.800**	0.444**	0.525**	0.0149	0.0206	0.0408	-0.0273	0.00092	0.0265
	(0.043)	(0.059)	(0.059)	(0.079)	(0.06)	(0.077)	(0.055)	(0.071)	(0.0176)	(0.0438)	(0.0273)	(0.0693)	(0.0302)	(0.0654)	(0.0278)	(0.0700)
Observations	2,063	2,063	981	981	1,948	1,948	2,108	2,108	2,490	2,454	1,164	1,140	1,158	1,140	1,050	1,032
Number of id	412	412	204	204	196	196	216	216	415	409	194	190	193	190	175	172

Robust standard errors in parentheses; **p < 0.01, *p < 0.05, +p < 0.1.; missing data –

5 Experiment 3: Hypothetical and actual information disclosure

5.1 Methodology

Experiment 3 investigated actual and hypothetical disclosure settings simultaneously to confirm that both behavioral and normative factors influence privacy decision making. Again, participants had to participate in two separate surveys, each with a different look and feel. Participants were randomly assigned to one of the eight groups.

The first survey served to set either a high or a low level of privacy protection (as in Experiment 2) but did not include self-disclosure measures. As in the original study, we did not request that participants indicate their disclosure behavior during the first survey, because we did not want actual disclosure to influence disclosures in the second survey. Privacy protection levels were graphically displayed as in Experiment 1 (see Appendix B, Figure B1). Participants had then to rate the level of privacy protection offered in the survey. In the low-protection condition, participants were asked to provide their email address to receive a confirmation code via email for their participation and to increase the perception that answer could be linked to their identity. Identical to the original study, participants had to complete a filler task that separated the first and the second survey. The filler task comprised a 5-minute video about business models and answering questions about the content. A non-privacy filler task enabled participants to encounter two different privacy settings with an extensive delay between both, which better represents real-world privacy scenarios. As in the previous experiments, we included an attention check.

In the second survey, participants were manipulated in such a way that they perceived either an increase, a decrease, or no change in the level of privacy protection compared to the first survey. Participants had then to rate the level of privacy protection offered in the survey. In the low-protection condition, participants were asked to provide their email address to receive a confirmation code via email for their participation. Next, participants were assigned either to the hypothetical or actual disclosure setting. In the actual disclosure setting, participants had to answer five personal and sensitive questions (Acquisti et al., 2012) (see Appendix D, Table D1). In the hypothetical disclosure setting, the questions remained the same; however, participants were asked to imagine participating in a study with certain privacy protection levels provided to the answers. Participants answered a set of questions referring to (un)ethical behaviors and indicated their likelihood of admitting such behaviors. At the end, participants indicated their gender and age. Figure 4 illustrates the process of Experiment 3 in a flow chart.

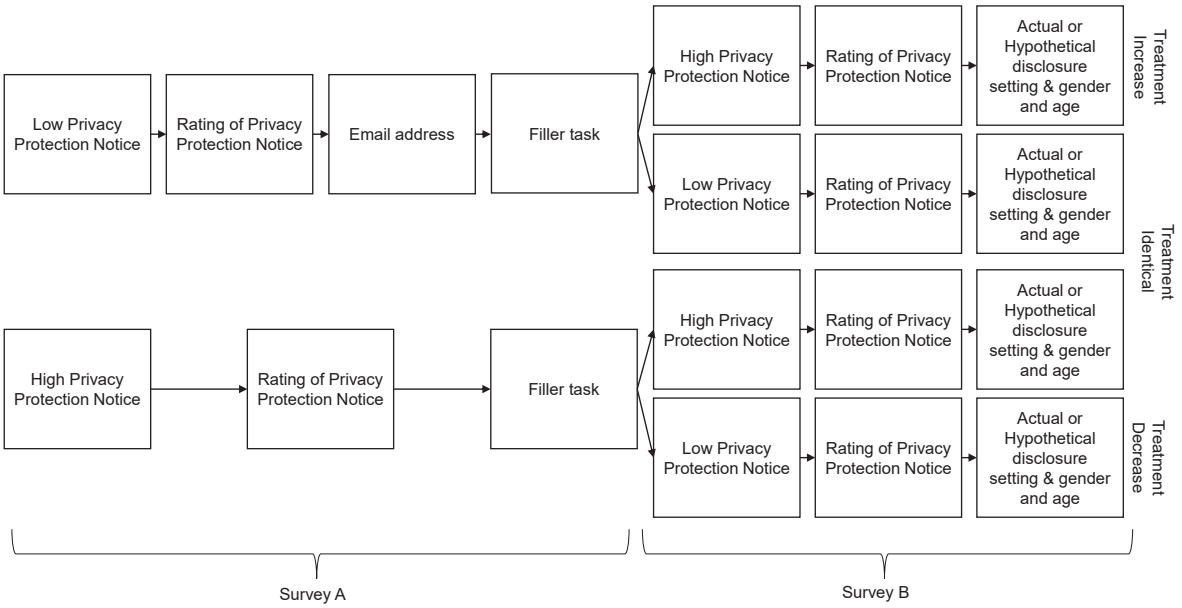

Figure 4: Flow Chart of Experiment 3

Table A3 in Appendix A shows the demographic data of all participants who successfully completed the experiment. In the original study the total sample size for the third experiment was 739 (51.7% were males and a mean age of 29.67, SD of age is 10.1) (Adjerid et al., 2018). Our sample size is 672 (52.38% were males and a mean age of 26.63, SD of age is 10.58).

5.2 Results

In the first study, participants in the high-protection condition rated the study as offering a higher level of privacy protection ($M = 3.76$ vs 2.48, $SD = 1.27$, $t(672.14) = -15.34$, $p < .001$). We found no consistent results for the ratings of privacy protections in the second study ($M = 3.13$ vs 3.11, $SD = 1.28$, $t(683.32) = -0.2234$, $p < .82$). We, therefore, could not conclude that our manipulation in the second survey worked as expected. However, the pattern and significance of the results remained the same when excluding manipulation failures, and we therefore report the results of the full sample. We discuss this circumstance in Section 6.

Now, we present the effects on actual and hypothetical disclosure. We first examine participants in the hypothetical settings, where we consider participants to have admitted to the behavior if they responded with either “strongly agree” or “agree” to the question as to whether they would admit to a particular behavior. We do not find statistically significant differences in hypothetical admission rates between those with objectively different (high vs. low) levels of protection (67% versus 52%, $t(622) = -1.197$, $p = .23$). Furthermore, we do not find any significant differences in hypothetical admissions when privacy protections are held objectively constant but relatively decrease (63% versus 57%, $t(461) = 1.44$, $p = .15$) or relatively increase (68% v2. 71%, $t(525) = -0.84$, $p = .40$). We verified that these results are robust to (1) alternative measurements for hypothetical admission, including a continuous measure (i.e., 1–5 on the Likert scale) and (2) considering participants that reported to be uncertain (neither agree nor disagree) as also admitting the behavior.

We confirm these results in a random-effects regression (see Table 5). We find that neither objective differences (high protection) nor relative changes in privacy protection have a significant effect in the hypothetical disclosure setting (see columns 1, 2, and 3). The pattern and significance of the results remain similar when we include participants who failed the manipulation checks. We therefore report the result of the full sample.

Subsequently, we consider participants in the actual-disclosure condition, where participants were shown the same privacy protections and asked the same questions as their counterparts in the hypothetical-disclosure condition. For these participants, we considered an admission as any response to our questions that indicated that the participant engaged in a particular behavior at least once (the same measurement of admission rates was used in the original study). Unlike in the hypothetical context, we find statistically significant differences in actual disclosure behavior between participants with objectively different (high versus low) privacy protections (57% versus 48%, $t(553) = -2.01$, $p = .045$). In line with the hypothetical condition, we find that those who perceived a relative decrease in protection did not disclose significantly less than those who did not perceive a change (45% versus 48%, $t(525) = 0.74$, $p = .46$). Finally, unlike in the hypothetical context, we find that those who perceived a relative increase in protection disclosed significantly more than those who did not perceive a change (57% versus 48%, $t(609) = 2.24$, $p = .03$).

However, the random-effects regression does not support the findings of the t-tests (see Table 6). The regression analysis does reveal a significant effect of objective differences, but the effect becomes insignificant when we exclude participants who failed the manipulation check (see column 1). All other results of Experiment 3 are robust when controlling for failed manipulation checks, and we therefore report the results of the full sample. Furthermore, the regression does not support the initial finding that a relative increase in privacy protection leads to higher levels of actual disclosure (see column 3). However, the regression confirms that a relative decrease in privacy protection does lead to lower levels of actual disclosure (see column 3).

Table 5. Experiment 3, Hypothetical Choice Results						
	Probability of Admission					
	Our results			Original results		
Variables	(1)	(2)	(3)	(1)	(2)	(3)
High Protection	0.036			0.0878*		
	(0.042)			(0.0441)		
Decreasing		-0.041			-0.0305	
		(0.047)			(0.0459)	
Increasing			0.044			0.00185
			(0.044)			(0.0433)
Age	-0.004*	-0.003	-0.007**	-0.00154	-0.000852	-0.000954
	(0.002)	(0.002)	(0.002)	(0.00251)	(0.00231)	(0.00276)
Male	0.078+	0.001	0.044	-0.105*	-0.107*	-0.0441
	(0.043)	(0.046)	(0.044)	(0.0453)	(0.0467)	(0.0441)
Constant	0.663**	0.754**	0.775**	0.737**	0.720**	0.718**
	(0.086)	(0.09)	(0.09)	(0.0915)	(0.0910)	(0.0967)
Observations	821	712	744	950	910	915
Number of id	179	154	162	190	182	183
Robust standard errors in parentheses; **p < 0.01, *p < 0.05, +p < 0.1.						

Table 6. Experiment 3, Actual Choice Results						
	Probability of Admission					
	Our results			Original results		
Variables	(1)	(2)	(3)	(1)	(2)	(3)
High Protection	0.097* / 0.05[1]			0.0552		
	(0.044)			(0.0410)		
Decreasing		-0.007			-0.108*	
		(0.047)			(0.0476)	
Increasing			-0.069+			-0.0126
			(0.042)			(0.0354)
Age	-0.005**	-0.005+	0.006**	0.00143	0.00248	-1.24e-05
	(0.002)	(0.003)	(0.002)	(0.00277)	(0.00232)	(0.00192)
Male	0.137**	0.075	0.130**	-0.0296	-0.0826+	-0.0321
	(0.043)	(0.048)	(0.042)	(0.0408)	(0.0480)	(0.0366)
Constant	0.464**	0.562**	0.739**	0.594**	0.646**	0.695**
	(0.085)	(0.102)	(0.093)	(0.0959)	(0.0987)	(0.0694)
Observations	778	696	833	895	810	1,010
Number of id	171	153	180	179	162	202
Robust standard errors in parentheses; **p < 0.01, *p < 0.05, +p < 0.1; [1] excluding manipulation fails.						

5.3 Discussion

In Experiment 3, we examined the simultaneous effects of normative and behavioral factors on actual and hypothetical information disclosure. We found no support for an effect of changes in privacy protection levels on disclosure. Neither objective differences nor relative changes influenced participants' hypothetical disclosure. This result also held true for actual disclosure (H1 and H2 are not supported). Moreover, when comparing the coefficients between hypothetical and actual disclosure, we found no support for the hypothesis that normative factors have a stronger influence on hypothetical intentions compared to actual disclosure (H3 is not supported). Nor did we find evidence that behavioral factors have a weaker influence on hypothetical intentions compared to actual disclosure (H4 is not supported).

Briefly concluding all three experiments, we observe some contradictions between Experiments 1 and 2 and Experiment 3. While Experiment 1 supports H1 and H2, Experiment 3 provides no support for these hypotheses in the hypothetical disclosure setting. Similarly, the comparison of Experiments 1 and 2 supports H3, which is not supported in Experiment 3. However, all experiments demonstrate that H4 is not supported and that neither H1 nor H2 is supported in the actual disclosure setting. Hence, we found mixed support for the argument that normative and behavioral factors can influence hypothetical disclosure and large support for the argument that normative and behavioral factors have no influence on actual disclosure.

6 General Discussion and Conclusion

Our study was carried out as a methodological replication of Adjerid et al. (2018). The original study aimed to fill the void in the IS literature about the simultaneous effect of normative factors (objective differences) and behavioral factors (relative changes) on hypothetical and actual information disclosure. Both studies drew upon literature on consumer privacy decision making and behavioral economics literature regarding reference dependency. However, in contrast to the original study, which showed that relative changes were more pronounced in actual disclosure settings and objective differences were more pronounced in hypothetical disclosure settings, we presented some evidence that normative and behavioral factors influenced hypothetical but not actual disclosure. A comparison of the results is illustrated in Table 7.

Table 7. Overview of Results

		Experiment 1	Experiment 2	Experiment 3	
		Hypothetical choice	Actual choice	Hypothetical choice	Actual choice
H1: Objective Privacy Protection	**Orig. study**	Support	Mixed support	Support	No support
	Our results	Support	No support	No support	No support
H2: Relative Privacy Protection	**Orig. study**	No support	Support	No support	Support
	Our results	support	No support	No support	No support
H3: Impact of normative factors	**Orig. study**	Support		Support	
	Our results	Support		No support	
H4: Impact of behavioral factors	**Orig. study**	Support		Support	
	Our results	No support		No support	

Our findings point to two areas of discussion. First, the comparison of our results and second, the difference between our results and the results of the original study.

6.1 Comparison of our results

Contrary results between Experiment 1 and Experiment 3

While Experiment 1 investigated the influence of changes in objective and relative levels of privacy protection on hypothetical disclosure, Experiment 3 investigated the influences of objective and relative changes on both actual and hypothetical disclosure. The results of Experiments 1 and Experiment 3 contradict in that Experiment 1 supports H1 (changes in objective levels of privacy protection will affect disclosure) and H2 (one's relative perception of the level of privacy protection will influence individual privacy decision making), whereas Experiment 3 provides no support for these hypotheses in the hypothetical disclosure setting. Therefore, we review the design differences between both experiments to explain the contradiction, in particular as the samples of both experiments do not differ. We argue that five design differences exist. First, Experiment 1 used the same survey design for both surveys, while Experiment 3 used two different survey designs. However, since the survey design had no effect in the original study, we neglect this as potential reason for differentiation. Second, participants in Experiment 1 were manipulated from high or low to medium levels of privacy protection. In contrast, in Experiment 3, participants were manipulated from high or low to high or low levels of privacy protection. Third, Experiment 1 measured objective changes based on disclosure behavior in the first survey, whereas Experiment 3 used disclosure behavior from the second survey. Fourth, Experiment 3 did not request that participants indicate their disclosure behavior in the first survey (to better reflect real-world privacy scenarios) while Experiment 1 did. Fifth, Experiment 3 included a non-privacy related filler task and Experiment 1 did not.

Regarding the contradiction within H1 (changes in objective levels of privacy protection will affect disclosure), we argue that Experiment 3 registered such a high number of manipulation failure (69%[3]) that it may have rendered the remaining sample too small to identify significant effects. Hence, the contradiction may rather stem from manipulation failure than from the differences between both experiments especially since the process of the objective manipulation is less effected by the differences between both experiments. In other words, if the manipulation would have better worked in Experiment 3, the experiment might have yielded the same supporting result as Experiment 1.

Concerning the contradiction within H2 (one's relative perception of the level of privacy protection will influence individual privacy decision making), we posit that the filler task and missing disclosure behavior in the first survey in Experiment 3 may have caused the result to become insignificant. While the filler task may have led participants to forget the privacy protection level of the first survey, missing disclosure behavior may have amplified this effect since participants were not incentivized to recall the first protection level. In contrast, Experiment 1 showed the two privacy protection levels in rapid succession and requested participants to indicate their disclosure behavior after the first survey which may have helped participants to better remember the first protection level when answering the second disclosure questions.

Contrary results between the results of the comparison of Experiment 1 & 2 and Experiment 3

Experiment 1 investigated the influence of changes in objective and relative levels of privacy protection on hypothetical disclosure, whereas Experiment 2 investigated the influence of both changes on actual disclosure and Experiment 3 investigated both changes on actual and hypothetical disclosure simultaneously. However, while the results of the comparison of Experiments 1 and 2 support H3 (the impact of objective changes will be stronger on hypothetical compared to actual disclosure), the results of Experiment 3 do not. We propose that the rejection of H3 in Experiment 3 is a corollary to the rejection of H1 (objective changes influence disclosure) in Experiment 3. Since H3 is dependent upon the outcome of

[3] We found no evidence that participants who failed to understand the manipulation were significantly different from participants passing the manipulation check: difference in means for age of 27.2 (for those who failed) vs. 26.3 (for those who didn't fail), $t(432) = -0.709$, $p = .47$ and 44% female (fails) vs. 50% female (not failed), $X^2(1, 686) = 0.96$, $p=.33$.

H1 and H1 had been rejected due to a high number of manipulation failures, H3 had also been rendered insignificant. We, therefore, argue that the contradiction may stem from manipulation failure rather than from the differences between the three experiments. In other words, if the manipulation had worked better in Experiment 3, the experiment might have yielded the same supporting results as the comparison of Experiments 1 and 2.

Comparison of students and their elderly referrals

The use of students as a sample is potentially problematic. Findings derived from a student sample might not be generalizable to the whole population. To ameliorate these concerns, we used snowball sampling, where the initial group of students was asked to recruit additional people to participate in the study, outside of the student population, to obtain a broader and more representative sample. As we collected as little data as possible to ensure high levels of participants' privacy, we were not able to identify the status of participants and to directly control whether students answer significantly different than referrals. However, we approximated the status of "student" by separating our sample by age in two groups (two times, in groups of older than vs. younger than or equal to 23, 25, and 27 years, respectively). In summary, the t-tests revealed statistically significant but no considerable differences in disclosure for eight out of 15 tests (see Appendix E). While these results provide additional credibility for the use of student samples, we conclude that our results are not entirely generalizable.

6.2 Comparison of our results and the results of the original study

We observed that behavioral factors (relative changes in privacy protection) influence hypothetical rather than actual disclosure. Hence, H4 (behavioral factors will be weaker on hypothetical compared to actual disclosure) is not supported, which stands in direct contrast to the original study supporting H4. Although our results are only valid in Experiments 1 (hypothetical disclosure) and 2 (actual disclosure), we argue that the high amount of manipulation failures in Experiment 3 (hypothetical and actual disclosure) rendered the effect insignificant and that we might have found consistent results among the experiments if the manipulation had succeeded.

We propose two lines of reasoning for the observed difference in our result and that of the original. First, behavioral factors may influence hypothetical disclosure, because (1) the hypothetical context triggers positive attitudes toward disclosing/concealing information (Ajzen et al., 2004) and (2) these positive attitudes foster hypothetical disclosure/concealment. Moreover, participants may fear fewer or even no consequences of their behavior in the hypothetical context and may, therefore, be willing to disclose/conceal more information. Hence, positive attitudes and a lack of consequences may explain why the results indicate that behavioral factors influence hypothetical rather than actual disclosure.

Our second line of reasoning argues that behavioral factors do not influence actual disclosure because participants may have recently developed such a strong disposition to privacy that they are not willing to reveal their actual disclosure behavior no matter the manipulation. By disposition to privacy we refer to "a person's general desire or need for privacy across contexts" (Y. Li, 2014). Such a disposition may have recently emerged and may be more pronounced in our German sample. While Adjerid et al. (2018) collected their data around 2012 and 2016[4] during which privacy scandals and data protection were less pronounced and discussed in public (Clement, 2019a, 2019b), our samples were exposed to a continuously increasing stream of major privacy breaches and fake news revelations over the last years (e.g. Facebook's influence in the US presidential election 2016 (Cadwalladr & Graham-Harrison, 2018) and in the Brexit referendum (Cadwalladr, 2017)) as well as to public and scholarly debates about GDPR. Hence, our participants may have been more restrictive or even reluctant to disclose actual behavior independent of the level of privacy

[4] According to the original study the "early analysis of Experiment 2 was published as part of the ACM proceedings from the 2013 Symposium on Usable Privacy and Security" and Experiment 3 has been based on data "of September 2016" (Adjerid et al., 2018).

protection offered due to recent awareness of privacy violations and mistrust toward entities collecting data. Prior work already indicates that increased awareness of privacy violations reduces trust and that trust reduction lowers disclosure (Dinev & Hart, 2006; Malhotra et al., 2004).

In addition to participants' increased disposition to privacy, we argue that the questions may have been too intrusive to elicit true responses about actual behavior. The original study found already a significant effect of intrusiveness on disclosure (Adjerid et al., 2018) as well as prior work (Malhotra et al., 2004) and in combination with high disposition to privacy participants may have decided to conceal their true actual behavior regardless of the manipulation.

Moreover, the original study primarily relied upon American participants and participants from Amazon Mechanical Turk. Both characteristics indicate that the sample of the original study was less privacy sensitive and more prone to information disclosure than our German sample. Not only does the language Americans and Germans use to discuss privacy reflect different ways of conceiving privacy ("privacy" versus "data protection") (Fromholz, 2000), but the divergent levels of uncertainty avoidance in both societies (Hofstede-Insights, 2019; Hofstede, 2001) also indicate that Germans may be more privacy-sensitive. For example, privacy protections in the USA (low on uncertainty avoidance) are mainly based on industry self-regulation, whereas Germany (high on uncertainty avoidance) has substantial laws in place to protect privacy (Bellman, Johnson, Kobrin, & Lohse, 2004). Related research further shows that Germans are more likely than Americans to believe that information provided on Facebook has a higher likelihood of negative outcomes and assume higher damages should these negative outcomes occur (Krasnova & Veltri, 2010).

Returning to Amazon Mechanical Turk, we argue that these participants may be less privacy-sensitive and more prone to disclose (even unethical) information since they disclose this information in return for monetary rewards and may, therefore, feel morally obliged to disclose true behavior (to achieve a good rating) and thus have fewer inhibitions to disclosing actual behavior.

Our first argument (strong individual disposition to privacy) is supported by the significant effect of the survey1sharing variable (approximating disposition to privacy) in Experiment 2 as it indicates that person-specific tendencies toward privacy account for changes in disclosure rather than objective or relative changes in protection. Our second argument (cultural differences regarding privacy) is supported by the fact that our results generally reflect very high privacy levels (low levels of disclosure), compared to those of the original study. In Experiment 1 for example, the original study demonstrates constantly higher baseline disclosure compared to our study (3.63 vs. 3.23, 4.17 vs. 3.67, 3.33 vs. 2.78, 3.77 vs. 3.40). We conclude that our participants have not been willing to indicate their true choice in the actual disclosure setting and thereby rendered normative and behavioral factors insignificant. In other words, at minimum behavioral factors have an impact in the actual setting (Adjerid et al., 2018), but may not be elicitable from privacy-sensitive individuals. This has important implications for scholars relying upon participants to truly report their actual behavior. Our conclusion suggests that these self-reports becomes more and more difficult for privacy-sensitive individuals.

Finally, we partially confirm the findings of Adjerid et al. (2018) that the impact of normative factors (objective changes in privacy protection) is more pronounced in the hypothetical than in the actual disclosure setting. That is, the results of Experiment 1 (hypothetical disclosure) and 2 (actual disclosure) support H3 (normative factors will be stronger on hypothetical compared to actual disclosure) but the results of Experiment 3 (hypothetical and actual disclosure) do not support H3. However, since Experiment 3 suffers from high manipulation fails, we need to interpret the results carefully and we therefore propose that consistent results may have merged from the experiments if the manipulation had succeeded.

7 Limitations and Future Research

Our study possesses several limitations. First, as Adjerid et al. (2018) pointed out, this work investigated specific factors within the normative and behavioral perspective. However, other biases such as framing effects, isolation effects, or bandwagon effects may lead to different findings. We, therefore, encourage future work to extend our manipulations by exploring how other cognitive biases affect privacy decision making. Second, although we tried to reach out to different sociodemographic groups, our study mainly

comprises students. Our work is therefore not representative of the entire German population. We suggest future work to engage in more representative studies to assess the extent, to which different sociodemographic groups are prone to manipulation and whether some groups may need more regulatory protection than others (in case biases are used to harm consumers, e.g. through less protective default settings). Third, our results suggest that an individual's disposition to privacy and their cultural background inhibited manipulation in the actual disclosure setting, but we did not directly control for those aspects. Hence, it seems fruitful to explore the moderating effect of disposition to privacy and uncertainty avoidance (as a more specific subdimension of culture) in future studies. Finally, while our manipulations succeeded in Experiment 1 and 2, the manipulations did not work well in Experiment 3 and therefore need to be interpreted carefully.

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Appendix A: Sample statistics

Table A1. Experiment 1, Demographic data		
	Responses (n)	
Total responses	331	
Did not finish	96	
Responses	235	
Failed attention check	60	
Group	Low privacy protection	High privacy protection
	Sex	
Male	50	38
Female	43	44
Total	93	82
	Age (Quantile)	
0%	19	18
25%	21	21
50%	23	23
75%	26	25
100%	55	64

Table A2. Experiment 2, Demographic data				
	Responses (n)			
Total responses	541			
Did not finish	129			
Responses	412			
Failed attention check	120			
Group	High, High	High, Low	Low, High	Low, Low
	Sex			
Male	44	58	49	54
Female	48	46	55	58
Total	92	104	104	112
	Age (Quantile)			
0%	18	18	18	18
25%	21	20	20	20
50%	23	23	23	23
75%	26	25	26	25
100%	51	66	67	91

Table A3. Experiment 3, Demographic data								
	Responses (n)							
Total responses	949							
Did not finish	277							
Responses	672							
Failed attention check	172							
Group (l=Low, h=High, a=actual, b=hypothetical)	h, h, a	h, h, b	h, l, a	h, l, b	l, h, a	l, h, b	l, l, a	l, l, b
	Sex							
Male	56	41	42	35	47	44	39	48
Female	39	45	40	27	44	33	44	48
Total	95	86	82	62	91	77	83	96
	Age (Quantile)							
0%	18	18	18	18	18	18	18	18
25%	21	21	22	22	20	20	20	20
50%	24	24	24	24	23	23	23	23
75%	28	26	27	27	26	25	26	26
100%	74	60	57	83	65	62	62	75

Appendix B: Experiment 1

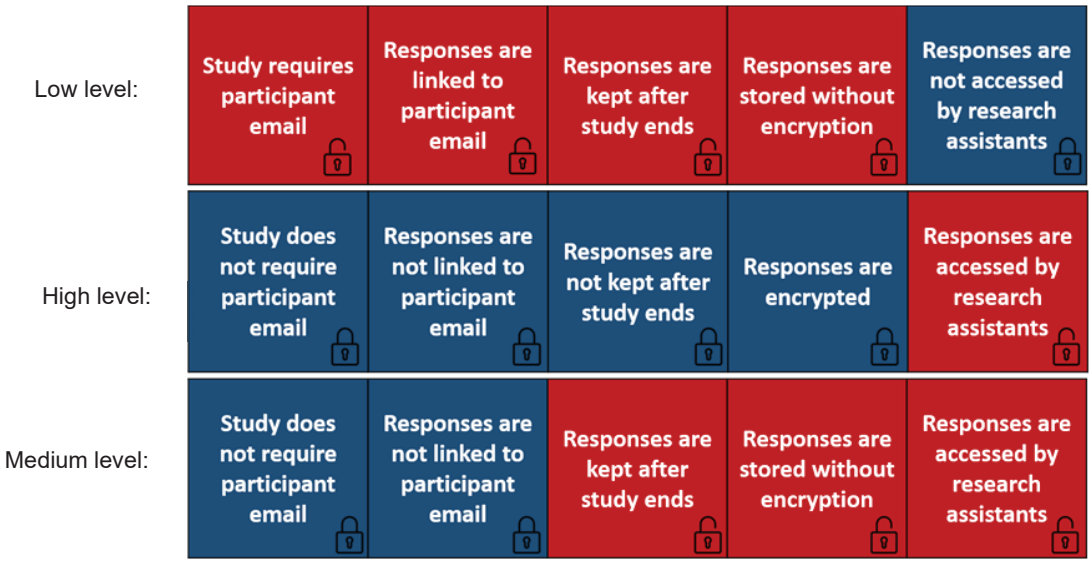

Figure B1. Low, High, Medium privacy level

The locks should indicate the privacy focus, an open lock means lower privacy and closed lock means higher privacy level.

Table B1. Manipulation checks and protection recall

Measure	Description	Response scale
Privacy Concern	I would be concerned about my privacy if I was participant in this upcoming survey A/B.	Strongly Agree – Strongly Disagree [5 scale]
Protection Satisfaction	I am satisfied with the protections provided in this upcoming survey A/B.	Strongly Agree – Strongly Disagree [5 scale]
Harm Perception	I would be concerned that my responses in this upcoming survey A/B could be used to harm me.	Strongly Agree – Strongly Disagree [5 scale]
Protection Recall 1	Does survey A/B require a valid email address?	Yes, No
Protection Recall 2	The responses in survey A/B are linked to my email.	Yes, No
Protection Recall 3	My responses are kept after the end of survey A/B.	Yes, No
Protection Recall 4	My responses are encrypted in survey A/B.	Yes, No
Protection Recall 5	My responses in survey A/B will be accessed by a research assistant.	Yes, No

As in the original study the following text was given to the participants: Imagine you are taking study A/B. How likely are you to truthfully answer the following questions?

Table B2. Hypothetical Questions	
Description	Response scale [5 scale]
What is your annual income?	Very Unlikely – Very Likely
What is your sexual orientation?	Very Unlikely – Very Likely
What is your address?	Very Unlikely – Very Likely
What is your phone number?	Very Unlikely – Very Likely
What is your view on gay rights?	Very Unlikely – Very Likely
Have you every downloaded a pirated song?	Very Unlikely – Very Likely
Have you ever flirted with someone other than your partner or spouse?	Very Unlikely – Very Likely
Have you ever used drugs of any kind (e.g., weed, heroin, crack)?	Very Unlikely – Very Likely
Have you ever looked at pornographic material?	Very Unlikely – Very Likely
Have you ever made up a serious excuse, such as a grave illness or death in the family, to get out of doing something?	Very Unlikely – Very Likely

Appendix C: Experiment 2

Table C1. Privacy notification	
Privacy notice	Text
High	The analysis for this study requires that your responses are stored using a randomly assigned ID. All other information that could potentially be used to identify you (email, zip code, etc.) will be stored separately from your responses. As such, your responses to the following set of questions cannot be directly linked back to you.
Low	The analysis for this study requires that your responses are stored using your email. As such, your responses to the following set of questions may be directly linked back to you.

Table C2. Manipulation checks and protection recall		
Measure	Description	Response scale
Protection Recall 1	Does survey A/B requires a valid email address?	Yes, No
Protection Recall 2	The responses in survey A/B are linked to my email.	Yes, No
Privacy Concern	I am concerned about my privacy in this survey.	Strongly Agree – Strongly Disagree [5 scale]
Protection Satisfaction	I am satisfied with the protections provided in this survey.	Strongly Agree – Strongly Disagree [5 scale]
Harm Perception	I am concerned that my responses in this survey could be used to harm me.	Strongly Agree – Strongly Disagree [5 scale]

The scale for the following questions ranged from never to many times, with an additional option I prefer not to say.

Table C3. Actual Questions	
Description	Study
Have you ever downloaded a pirated song from the internet?	A
While in a relationship, have you ever flirted with somebody other than your partner?	A
Have you ever masturbated at work or in a public restroom?	A
Have you ever fantasized about having violent nonconsensual sex with someone?	A
Have you ever tried to gain access to someone else's (e.g., a partner, friend, or colleague's) email account?	A
Have you ever looked at pornographic material?	A
Have you ever used drugs of any kind (e.g., weed, heroin, crack)?	B
Have you ever let a friend drive after you thought he or she had had too much to drink?	B
Have you ever made up a serious excuse, such as grave illness or death in the family, to get out of doing something?	B
Have you ever had sex in a public venue (e.g., restroom of a club, airplane)?	B
Have you ever, while an adult, had sexual desires for a minor?	B
Have you ever had a fantasy of doing something terrible (e.g., torture) to someone?	B

Table C4. Exit questions	
Description	Response scale
The confidentiality protections in this study [were the same as, increased relative to, decreased relative to] the confidentiality protections in the prior study.	[Strongly Agree – Strongly Disagree] [5 scale]
As part of this hit, you participated in:	[One Study, Two Separate Studies, Three Separate Studies]
What are the differences between the first and second study?	[No Difference, Different Questions, Different Confidentiality Protections, Different Purpose]

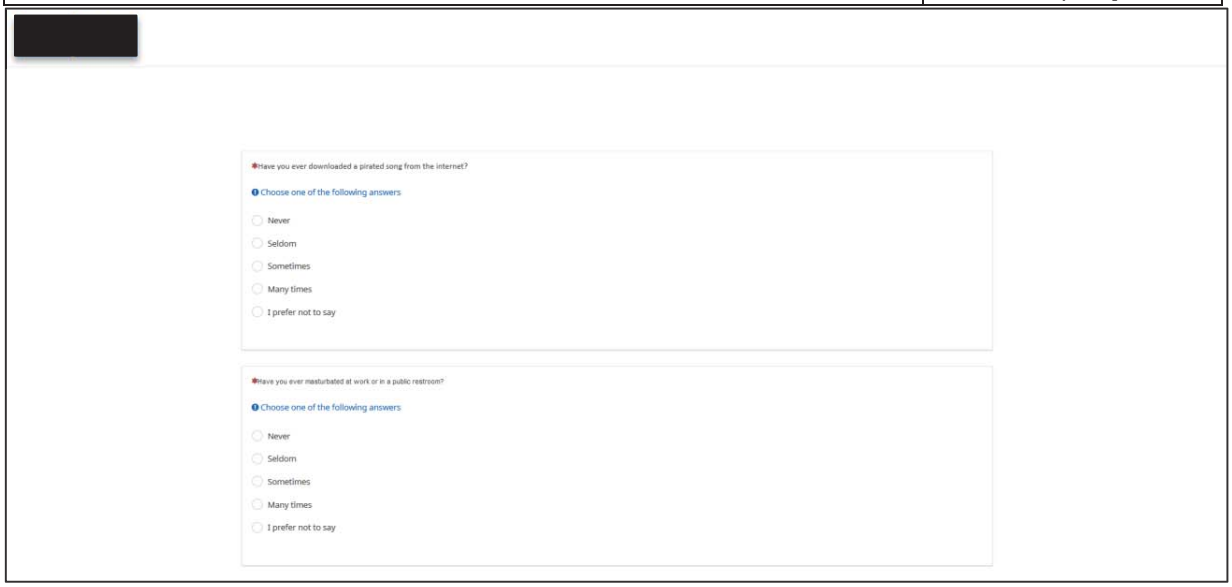

Figure C1. Design of Survey A

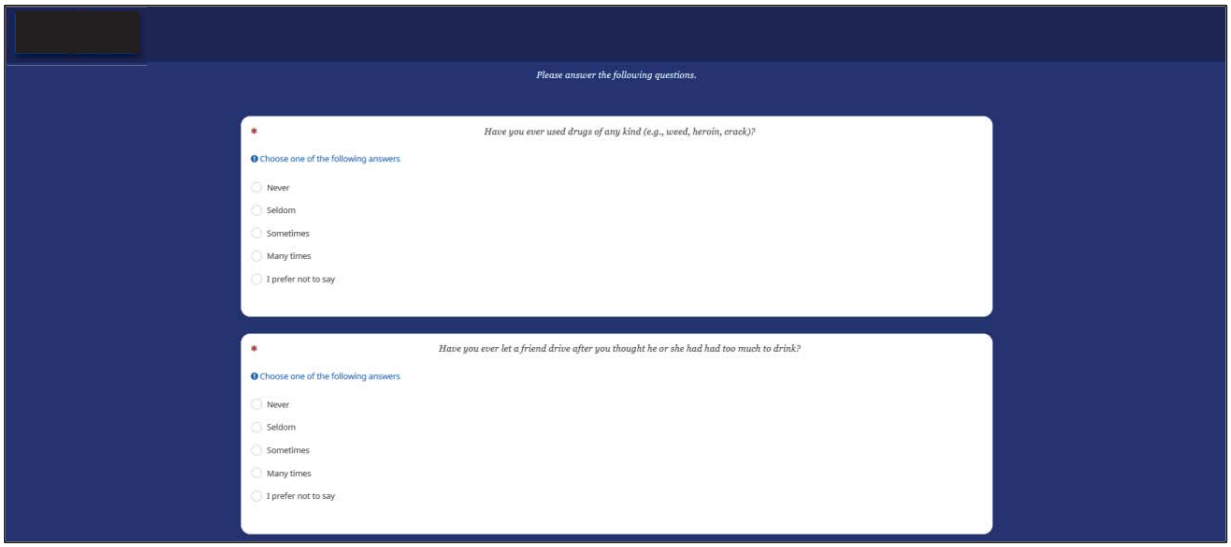

Figure C2. Design of Survey B

Appendix D: Experiment 3

Actual response scale: Never - many times, additional option: I prefer not to say
Hypothetical response scale: [Definitely no - Definitely yes], 5 points

Table D1. Actual and hypothetical questions
Description
Have you ever downloaded a pirated song from the internet?
While in a relationship, have you ever flirted with somebody other than your partner?
Have you ever looked at pornographic material?
Have you ever used drugs of any kind (e.g., weed, heroin, crack)?
Have you ever made up a serious excuse, such as grave illness or death in the family, to get out of doing something?

Appendix E: Generalizability of results

As there was no identifier for students vs. their referrals, we approximated the status of participants by splitting them in two groups at various split points by their age. Table E1 reports the disclosure of the two groups including results from t-tests for all three experiments for all of these split points.

Table E2. Disclosure of younger and older participants

	Mean of the group: younger/equal	Mean of the group: older	DF	t	p
Experiment 1 with split at age=23, Survey 1	3.087	3.040	232.708	-0.390	0.697
Experiment 1 with split at age=25, Survey 1	3.137	2.881	133.972	-2.037	**0.044**
Experiment 1 with split at age=27, Survey 1	3.124	2.772	60.759	-2.397	**0.020**
Experiment 1 with split at age=23, Survey 2	2.981	2.854	229.349	-0.978	0.329
Experiment 1 with split at age=25, Survey 2	2.976	2.775	120.233	-1.401	0.164
Experiment 1 with split at age=27, Survey 2	2.986	2.590	55.531	-2.293	**0.026**
Experiment 2 with split at age=23, Survey 1	2.669	2.530	361.574	-2.009	**0.045**
Experiment 2 with split at age=25, Survey 1	2.634	2.538	152.856	-1.144	0.254
Experiment 2 with split at age=27, Survey 1	2.643	2.423	76.338	-2.087	**0.040**
Experiment 2 with split at age=23, Survey 2	2.417	2.249	345.792	-2.683	**0.008**
Experiment 2 with split at age=25, Survey 2	2.351	2.332	148.729	-0.252	0.801
Experiment 2 with split at age=27, Survey 2	2.354	2.301	72.758	-0.519	0.606
Experiment 3 with split at age=23	2.208	2.111	680.658	-1.656	0.098
Experiment 3 with split at age=25	2.218	2.025	378.169	-3.023	**0.003**
Experiment 3 with split at age=27	2.227	1.910	227.395	-4.515	**0.000**

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Breeding Grounds of Digital Platforms (P5)

BREEDING GROUNDS OF DIGITAL PLATFORMS: EXPLORING THE SOURCES OF AMERICAN PLATFORM DOMINATION, CHINA'S PLATFORM SELF-SUFFICIENCY, AND EUROPE'S PLATFORM GAP

Research paper

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Abstract

EU firms are largely dominated by American platforms in online consumer-facing markets as well as cloud computing services and are likely to face domination in further markets. In contrast, China has mainly escaped American domination and established a self-sufficient platform economy. This situation provides the opportunity to move beyond research on firm-level strategies of platform competitiveness and to assess national factors that foster the emergence and growth of digital platforms. Understanding different platform breeding grounds is essential to guide EU regulators toward a self-sufficient European platform economy and to help them protect EU firms from the risk of exploitation by dominant platforms. These insights are also important to develop a theory of platform regulation, especially as dominant platforms violate EU laws. To address this gap, this study builds upon 32 expert interviews across 7 EU countries and 19 industries. Our results indicate that in general, a fragmented market, risk-aversion, lack of local clusters, and lack of funding and, more specifically, late entrance, legacy systems, and historic dependence have led to the EU's platform gap. We discuss why and how EU regulators should intervene and propose a regulatory strategy that establishes a self-sufficient EU platform economy.

Keywords: Digital platforms, platform dominance, platform regulation, platform breeding grounds

1 Introduction

In recent years, the number and size of companies that draw upon digital platforms (Hein et al., 2019a) have increased substantially (Evans and Gawer, 2016). Their emergence has transformed the way people communicate (e.g. Facebook and WeChat), search for information (e.g. Google and Baidu), pay online (e.g. PayPal and Apple Pay), and utilize services (e.g. Spotify and DiDi). Digital platforms have also transformed the way organizations distribute products (e.g. Amazon and Alibaba), find human capital (e.g. UpWork), and store data (e.g. Microsoft and Google). American online platforms such as Google Search, Apple iOS, Facebook, Microsoft Azure or Amazon's Marketplace are becoming in-

creasingly important forms of infrastructure in the EU. They are not only critical to entire industries and societies, but they are also too expensive to replicate and may be inappropriate for competition due to the loss of value created by network effects. However, while EU firms are largely dominated by American platforms in online consumer-facing markets as well as cloud computing services and are likely to face domination in further markets, China has mainly escaped American domination and establish a self-sufficient platform economy (Evans and Gawer, 2016).

Digital platforms can outcompete traditional firms (Tiwana, 2013, Parker et al., 2017), are increasingly evolving into important forms of infrastructure (e.g. Facebook in elections, Google in consumer access, and Amazon in cloud services), and may abuse their power. Therefore, it is crucial for the EU to become a dominant host of digital platforms to remain competitive and sovereign in the emerging platform economy (Parker et al., 2016). Besides providing a fertile environment for digital platforms, it is also essential for the EU to build own critical platform infrastructure as illustrated by the EU Commission (2020): *"EU-based cloud providers have only a small share of the cloud market, which makes the EU highly dependent on external providers, vulnerable to external data threats and subject to a loss of investment potential for the European digital industry in the data processing market. Service providers operating in the EU may also be subject to legislation of third countries, which presents the risk that data of EU citizens and businesses are accessed by third country jurisdictions that are in contradiction with the EU's data protection framework."* Hence, from an EU perspective, it is important to move beyond niches as they do not protect firms from the risk of exploitation by dominant platforms and their ecosystem.

To establish platform competitiveness, the EU has begun to explore different strategies. These include fighting the abuse of power by American platforms (European Commission, 2019b, European Commission, 2017, European Commission, 2018, European Commission, 2019a), supporting European platform consortia (e.g. the European Mobile Payment Systems Association), passing the General Data Protection Regulation, or initiating the new Payment Service Directive. However, to the best of our knowledge, it remains unclear *which national factors led to American platform domination, China's platform self-sufficiency, and Europe's platform gap in the first place and which strategies might help the EU to develop its own platform infrastructure*. These insights are essential for understanding the breeding grounds on which digital platforms do and do not flourish. They enable us to assess the role of national environments in the competitive positions of digital platforms (Porter, 1990). Without this understanding, the EU will not be able to provide a fruitful environment to foster the emergence and growth of digital platforms. This empirical setting is particularly helpful to advance platform theory. To the best of our knowledge, the literature on digital platform leadership takes the firm as level of analysis and focuses on which problems to solve to launch and scale platforms (e.g. Caillaud and Jullien, 2003, Evans and Schmalensee, 2010, Parker et al., 2016, Tiwana, 2013) and how to improve the competitive position of platforms (e.g. Cusumano and Gawer, 2002, Hein et al., 2019b, Cennamo, 2019). However, the literature neglects the national breeding grounds that have led to the creation of digital platforms in the first place. The existing research stream further neglects to consider the perspective of "the dominated" and how dominated countries need to strategize to develop their own platform infrastructure. Related research streams such as technology management and its logic of dominant designs (Suarez et al., 2015, Suarez and Utterback, 1995), institutional entrepreneurship (Garud et al., 2002, Wade, 1995), and industrial economics (Katz and Shapiro, 1994, Rochet and Tirole, 2003) also do not address these issues. We, therefore, draw upon prior work in the domains of nations' competitive advantage (Porter, 1990, Porter, 1998), internationalization (Rothaermel et al., 2006) and national innovation systems (Mowery, 1992, Nelson, 1993).

In this paper, we aim to understand the breeding grounds for digital platform by identifying which national factors led to American platform domination, China's platform self-sufficiency, and Europe's platform gap based on 32 expert interviews across 7 EU nations and 19 industries. We explored executives' beliefs about how American platforms came to dominate the European online platform infrastructure to understand what American strengths and European weaknesses may have been. We also explored their beliefs about how China has escaped American dominance and successfully warded off

their envelopment practices. We explored Chinese exceptionalism to investigate lessons that may be relevant to the EU. This study extends our prior study (Clemons et al., 2019) by providing further empirical evidence, new insights about China, and a possible strategy for the EU to develop its own platform infrastructure. The remainder of this paper is structured as follows: first, we outline our theoretical lens and synthesize prior work on American platform domination and China's platform self-sufficiency; second, we describe our methodology of interview-based field research; third, we present the national factors that our interview subjects believe led to the emergence of American and Chinese platforms and the platform gap in the EU; and finally, we explore regulatory policies that might enable companies in the EU to establish competitive platforms as part of a self-sufficient platform economy at the EU level.

2 Theoretical Lens and Related Work

The Competitive Advantage of Nations. Our study draws on the work of Porter (1990) and Porter (1998) to conceptualize breeding grounds of digital platforms to systematically analyze their role for the emergence and performance of digital platforms. Porter (1990) outlined how national environments influence the way industries compete in a global context and thereby identified five factors: Factor conditions (skilled labor, infrastructure, cost and quality of inputs), demand conditions (nature of the home-market), related and supporting industries (absence or presence of national supplier industries), firm strategy and rivalry (nature and intensity of local competition), and the role of government as catalyst and challenger. In his later work, Porter (1998) focused on the role of clusters (geographic concentration of agents in a specific field) for production, innovation, and new business formation. He also emphasized local knowledge, trust relationships and culture as basis for competition (Porter, 1998). Taken together, we propose that breeding grounds of digital platforms comprise seven national/regional attributes: factor conditions, demand conditions, related and supporting industries, firm strategy and rivalry, government agencies, culture and institutions, and local clusters. These attributes determine the emergence and performance of digital platforms within a nation/region as well as their international performance in foreign markets.

American Platform Dominance. Online consumer-facing markets are largely dominated by American platform operators (Evans and Gawer, 2016). For example, Google dominates online search (Vynck and Roache, 2019, Statista, 2019b), digital advertisement (Enberg, 2019), and mobile operating systems (Khan, 2018) whereas Facebook dominates social networks (Statista, 2019a, StatCounter, 2019) and digital advertisement (Enberg, 2019). Amazon has achieved a dominant position in online shopping (Koch, 2019, Lipsman, 2019) and is continuously expanding into new domains such as smart home and voice-based shopping. Additionally, the market of cloud services is dominated by a small number of American platform operators including Microsoft, Apple, Google, Amazon, and Salesforce (Gartner, 2019, Riasanow et al., 2020).

Previous work on the national factors that led to the emergence of dominant American platforms highlighted multiple aspects. The work of Porter (1990) on the competitive advantage of nations indicates that the availability of **private risk capital** and equity funding and the presence of a **strong local rivalry** were critical factors for the uptake of the American computer and software industry. In addition, the work of Mowery (1992)—who investigated the U.S. national innovation system—outlined the **procurement activities of the US military** in the 1950s/1960s. This was a crucial driver of the growth of start-ups and technological spill-overs in microelectronics and computers. In contrast, the military procurement activity of European governments benefited established firms in traditional markets. Mowery (1992) also argued that **antitrust policies** during that time inhibited incumbents such as AT&T from entering the commercial production of microelectronics. This allowed new firms to commercialize new computer and semiconductor technologies. While these factors led to the establishment of new software and computer firms, cultural, and risk-related factors led to the successful market entry in the EU. Rothaermel et al. (2006) showed that 445 American internet firms had already entered the European market in 2001. Their results indicated that the market entry decision was based on **low**

political and economic risks in the EU, as well as on **low cultural distance** (Hofstede, 1984), which reduces uncertainty and the cost of conducting business

In addition to reviewing the American breeding ground, we also needed to illustrate how dominant American platforms sustain and extend their domination in the EU. That is, the dynamics in platform competition may create conditions under which the sheer provision of the right breeding ground might not be enough to foster the development of their own platforms. In other words, current platform practices indicate that breeding grounds may only be effective in combination with platform regulation. Table 1 illustrates the practices used by American platforms to sustain and extend their dominance.

Table 1: Examples of practices used by American platforms to sustain and extent dominance

Mechanism	Examples
Tying	Google ties additional services to search results and places them in highlighted positions (European Commission, 2017, Iacobucci and Ducci, 2019, Edelman and Geradin, 2016). Google grants these services free traffic and therefore reduces their start hurdles (Edelman, 2015).
Bundling	Microsoft bundled its operating system with a media player (Amelio and Jullien, 2012) and its browser (Clemons and Madhani, 2010). Google used its Mobile Application Distribution Agreement to force manufacturers to pre-install Search and Chrome (European Commission, 2018).
Vertical integration& self-preferencing	Amazon is currently under investigation for using third-party data to provide high-selling products on its own, enveloping their merchants (European Commission, 2019b). Similarly, Apple is under investigation for abusing its power of the AppStore to envelop Spotify (European Parliament, 2019).
Predatory pricing	Uber was sued for setting illegal predatory prices with the intention of eliminating actual and potential ridesharing competitors (Bamberger and Lobel, 2018, Khan, 2016).
Limiting interoperability	Apple broke compatibility with RealNetworks converter by upgrading iTunes to prevent Real's music store from working on iPods (Gawer, 2011). Apple is also under investigation for denying access to its NFC chip for mobile payment (CPI, 2019).
Privacy violation	Google and YouTube violated children's privacy (FTC, 2019). Google has been illegally bypassing privacy settings on Apple iPhones to assign people to categories for advertisers (Pettit, 2019).
Illegal revenue sources in the EU	Facebook generates revenues from the support of fake news and election manipulation (Clemons, 2018).
Network effects & installed user base	Same side network effects as in the cases of Facebook or Google Search (Parker et al., 2016, Orlikowski, 2007) create exponential value to users and increases their switching costs (Evans and Schmalensee, 2008). Indirect network effects occur when advertisers become increasingly attracted to Google Search the larger its installed user base gets (Gawer and Cusumano, 2014).

Platform markets are prone to tip toward a winner-takes-all or a winner-takes-most market outcome (Cusumano et al., 2019) and to create super-additive value (Schreieck et al., 2019, Jacobides et al., 2018). This allows users to derive additional value through the interactions of their applications (e.g., the value of Android plus YouTube plus Google Maps plus Search is greater than the sum of their values as standalone offerings.) These interactions not only enhance value for users but enable the collection of vast amounts of data, which provides the advantage of using data across business lines to improve platform competitiveness (Khan, 2016, van Dijck et al., 2019). This may affect new entry because new companies do not enjoy the positive feedback loops of multiple, interacting applications. Hence, when firms compete for network effects and platform envelopment it may inhibit new firms to enter markets and to erode the advantages of dominant platforms. Therefore, technological discontinuities may not be an effective market mechanism to level the playing field (Suarez, 2004).

China's Platform Self-sufficiency. In contrast to the EU, China's firms are not dominated by American platforms. China has its own online market place (Alibaba), its own messaging and social network (WeChat and its mini programs (Cheng et al., 2020)), its own search engine (Baidu), its own ride sharing (DiDi), its own ecommerce (Taobao) (Clemons et al., 2012) and its own cloud (Alibaba and Tencent) (Wang and Rhen, 2012, Cusumano et al., 2019, Jia et al., 2018). Previous work on the national factors that led to the emergence of self-sufficient Chinese platforms investigated how foreign firms fail to cope with national factors during market entry and less on how national factors contributed to the success of Chinese platforms (Li, 2019). However, one significant factor that contributed to China's success is **government censorship**. The government blocks website content and monitors indi-

viduals' internet access and has blocked international rivals from its market (Wang and Rhen, 2012, Zeng and Glaister, 2016).

On the other hand, the literature mentions multiple aspects of why early movers in software and platform-based business models failed to cope with China's environment. First, there were **informal constraints** such as cultural distance and diverging norms (Zeng and Glaister, 2016). Second, new entrants largely ignored **subnational differences** within China, which hampered being able to achieve a critical mass of users (Zeng and Glaister, 2016). Third, **western business models** have not been modified to the Chinese market (Yang, 2019, Wang and Rhen, 2012); rather, they managed customer expectations and exploited existing practices. Fourth, foreign firms underestimated the **extreme competition** that emerged during China's late entrance (Li, 2019). Fifth, there were **problems with local partners**. On one side, closed networks with only direct partners isolated new entrants from the local market, creating a barrier for innovation (Zeng and Glaister, 2016). On the other side, foreign firms were concerned about sharing their intellectual property with Chinese partners, which impeded the creation of a domestic network in the first place (Froese et al., 2019). Sixth, **attracting and retaining talented labour** has been a major problem for foreign firms (Froese et al., 2019). Finally, foreign firms have been unable to manage **China's regulatory environment**, which changes quickly, is less transparent, and preferentially supports domestic firms (Froese et al., 2019, Li, 2019).

3 Research Design

Our exploratory and explanatory research questions resulted in a research design that combined a set of semantically rich case studies (Yin, 2017, Eisenhardt, 1989) with a partial portfolio approach to the grounded theory methodology (Strauss and Corbin, 1990, Fendt and Sachs, 2008). We, therefore, take an interpretivist stance (Conboy et al., 2012) to discover new content and fresh perspectives instead of testing theory (Locke, 2011). This seemed appropriate given the lack of theory about the national factors influencing American platform domination, Chinese platform self-sufficiency, and the European platform gap. We further argued that different interviewees were likely to perceive different factors as having different relevance, which made an iterative interplay of data collection and analysis therefore suitable. Moreover, the theory gap we identified is worth researching with an explorative, inductive approach. Due to the heterogeneousness and youth of platform theories, developing a theoretical framework and formulating hypotheses upfront was hardly feasible (Urquhart et al., 2010).

Expert Selection and Data Collection. The selection of experts represented an essential decision because their explanation of the phenomenon constitutes the subject of this study (Miles et al., 1994). We relied on different criteria to select the experts and to determine a suitable sample. We focused on experts at the executive level. If none were available, we shifted to middle management. All executives worked for European companies headquartered in the EU and had previous experience with platform domination. Hence, interviewees had experience in building platforms and/or defending against platform leaders. Multiple European nations were required in the final sample to derive generalizable conclusions, and various industries were included to control for industry specifics.

We conducted semi-structured interviews with these experts following the guidelines of Gläser and Laudel (2009). To embrace the depth and richness of the data, we construct the interviews following the exploratory stance of the grounded theory methodology (Strauss and Corbin, 1990). Hence, we iteratively revised our interview guidelines based on the insights of interviews that we had already conducted. For example, we decided to explore Chinese platform self-sufficiency in batch 4 after the data suggested that this phenomenon provides additional lessons for EU firms and EU regulators (Table 1). We also chose subsequent interview partners based on the saturation of our constructs from the data that we had already collected. For example, we continuously explored new industries and countries and, we also shifted toward interviewing consultants, academic experts, and regulatory employees that were experienced in digital platforms. We ended the interviews once new insights stopped emerging. In total, 32 interviews were conducted between May 2018 and September 2019 (Table 1). The interviews were conducted in seven European countries and include 19 different industries.

Table 2: Overview of the interviewees

ID	Batch	Industry	HQ[1]	Market	Size[2]	Position[3]	Duration	Documentation
26	1	Electronic engineering	Germany	B2B	Large	CIO*	around 1h	Verbatim
27	1	Insurance	Germany	B2C	Large	Group IT Governance	around 1h	Verbatim
28	1	Mobility Research	Germany	non-profit	Small	Institute chief*	around 1h	Verbatim
29	1	Telecommunication	Germany	B2C	Large	Senior Project Field Manager*	around 1h	Verbatim
30	1	Open Source Community	Germany	non-profit	Large	Division Manager Public Affairs	around 1h	Verbatim
31	1	Enterprise Software	Germany	B2B	Large	Cloud Manager*	around 1h	Verbatim
21	2	Manufacturing	Denmark	B2B	Large	CIO*	01:10:33	Transcript
22	2	Food and Beverage	Denmark	B2B	Large	Senior VP of IT*	01:02:33	Transcript
23	2	Medical Equipment	Denmark	B2B	Large	VP of Corporate IT	01:00:57	Transcript
24	2	News Publishing	Denmark	B2B/B2C	Medium	CIO*	00:57:41	Transcript
32	2	Academia	Denmark	non-profit	Medium	Professor	around 1h	Verbatim
16	3	Telecommunication	France	B2B/B2C	Large	Senior Manager for Strategic Partnerships	around 1h	Verbatim
17	3	Banking / Finance	France	B2B/B2C	Large	CIO*	around 1h	Verbatim
18	3	Broadcasting	France	B2B	Large	CIO*	around 1h	Verbatim
19	3	Aerospace	France	B2B	Large	Head of Data Governance*	around 1h	Verbatim
20	3	Ophthalmic Optics	France	B2C	Large	CIO*	around 1h	Verbatim
1	4	Fashion and Media	Germany	B2C	Small	CEO*	00:46:31	Transcript
2	4	Digital Consultancy	France	B2B	Large	Client Service Director	00:51:29	Transcript
3	4	Strategic Communications	Austria	B2B	Small	CEO	00:44:36	Transcript
4	4	Distributor of Steel and Metal Products	Germany	B2B	Large	Head of Corporate Office*	00:45:12	Transcript
5	4	Messenger Application	Germany	B2B	Small	CEO*	00:55:30	Transcript
6	4	Graduate Recruiting	France	B2C	Medium	Team Manager DACH*	00:37:13	Transcript
7	4	Sales Automation	United Kingdom	B2B	Small	CEO*	00:30:07	Transcript
8	4	Platform Advisory	Netherlands	B2B	Large	Senior Manager*	00:47:19	Transcript
9	4	Management & Strategy Consultancy	Germany	B2B	Small	CEO*	00:53:52	Transcript
10	4	Mechanical Engineering	Germany	B2B	Medium	Head of Performance Marketing	00:57:54	Transcript
11	4	Strategic and Technical Consultancy	United Kingdom	B2B	Small	Principal Consultant*	00:58:17	Transcript
12	4	Advice Community	Germany	B2C	Small	COO*	00:56:29	Transcript
13	4	Digital Service Provider, Technology Consultancy	Germany	B2B	Small	CEO	00:55:14	Transcript
14	4	Financial Software	France	B2B	Medium	General Manager DACH and CEE*	00:36:49	Transcript
15	4	Car Manufacturer	Germany	B2C	Large	Developer Infotainment Systems*	00:33:32	Transcript
25	4	Regulator	Belgium	non-profit	Large	Policy Officer - Lawyer	00:36:04	Transcript

[1] HQ = Headquarter; [2] Number of Employees: small = 0 – 99; medium = 100 – 999; large = 1000+, [3] * = first-hand experience with platform domination

The interviews lasted around 1 hour on average. The interview questions covered the general background of the company, the sources within the US that lead to American domination, the sources within each country and Europe more broadly that lead to American domination and European failure, Chinese sources of platform self-sufficiency, and strategies for the EU to bridge the platform gap. To

prevent capturing stereotypes and generalization, interviewees were asked to provide specific examples. We tried to verify claims by reviewing press articles and literature. Discussed platform companies included Google, Amazon, Facebook, Uber, Airbnb, Microsoft, Apple, Baidu, Tencent, TripAdvisor, Alibaba, Twitter, SAP, Dropbox, Bosh, IBM, Slack, Spotify, and Netflix.

Coding Process. Based on our interpretivist stance, the data analysis follows open, axial and selective coding as proposed by Strauss and Corbin (1990). We started with open coding and created 210 open codes associated with the sources of American platform domination, China's platform self-sufficiency, and Europe's platform gap.

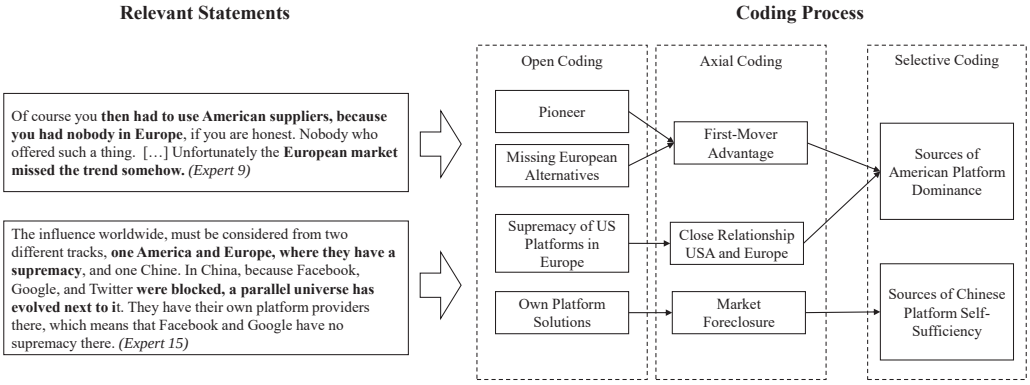

Figure 1: Illustration of the coding scheme

In axial coding, we identified 10 main categories of codes that included more than 18 subcategories. Subsequently, we conducted selective coding to relate the categories to our theoretical pre-understanding. Following the principle of constant comparison (Urquhart et al., 2010), we examine additionally collected data in light of other developed codes and extant literature.

4 Results

In the introduction, we stressed the fact that national factors are crucial aspects in assessing where dominant platforms emerged. This insight resulted completely from the interviews. Interestingly, the mechanisms for sustaining dominance were not—or were only marginally—mentioned by the interviewees.

4.1 General Sources for the Emergence of Dominant American Platforms and Self-Sufficient Chinese Platforms

Entrepreneurial and Digital Mindset. As mentioned by the expert interviews, the American work attitude is characterized by a high level of risk tolerance and entrepreneurial orientation. No matter how bizarre an idea or business model might seem, Americans will take the risk and try to make it work. Failure is therefore rather understood as gaining additional experience, instead of signaling incompetence and defeat. Executives believe that besides taking high risks, American platforms have been fully committed to their work and eager to destroy competition, no matter the sacrifices. Americans did not wait until they knew something was going to be legal; they just made sure that it was not already illegal. Such a mindset constituted a general greater openness toward innovations and, thus, promoted a digital mindset. In other words, the American openness toward innovation resulted in faster adoption and spread of new technologies without much adherence to traditional values and structures.

In terms of China, executives stated that the Chinese mindset is also characterized by a great willingness to push things forward, to focus on results, and to implement things quickly. This fostered a high acceptance and fast spread of new technologies and services such as mobile payment, social media, and e-commerce. While a digital mindset is also firmly rooted in Chinese society, there are significant differences from the US concerning failure. In China, failure is more related to public disapproval than

to the process of learning. In contrast to both the United States and China, a conservative mindset prevails in Europe. This different mindset becomes particularly apparent in the perception of new opportunities because in Europe there is a tendency to focus on the downside rather than the upside, as illustrated by Interviewee 23: *"If you talk to a German, he will tell you 1,000 good reasons why you should not start your own business: Your building savings contract, your rent, and think about your pension."* Another difference is the attitude toward perfection, referring to the phenomenon of "engineering thinking." Traditionally, mechanical engineering is one of the largest industries in Europe, making Europe the largest producer and exporter of machinery worldwide (Vieweg et al., 2012). This heritage has led to a mindset that always strives for perfection and never accepts solutions that are just good enough. However, such a mindset contrasts with the process of developing modern software like platforms. It also hampers new approaches, such as the minimum viable product.

Single Market. Executives agreed that the size of the single market is a major factor in creating the right breeding ground for platforms to emerge. Interviewee 12 illustrates how scalability is limited by national borders and perceived market size: *"If we think in millions of users, then we are cool; the Americans think in tens of millions of users, and in China, they are already thinking in billions of users. Because they just have the people. The scaling there is simply amazing."* The quote highlights the importance of a large user base to facilitate the scalability of a platform and to leverage positive network effects. Otherwise, platforms might not tip toward a dominant position and establish themselves as winner-takes-all. Moreover, the American and the Chinese single market are homogenous, meaning that the languages, legislation, standards, and laws are unified. This allows platforms to easily address an extremely large potential user base without the need for regional adjustments. A large single economy, therefore, enabled platforms to create an enormous momentum, mature their technologies, and build economies of scale. As a result, American platforms were able to crush global competitors and establish a dominant position, whereas China created and sustained self-sufficient platforms. In contrast, the interviewees regarded Europe as a very fragmented market. Europe is a region with multiple languages, heterogeneous laws, differing trade and tax laws, and various national preferences. Therefore, European platforms must conduct individual rollouts for each country. This impedes their growth and speed of expansion. Furthermore, Europe lacks a unified technological ecosystem. For example, card payments are processed differently in each country. As a result, European platforms must create different nation-specific versions to adjust to local technological ecosystems. This increases cost and complexity.

State Financing. Some interviewees highlighted that the American government, more precisely the US military, was the main driver of innovation from the 1970s to the '90s, for example by laying the foundation for the internet. Even nowadays, the US government's defense- and security-focused investment firms, for example the Army Venture Capital Initiative (Army Venture Capital Initiative, 2015), are funding American technology companies that are related to a political agenda. In China, the state plays an even more important role as it substitutes conventional venture capital firms to a large extent. Hence, the government has been and continues to be a significant financier and driver of innovation. Due to the lack of democratic processes, the government can also make faster political decisions and has to cope with fewer personal rights and data protection laws. In contrast, European decision making is slow due to high bureaucracy burdens, lack of consensus on the EU level, and the limited stability of national governments. Interviewee 3 stressed this as follows: *"What annoys me is […] that we do not get those things right in Europe; it is 'too little too late' what we are doing in Europe so far. This is due to our decision-making processes and also due to our political processes."*

Local Cluster. The executives emphasized the fact that the geographic concentration of platform companies, suppliers, complementors, and venture capitalists played a key role in the successful development of digital platforms in the USA and China. Interviewee 9 described such clusters and their advantages as follows: *"On one side of the street are the platform providers and on the other side of the street are the applications providers. In other words, you try to keep the distances short and simplify the networking."* These local clusters allow digital platforms to operate more productively and to innovate continuously (e.g. by accessing information, technology, and partners). More importantly,

new platforms such as Uber or Twitter have been growing within Silicon Valley, which may have been more difficult in isolated locations. In contrast, interviewee 13 stressed that *"I can't think of a European Silicon Valley around the year 2000"* and interviewee 8 indicated that nowadays *"in Europe it's more scattered."* Thus, indicating that every nation aims to build its own hotspot instead of joining forces.

4.2 Specific Sources for the Emergence of Dominant American Platforms

First Mover Advantage. The executives agreed that American firms entered the market first and that early adoption of computer technology helped platform companies such as Apple and Microsoft. First-mover advantage allowed American platforms to create lock-in effects, achieve network effects, and economies of scale, gain a reputation among consumers and firms, and mature their technologies. This enabled them to establish high entry barriers for potential competitors and to exploit the winner-takes-all characteristics of platform ecosystems. Interviewee 9 emphasized that even nowadays American platforms keep exploiting first-mover advantages: *"Of course, you had to choose American [cloud] providers, because you had no one in Europe, I have to say quite honestly. No one has offered something like this."* Moreover, American regulations were slow to adapt to platform-based business models, which could, therefore, scale quickly and cheaply. These platforms accumulated financial and human capital, and they could then compete more easily against new entrants, which faced stricter regulations, especially in the EU.

Renowned Technical Universities. According to the interviewees, early on, the United States had renowned universities in the technical areas of computer science and information systems. As a result, *"many of the big companies in Silicon Valley, they came out of the Stanford and Berkeley University network"* (Interviewee 12), as is witnessed by the fact that Stanford alumni founded Google, Yahoo, and Cisco, for example (Lebret, 2017). The close ties between the universities and the start-ups allowed emerging platforms to quickly and continuously access talent. This head start in knowledge helped to create superior technology, which in turn created new challenges and new knowledge, triggering a positive feedback loop

Historic Partnership. American platform dominance has been encouraged by the historically strong ties between Europe and the United States. This implies that the EU had little concern about American software providers. Interviewee 23 described Europe's relationship to the United States and China as follows: *"It's being perceived that the US is our friend and the Chinese are more like, you know, the threat coming in."* Since Americans had provided technology for Europe for quite a long time, for example IBM provided espionage tools to Denmark during the Cold War, the executives emphasized that it is the norm to use American software in Europe (see also Macrakis et al., 2009). The long history of relying on American technology was also mentioned by Interviewee 24 as one reason that prevented European companies from building their own products: *"The Danes kind of gave up on building their own stuff since […], I think the last time we did something was in the 1950s."*

Access to Venture Capital. All the executives agreed that the immense scaling of American platforms was first and foremost due to high amounts of venture capital funding. These funding rounds were achieved because the American investors focused less on key performance indicators, such as profitability, but rather on the rapid growth of the platform and the potential behind the ideas such as controlling online gateways or harvesting big data. They were not as concerned about losing on many investments as they were on winning big on a few. Venture capital firms have been around longer in the United States than in Europe or China, and they have gathered more experience, established efficient investment structures, and built venture capital hotspots like Silicon Valley. Europe, however, lacks the willingness to invest in platform-based business models. Investors tend to avoid risky software-based business models that have global objectives. They prefer instead to invest in industry-specific solutions. This behavior might be attributed to the lack of successful European platforms. However, if this attitude remains, a vicious circle is created that impedes future investments.

4.3 Specific Sources for the Emergence of Self-Sufficient Chinese Platforms

Rivalry. As the interviewees stated, the mindset in China is heavily influenced by its rivalry with the United States over becoming the most powerful nation in the world. The Chinese government has realized that economic and technical domination, including in the realm of digital platforms, is a good way to increase its worldwide power and influence. This competition with the United States for global technological supremacy is an immense incentive and provides the motivation for China to catch up with American platforms and push them off the throne. Due to this rivalry, there is generally a lower willingness to use American software in China.

Market Foreclosure. The most evident reason for Chinese players to thrive in their domestic markets is outlined by Interviewee 15: *"In China, as a result of blocking Facebook, Google, and Twitter, a parallel universe has evolved alongside."* Because platform dominance is sustained by limiting access to unauthorized sources of information, a parallel universe of self-sufficient Chinese platforms has evolved: Alibaba ("China's Amazon"), Weibo ("China's Twitter"), Baidu ("China's Google"), QQ and WeChat ("China's Facebook"), and Youku Tudou ("China's YouTube"). Even though American platforms initially did not refuse to support the Chinese government's efforts strengthen local censorship and control over society, public disapproval, and political pressure caused American platforms to change their strategy. Therefore, China engaged more thoroughly in protectionism to sustain its objectives.

Greenfield Approach. While European firms faced major issues in trying to convert their existing business models into platform-based business models, China's less developed infrastructure provided the following advantage according to Interviewee 4: *"The market was simply not as mature as in Europe and the USA. Therefore, structures were not as fixed and perhaps not too rigid, instead, it was just a young market, which was completely open to incorporate the improvements associated with digitalization and platforms […]."* Hence, the greenfield approach has the major advantage of being able to fully incorporate all improvements associated with digitalization and platformization, instead of taking legacy systems and rigid structures into account. This allowed China to leap for radical innovations in contrast to most European firms, which were and are mainly restricted to incremental innovations. For example, China skipped desktop computing. Once mobile computing gained momentum, the Chinese could directly leverage this trend, which enabled China to quickly adopt new approaches to software development and user experiences, as can be seen in online finance.

5 Discussion and Conclusion - The European Path to Platform Self-Sufficiency

In this section, we first summarize the historic breeding grounds of digital platforms in the United States, China, and the EU based on the interviews and related work. We use the theoretical lens of competitive advantage of nations to systematically compare the three breeding grounds. The summary is shown in Table 3. Second, we discuss why regulatory intervention is necessary for Europe's platform self-sufficiency. Finally, we outline how regulators should intervene and propose a regulatory strategy to establish a self-sufficient platform economy at the EU level. Our recommendations are based partially on the interviews and partially on desk research because the interviewees had few suggestions for regulation and lacked economic and legal frameworks to create recommendations.

In the following section, we discuss **why regulatory intervention is necessary** for Europe's platform self-sufficiency. Regulatory intervention becomes necessary when two conditions are met. First, when technological discontinuities do not reduce entry barriers or when changes in consumer preferences do not weaken the competitive advantage of dominant firms and second when dominant firms abuse their power and engage in illegal conduct. Hence, when markets fail to remain competitive and when firms disregard laws, dominant firms can (1) easily defend their dominant position as new entry encounters high barriers to enter and high barriers to dethrone the dominant firm and (2) dominant firms can more easily enter and conquer markets of competitors as well as completely new markets. Dominant firms

thereby expand their lines of business which increases their market power and architectural control (Cennamo, 2019). We argue that both conditions are met in the European platform economy.

Table 3: Summary of the Historic Breeding Grounds of Digital Platforms

Breeding Ground	USA	China	EU
Factor condition	▪ Knowledge through skilled labor and local cluster ▪ Infrastructure through early access to computer and telecommunication technology	▪ Knowledge through local cluster and heavy investment in research and education	
Demand condition	▪ Single market ▪ Military procurement ▪ Western requirements	▪ Single market ▪ Chinese requirements	▪ Fragmented market ▪ Western requirements
Related and supporting industries	▪ Venture capital ▪ Suppliers in computer telecommunication technology		
Firm strategy and rivalry	▪ Domestic rivalry ▪ Entrepreneurial and digital mindset ▪ First mover ▪ Western business practices ▪ Superior technology	▪ Entrepreneurial and digital mindset ▪ Chinese business practices ▪ High competition ▪ Greenfield approach	▪ Engineering thinking ▪ Western business practices ▪ Low competition ▪ Legacy systems
Government	▪ Antitrust protected new entrance ▪ State financing	▪ Censorship ▪ Blocked foreign entry ▪ Support of domestic firms ▪ Changing and opaque environment ▪ State financing	▪ Benefited established firms
Local cluster	▪ Early and concentrated	▪ Late and concentrated	▪ Late, small and scattered
Culture and Institution	▪ Western culture and institutions ▪ Historic partnership with EU	▪ Chinese culture and institutions ▪ Rivalry towards the US ▪ Subnational differences	▪ Western culture and institutions ▪ Low political and economic risk ▪ Historic partnership with the US

The reason why a technological discontinuity (Suarez, 2004) may not help resides in the nature of information technology. New information-based technology such as artificial intelligence strongly builds upon large amounts of data. Such big data can easily be harvested by offering free services in exchange for personal information. The continuous increasing flow of information is then used to develop better services, which again increases the flow and scope of incoming information, generating a positive feedback loop (Zuboff, 2019, van Dijck et al., 2019). Although simplified, this model describes how American platform giants continuously develop superior technology. European firms did not engage - and are now unable to engage - in this data harvesting to the same extent as American and Chinese platforms. European firms may now be strongly limited in building up big data databases. European firms may, therefore, be hampered in their ability to exploit new technologies and to offer novel services.

At the same time, we observe that consumer preferences have not largely changed. In contrast, consumers mainly prefer convenience and targeted advertisements over privacy and security. Consumers also prefer the super-additive value creation of platform conglomerates and would lose value if they switched to less integrated platform operators. Hence, consumer willingness to prefer dominant platforms over new, small, and clean alternatives does not help new entrance. Finally, we argue that dominant platform operators are abusing their power and engage in illegal conduct to sustain and extend their dominance in Europe. Table 1 provides an overview of illegal mechanisms penalized by European regulators such as tying, bundling, vertical integration, privacy violations, and predatory pricing. Consequently, dominant platforms can harvest revenues that are not available to European firms that allow them to cross-subsidize new services and even offer them for free, foreclosing on European competition. Taking both conditions into account, we argue that regulatory intervention is necessary to create a self-sufficient platform economy in the EU.

Finally, we outline **how regulators should intervene** and propose the following regulatory strategy to establish a self-sufficient platform economy at the EU level: (1) provide a fertile breeding ground, (2) leveling the playing field and (3) cooperate and build own critical European platform infrastructure. First, the EU needs to engage in *regulatory support* by providing a fertile breeding ground to foster the emergence and growth of digital platforms. Based on the general findings from the US and China, we argue that the EU needs to provide a greater amount of finical support, either by private venture funds or state governments. Although the EU has partially resolved the critical issue of single market, it further needs to reduce the perception of risk, build digital capabilities, build European platform clusters, and foster an entrepreneurial and digital mindset.

Second, the EU needs to engage in *regulatory ban* by leveling the playing field to establish and sustain fair and transparent competition. While we have already illustrated some illegal practices that have been banned or are currently under investigation in table 1, we argue that platform regulation needs to move beyond penalizing single practices ex-post and to move towards more general frameworks that constrain platforms ex-ante. This is particularly important as banning ex-post often comes too late in the sense that dominant platforms will have already conquered a new market and new entry might have already been forced out. For example, the EU Commission forced Google to mitigate its Mobile Application and Development Agreement after Google had abused the contract to extend its dominance in web search to mobile search (European Commission, 2018). Although Google now offers European Android users to choose their default search engine when setting up their phones (Gennai, 2019), it might not restore fair competition as users might prefer the search engine with which they are most familiar with and might prefer high quality and personalized search results (technological superiority derived through prior dominance). At the same time, Google has provided financial incentives to manufacturers to circumvent the EU ruling (Amadeo, 2018). It, therefore, remains uncertain whether this ex-post regulatory ban helps European firms to develop apps for preferred locations. In contrast, constraining ex-ante provides the opportunity for setting a level playing field early on. For example, banking laws require the separation of banking and commerce (Shull 1999) and prohibit banks from entering markets other than those in the business of banking. The laws are maintained to ensure fair and efficient allocation of credit, to prevent concentration of power in the banking industry and to counteract possible anticompetitive banking practices (Khan 2016). Similar to banks, dominant platforms are prone to concentration and subject to conflicts of interests when competing with their complementors. Hence, to limit these issues, it might be worth drawing on related rulings and prohibit platforms ex-ante from vertical envelopment.

We also argue that regulators need to consider the worth of unprecedented areas for regulation, such as data monopolization, information asymmetries, and data sharing. We propose that the EU might also enforce data sharing and ban the monopolization of data. While the General Data Protection Regulation allows data portability, this may only be useful once the EU has developed American platform counterparts. Otherwise, users do not have a better alternative to port their data to. Enforcing data sharing**,** however, goes one step further, forcing platform operators to open up their database to some extent to the public. We argue that this would not impede their competitive position; in contrast, it would diminish entry barriers for new entrants and provide more opportunities for innovation and competition.

Third, the EU needs to engage in *regulatory relief* by cooperating and building critical European platform infrastructure to gain digital sovereignty. In contrast to the findings from China, however, we do not see digital sovereignty as digital protectionism. This is not a matter of excluding foreign platforms, but rather of ensuring that European alternatives exist. Building European platform infrastructure (such as operating systems, cloud services, social media, and search) is crucial because European firms will have fewer opportunities to capture new markets in the future compared to their American counterparts. Future customer-facing online applications will call for integration into existing platforms, and European solutions could be denied access or encounter limited interoperability, whereas applications developed by American platforms themselves would be preferred. The resistance of individual European firms seems therefore unlikely, for example for competing against Alexa and Siri in

new smart home or smart assistant platforms. In contrast, European incumbents are likely to join American platforms like Volvo, which has already decided to adopt Google's Assistant (Svahn et al., 2017, Volvo Cars, 2018), and Mercedes, which is working with Apple's iOS (Mercedes-Benz, 2019).

We, therefore, encourage to continue calling and supporting joint consortia as in the case of the European Processor Initiative or Gaia-X, an initiative for a European cloud. However, the support also needs to provide regulatory relief. For example, if a consortium is required to gain a critical mass of apps, the EU must ensure that if Mercedes, BMW, and Audi cooperate in Germany, and if FIAT and Volvo join, this will not be viewed as a cartel or restraint of trade. This would directly benefit companies by reducing their dependence on American platforms, reducing their strategic vulnerability, and reducing their expense. Consumers would benefit from lower prices and from greater interoperability, allowing European firms to create increasingly integrated services. Although the EU would end up with a single platform for a specific domain, instead of dozens of small specialized platforms, this would be a single viable and relevant platform that could compete effectively and globally with dominant platforms. It would increase the number of European competitors from zero to one. Regulators would need to ensure that access was fair and inexpensive for all companies, but this would increase rather than decrease the number of viable alternatives preserving competition.

6 Contribution, Limitation, and Future Research

Our study makes several **theoretical contributions** to prior work. We confirmed that American platforms gained dominance through military support, renowned technical universities, access to venture capital, first-mover effects, local clusters, and an entrepreneurial and digital mindset (Rothaermel et al., 2006, Porter, 1990, Mowery, 1992). We extended these insights by illustrating that the large size and homogeneity of the American market, as well as its historic partnership with the EU, allowed American platforms to scale their business in their home market and to leverage network effects and benevolent relationships to quickly enter the European market. We confirmed that China's platform self-sufficiency has been achieved through market foreclosure, local clusters, state financing, and its entrepreneurial and digital mindset (Li, 2019, Zeng and Glaister, 2016, Froese et al., 2019). We augmented these factors by demonstrating that the lack of legacy systems and the political and economic rivalry with the United States have been further drivers of China's self-sufficiency. Most importantly, by drawing on Porter (1990) concept of national competitive advantage, we identify the national factors that have led to the platform gap in the EU. We further contributed to the current discussion in IS research to regulate platforms (Bazarhanova et al., 2019, Hermes et al., 2019, Mantovani et al., 2019) by discussing why and how EU regulators should intervene.

Our **contribution to practice** is three-fold. First, we outlined which national factors EU regulators need to support to foster the emergence and growth of digital platforms in the EU. Second, we discussed the role of platform regulation and encouraged regulators to move beyond penalizing single practices ex-post and to move toward more general frameworks that constrain platforms ex-ante. Third, we illustrated that the EU businesses need to cooperate with each other and build an EU critical platform infrastructure. We argue that such platforms are critical to establishing digital sovereignty in the EU and that regulators need, therefore, to provide regulatory relief for extensive industry cooperation.

Our study has multiple **limitations**. First, it is of a qualitative nature; therefore, it is limited by its small sample size and its causal power. Second, we didn't reach out to American and Chinese platform operators to triangulate our results. Third, interviewer bias may be significant. We propose two avenues for **future research**: exploring the consequences of American platform domination for the EU and further analyzing the European platform gap by conducting comparative analysis about American, European, and Chinese platform equivalents like Facebook, WeChat, and SchülerVZ.

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Business Model Innovation and Stakeholder (P6)

Business Model Innovation and Stakeholder: Exploring Mechanisms and Outcomes of Value Creation and Destruction

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Abstract. Given the objective of the focal firm to generate value for stakeholders, this research aims at assessing mechanisms and outcomes for value creation and destruction between business model innovation (BMI) and stakeholders. To achieve this goal, we conduct a systematic literature review and apply grounded theory as coding scheme. Taking frequent mechanisms and outcomes into account, we construct a conceptual framework and pioneer theory building. As main result, we identify BMI creating economic return for third parties and product/service access for customers. Both outcomes are based on the mechanism of altering resources and processes. In contrast, analyzing stakeholder's main influence, we find management creating strategic orientation by providing know-how. Our research agenda emphasizes the design of BMI from an ecosystem perspective and the destructive consequences of BMI. While the ecosystem level of analysis provides new insights into the concept, investigating negative impacts contributes to a more holistic understanding of BMI.

Keywords: Business model innovation, stakeholder theory, literature review, grounded theory, theory building

1 Introduction

The concepts of business models (BMs) and, more recently, BMI have become of increasing interest for scholars in recent years [1-3]. While BMs usually relate to firm-level value creation and capture [4], BMI also scrutinizes the novelty in value proposition as well as the logical and structural reorganization of firms [5]. The present paper defines BMI as a "search for new business logics of the firm and new ways to create and capture value for its stakeholders" [6], because it emphasizes the importance of an ecosystem perspective. One of the approaches to BMI recommended by Chesbrough [7] is to orient the firm towards an open BM. The concept of openness in BMs is viewed as being both innovative and cost-effective [8], which stresses the virtue of value creation and value capture when cooperating with external stakeholders. In addition, Tankhiwale [9] identifies that pressures from external stakeholders and regulations are often the drivers of BMI. Further reasons to involve stakeholders in the innovation process stem from managing conflicting objectives between internal and

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external stakeholders [10, 11], sensing new business opportunities [1], aligning and internalizing inter-organizational cognitions [12], strengthening a focal value proposition [13], and sustaining competitive advantage and profitability. Thus, some authors suggest that the objective of the firm is to generate value in different ways for different stakeholder groups [14]. Focusing on stakeholder theory is therefore vital to understand the emergence and consequence of BMI. The stakeholder-oriented approach becomes also relevant in the age of digital transformation as organizational boundaries are dispersing and the processes of value creation and capture are evolving from bidirectional to multidirectional, from centralized to decentralized, and from closed to open. As a consequence, stakeholders can be involved by applying open innovation approaches like idea communities [15] or idea competitions [16], but also through merger and acquisitions, joint development agreements, or inter-organizational negotiations [12]. To date, limited attention has been given to the reciprocal relationship between BMI and stakeholders despite the acknowledged influence stakeholders can exert on an organization's BM [9] and despite the fact that firms are reacting to innovations instead of driving them [17]. More specifically, Foss and Saebi [3] as well as Aspara, Lamberg, Laukia and Tikkanen [12] identify the need to examine the initiatives exerted on BMI by stakeholders while Spieth, Schneckenberg and Ricart [1] perceive the integration of stakeholders into the BMI process requiring further investigation. However, such fundamental questions are currently not systematically outlined, addressed, and answered. We are therefore providing a starting point with the present paper, which aims to contribute to the development and refinement of BMI by using a stakeholder lens [2, 18]. We determine the need for a more comprehensive view and assessment of value creation and destruction in a focal firm's ecosystem during the BMI process. Hence, the paper investigates what outcomes of value creation and destruction occur during BMI and the intervention of specific stakeholder groups. The outcomes are analyzed from a BMI perspective on the one side and from a stakeholder perspective on the other side. In addition, we present latent mechanisms pursued by each entity to achieve either value creation or destruction. Revealing these mechanisms is particular important to better describe and explain how value was created or destroyed [19]. The purpose of this paper is therefore to review current literature on the reciprocal relationship between BMI and stakeholders, evaluate them, and outline avenues for future research. While reviewing, synthesizing, and structuring current literature, we are guided by the following three research questions:

1. *Which outcomes does BMI have for stakeholders?*
2. *Which outcomes do stakeholder interventions have for BMI?*
3. *Which mechanisms account for the outcomes?*

2 Related Work

2.1 Business Models and Business Model Innovation

Although a focus of attention, the concept of BMs is "a slippery construct to study" [6]. Several frameworks of BMs have been seen in the literature so far [20-23]. A consensus

is evolving to conceptualizing BMs as a holistic description and architecture of how value is created, delivered, and captured [24-26]. Thus, emphasizing the importance of integrating the perspective of stakeholders [27]. While interest in BMs is several decades old, the notion of BMs as distinct object of innovation was initially discussed in 2003 by Mitchell and Coles [28]. According to Zott, Amit and Massa [2], BMI can be characterized as a new dimension of innovation setting itself apart from process, product, and organizational innovation. Hence, giving rise to novel approaches for incremental or radical innovation of entire value chains, enabling competitive advantage and superior performance [29]. Due to the lack of construct clarity in BMs [30], it is not surprising that similar conclusions have been made with regard to the definition of BMI. However, various literature reviews attempt to categorize BMI research in unique streams paving the way for granular construct agreement [1, 3, 18]. For instance, Schneider and Spieth [18] present three major research streams: Prerequisites of conducting BMI, elements and processes of BMI, and results achieved through BMI. Building on these findings, Foss and Saebi [3] systematically investigate concepts, processes, outcomes, and consequences of BMI. This paper contributes not only to the research gaps of examining antecedents, outcomes, and boundary conditions of BMI as discussed by Foss and Saebi [3], but also to the effects and enablers of BMI since organizations often innovate their BMs as a reaction to changes in their environment [18].

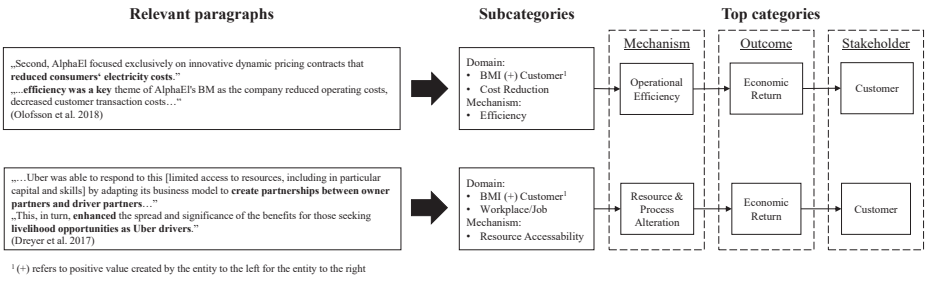
2.2 Stakeholder Theory in Business Model Research

According to Donaldson and Preston [31], stakeholder theory has turned into a major research stream in management literature. The concept is also widely recognized across different domains and becomes an increasingly important perspective for investigating BMs [32]. Freeman and Reed [33] define stakeholder as "any identifiable group or individual who can affect the achievement of an organization's objectives or who is affected by the achievement of the organization's objectives" and may be either primary (impacting the firm directly) or secondary (influencing the firm indirectly via primary stakeholders). Besides, stakeholders can be differentiated into internal and external stakeholders. While internal stakeholders include for example employees and top management teams, external stakeholders refer mainly to customers, users, suppliers, or universities [34]. Another well-established method to categorize stakeholders refers to arraying stakeholders on a power versus interest grid [35]. Freeman and Reed [33] argue that the responsibility for evaluating and mapping stakeholders lies at the top management level. Various researchers combining stakeholder theory and BMI agree on this perspective and regard the integration of stakeholders as a managerial task as well [36, 37]. Integrating customers is especially seen as a key activity for BMI. We infer from current literature that active stakeholder management is highly relevant to BMI research and that this implies developing strategies about when to integrate whom in which phase of BMI.

3 Design and Classification Paradigm of the Literature Review

Literature reviews are a well-known and rigorous approach to collect existing knowledge within an area of interest and to outline former research [38]. We found a descriptive review approach most appropriate for the present stage of this research [39]. We have therefore targeted three prominent online databases: Scopus, Web of Science, and EBSCOhost. Following the search terms of Foss and Saebi [3], we conducted title, keyword, and abstract searches across all three databases with the following query: (stakeholder OR partner* OR "Special interest groups" OR "Open Innovation") AND ("Business Model Innovation" OR "Business Model reinvention" OR "Business Model renewal" OR "Business Model dynamics" OR "Business Model transformation" OR "Business Model evolution") AND (effect* OR influenc* OR affect* OR impact*). The search identified a total of 101 articles. Following a staged selection process [40], the articles in the database were then scanned and filtered in two stages. The first stage involved removing duplicates as well as scanning titles and abstracts for apparently irrelevant articles. This stage of filtering excluded for example those articles that addressed the phenomena of new BMs instead of innovating an existing one or those articles that relied on the wording "partner" instead of describing the stakeholder they refer to in more detail. A total of 25 articles remained in the database. The second stage involved manually analyzing each article's full text and including those articles that touched on the phases and components of BMI as well as distinct stakeholder specifications and precise value creation and destruction descriptions. By the end of this stage two articles were discarded, resulting in 23 remaining articles. In addition, we conducted a backward and forward search as recommended by Levy and Ellis [41]. We therefore reviewed all cited and citing papers of the 23 articles. We identified 10 additional articles, and therefore 33 peer-reviewed articles form the basis of the review in this paper. To systematically reveal and investigate academic insights on the reciprocal relationship of BMI and stakeholders, we developed a literature coding scheme. Figure 1 provides a small extract of the coding scheme.

Figure 1. Exemplary extract of the coding scheme



The extraction of insights was guided by the research questions raised earlier in this paper. In order to comply with our research aim, coding occurred on a textual level instead of categorizing the papers in general. Hence, an "open - axial - selective" approach informed by grounded theory [42] was adopted to identify the categories used

for literature analysis. Such conventional and explorative content analysis has been recommended as a rigorous method for reviewing literature [43] and described as less confirmative than direct or summative approaches [44]. We assigned therefore specific subcategories to relevant paragraphs of each paper and then synthesized them into more generic top categories.

4 Descriptive Analysis

The 33 articles investigated account for a total of 319 subcategories. These split into 164 subcategories for mechanisms and 155 subcategories for outcomes. While the subcategories for the mechanisms converge into 13 top categories, 11 top categories emerge for the outcomes. The general focus has been on value creation and less on value destruction as destructive mechanisms and outcomes account for merely 79 subcategories altogether. It is noteworthy that the studies of Hienerth, Keinz and Lettl [45] and Olofsson, Hoveskog and Halila [46] make up the highest numbers of subcategories. While Olofsson, Hoveskog and Halila [46] explore BMI driven by sustainability issues at a social enterprise, Hienerth, Keinz and Lettl [45] focus on the implementation process of user-centric BMs. Both articles emphasize information and communication technology (ICT) as enabler and driver for digital transformation, which can act as antecedent for BMI [3]. However, BMI does not necessitates using ICT, in contrast, changing the logic of a firm can be achieved by different means [3]. The finding of ICT as trigger for digital BMs is also highlighted by most of the remaining articles [e.g. 47]. Moreover, the topic of sustainability appears to be another important unit of analysis as it is often mentioned as goal or purpose of BMI [e.g. 48]. The vast majority of articles have been published either in the areas of technology, innovation and entrepreneurship or in business administration literature. Around one fourth of articles stem from engineering and organization studies. The remaining articles are allocated to areas of sustainability, strategy, production, finance, and marketing. Interestingly, no article originates in information systems research despite the significance given to ICT and digital transformation in context of BMI. Further characteristics about the articles considered are illustrated in table 1.

Table 1. Descriptive analysis of articles considered

Paper Type		*VHB Ranking*		*Publication Year*		*Methodology*	
Journal	30	A	1	2018	4	Theory Paper	2
Conference	3	B	14	2017	6	Single Case Study	12
		C	8	2016	4	Multiple Case Study	10
		n.a.	10	2015	5	Regression Analysis	6
				2014	5	Structural Equation Model	1
				2013	3	Mixed Methods	2
				2012	2		
				2011	1		
				2010	2		
				2007	1		

5 Towards a Conceptual Framework

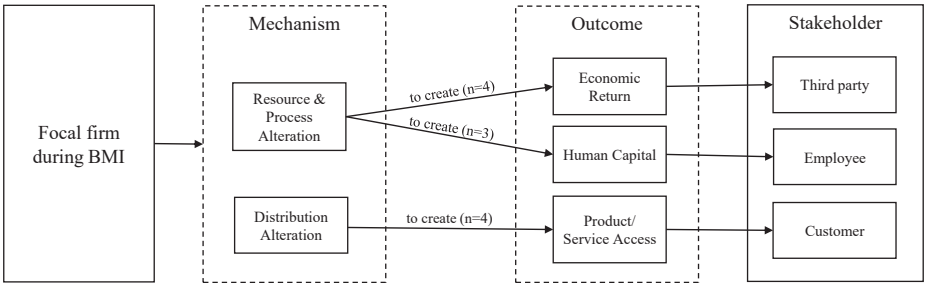
We are now aiming to conceptualize the field, which might be a first attempt towards theory building [49]. Meredith [50] calls this a philosophical conceptualization, which in this case is based on reading the papers repeatedly. Since our goal is not only to describe the phenomenon accurately (outcome) but also to explain how it occurs (mechanism) and to whom (focal firm or stakeholder), we draw on the concept of context-mechanism-outcomes (CMO) pattern configuration. According to Linsley, Howard and Owen [19], "a CMO configuration is a proposition stating what it is about an initiative that works, for whom and in what circumstances." In this paper, context refers to BMI and stakeholder intervention while mechanisms and outcomes are investigated in order to develop an in-depth understanding about the reciprocal relationship between BMI and stakeholder intervention. Thus, we extracted according configurations only if the mechanism-outcome-stakeholder configuration had been identically mentioned by at least three articles. Doing so allows rigorous conceptual deduction of the cautiously proposed framework. The mechanisms and outcomes used to develop the framework stem from the synthesized top categories. The results are depicted in figure 2 and 3 and will be further explored in the next sections.

5.1 Business Model Innovation and Value Creation

As initial step, we identify the mechanisms used and the outcomes triggered by BMI to create value for particular stakeholder groups. On the one hand, we recognize how *altering resources and processes creates economic return for third parties*. Berti and Casprini [51] for example describe how an airport's processes changed towards offering extra-aviation activities. Thus, enabling shopping malls, parking providers, and restaurants to build flourishing businesses at the airport. On the other hand, we notice that *resource and process alteration also benefits employees in form of fostering their human capital*. While Aspara, Lamberg, Laukia and Tikkanen [12] stress how Nokia's business model transformation led to the selection of business that enhanced the development of corporate human resources, Carayannis, Sindakis and Walter [48] mention that the organizational transition towards servitization encouraged employees to adopt new skills and knowledge. Next, we present our findings about the *alteration of distribution channels and its positive influence on the customer's access to products and services*. By investigating how an original equipment manufacturer innovated its BM towards becoming an own brand and product developer, Carayannis, Sindakis and Walter [48] observed an expansion of direct sales from wholesalers to single retailers. Hence, allowing additional customers in the value chain to access its products. Ghezzi, Cavallaro, Rangone and Balocco [17] find a similar effect studying BMI in the context of mobile portals and their shift to application stores. In mobile portals, the customer's access is limited to the operator's portal. The portal represents the sole interface through which end customers obtain content and service offers. By engaging in the application creation and distribution paradigm, the focal firm permits higher openness and independence to third parties, providing users broader product and service choices. Moreover, the firm integrates application developers as a new customer group and

transforms its business model into a two-sided market. Figure 2 illustrates the mechanisms used and outcomes triggered by BMI to create value for particular stakeholder groups.

Figure 2. Business model innovation and value creation for stakeholder



5.2 Stakeholder Intervention and Value Creation

This section describes how the mechanisms used and the outcomes triggered by different stakeholder groups enhance the BMI of the focal firm. First, we present our findings about the *beneficial effect of customers and users engaging in co-creation in new product or service development*. In their multiple case study, Hienerth, Keinz and Lettl [45] investigate the success factors of involving users in core business processes. Doing so, they report that the company LEGO engaged continuously with its users in co-creation resulting in the launch of the LEGO Factory platform - now called LEGO Ideas. The authors observed the same pattern at the company Coloplast, which integrates users in order to co-create new products with the development staff. Interestingly, the companies in both cases relied on IT tools to improve their co-creation processes since these IT tools facilitated large-scale user interaction and effective information collection. Accordingly, Kohler [52] delineates how various integrator platforms offer products that are co-created by the crowd ranging from t-shirts sold on Threadless to cards sold on Minted. In case of product platforms, the author identifies a similar co-creation procedure and refers to Apple's IOS and Google's Android ecosystem. Both companies allow users to develop and distribute their apps on top of their platforms. Hence, crowd members co-create new products or services with platform providers. Secondly, we discuss how *management's provision of knowledge creates organizational growth* for the focal firm during BMI. Abebe and Myint [53] identify that board members facilitate BMI adoption because they provide valuable information on changes in the external environment. Accordingly, management can positively contribute to firm performance by providing valuable and relevant external information. Similarly, Guo, Zhao and Tang [54] provide statistical support for the positive effect of top managers' human capital on BMI. More specifically, the authors show how combining top managers' managerial skills and managerial ties might enable the focal firm to capitalize on existing opportunities, whereas top managers' entrepreneurial skills can guide the focal firm to convert information and knowledge acquired through managerial ties into new business or product opportunities. Thirdly,

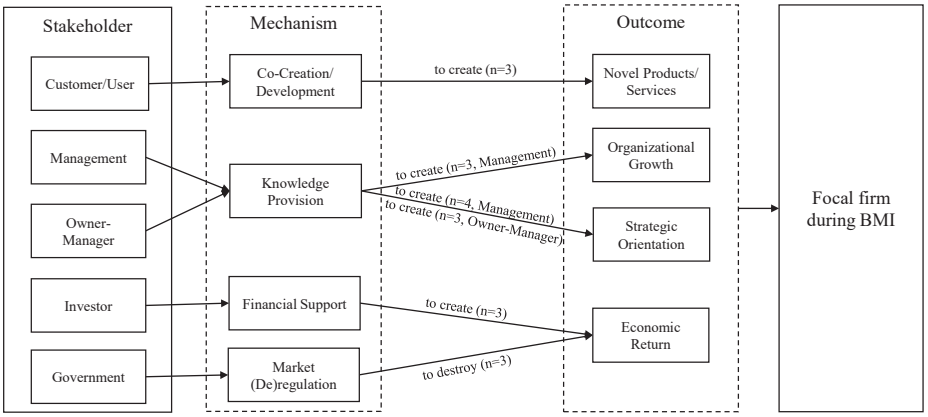
we outline our findings on the *positive influence between managers' or owner-managers' provision of knowledge and the focal firm's strategic orientation.* In addition to enhancing organizational growth, Abebe and Myint [53] also show that larger boards can positively contribute to firm strategy since their extensive knowledge improves the quality of strategic decisions. Hence, management teams provide the human capital necessary to adopt new innovations in the marketplace. By analyzing Nokia's corporate BM transformation, Aspara, Lamberg, Laukia and Tikkanen [12] describe how top managers seek to retain or renew existing BM elements. While a corporate crisis led top managers to decide on changing Nokia's BM to a new, more legitimate corporate recipe, it was top management's knowledge about strategic fit and complementarity product that enabled the firm to reformulate its strategic positioning. Regarding owner-managers, Olofsson, Hoveskog and Halila [46] state that the social vision and the business experience of the founder were especially crucial factors contributing to the success of the focal firm. For example, the founder introduced new marketing ideas like environmentally certified electricity, which attracted new customers. Interestingly, once the founder resigned, the firm experienced a strategic identity crisis to some degree. Additionally, Velu and Jacob [55] argue that entrepreneurs that are also managers comprise a more holistic understanding of the business and more comprehensive insights about internal and external environments. Therefore, owner-managers enable the systemic and strategic change that BMI demands. Finally, we elaborate how *investors create economic return by providing financial support* to the focal firm engaging in BMI. While Berti and Casprini [51] describe that investors became an important source of revenues by acquiring company equity, Olofsson, Hoveskog and Halila [46] scantily state that the investor's financial support was critical to the success of the sustainability-driven firm investigated. Moreover, Demil and Lecocq [21] elucidate how one major investment enabled an English football club to build new infrastructure and improve personnel training. These developments permitted the football club to counter negative impacts resulting from legal rulings.

5.3 Stakeholder Intervention and Value Destruction

The following section depicts how *market regulations and deregulations implemented by the government destroy economic return*. In their search of dynamic consistency during BMI, Demil and Lecocq [21] illustrate how regulation reduced revenues and deregulation increased costs. The governmental regulation was grounded in the Taylor report and forced an English football club to reduce the capacity of its stadium by almost 50 percent. As a consequence, the club was facing the prospect of regular losses by the end of the 90s. In contrast, the Bosman ruling relaxed the existing transfer system and relieved football players from their preposterous contractual status. This deregulation facilitated competition for the best players between European clubs which raised both salaries and transfer fees. Similarly, Sosna, Trevinyo-Rodríguez and Velamuri [56] report that the deregulation of the Spanish dietary products market eased the government registration of products. Hence, the focal firm had to contend for shelf space against incumbents, who competed on brand strength and product range, and against new firms competing on price. Figure 3 illustrates how the mechanisms used

and the outcomes triggered by different stakeholder groups create and destroy value for the focal firm engaging in BMI.

Figure 3. Stakeholder and value creation and destruction for the focal firm



6 Future Research

6.1 Designing Business Model Innovation from an Ecosystem Perspective

Our review revealed that all studies focused on BMI from a firm-centered, inside-out perspective, neglecting network relationships [10, 51, 57, 58]. Hence, future research can gain additional insights from applying an ecosystem perspective that goes beyond the dyadic stakeholder-firm relationship. Spanning organizational and bilateral borders does not only enhance our understanding of the consequences of BMI, but it also reveals a new context to which the purpose of BMI can be aligned to. Instead of striving to create value solely for the firm or different stakeholder groups, BMI can be designed to propose and create value for the entire ecosystem it operates in. We argue that adopting such a holistic approach alters the purpose of BMI towards more sustainable business practices. The underlying reasoning is two-folded. First, we draw on general equilibrium theory [59] and derive that value creation on the one side leads to value destruction on the other side of the ecosystem. However, as is typical for biological ecosystems, once one side of the ecosystem suffers it also affects the other side of the ecosystem. Destroying value in one part of the ecosystem will therefore sooner or later affect the firm initiating the value destruction in the first place. Secondly, we feel that the understanding of this circular independency leverages preventive activities. Thus, firms applying the ecosystem level of analysis to BMI will adopt more sustainable business practices. Theoretical contributions can be made in two ways. First, to the position-based view of the firm as the company adjusts its position in response to environmental and market forces following an outside-in perspective. Second, to the ecosystem concept as the company aligns its structure, processes, and activities towards proposal and creation of value for a multilateral set of stakeholders and ecosystem

actors [13]. Building on the above reasoning, we propose to investigate the following research questions: Who to design BMI for and for which purpose(s)? When to integrate which kind of ecosystem actor to achieve the selected purpose(s)? How to design BMI to create and maintain sustainable business practices? How to govern sustainable business practices? How to incentivize direct and indirect stakeholder to participate in sustainable business practices? Studying these questions can provide practitioners with novel concepts on how to build sustainable business growth and enhance firm survival.

6.2 Exploring Value Destruction of Business Model Innovation

In our analysis of existing literature, we identified that the concept of value destruction as a consequence of BMI is being under-researched. Current research efforts do scratch the surface of value destruction, but hardly manage to investigate it in more detail. In cases where they do explore value destruction, it is solely in terms of how stakeholders affect BMI, but not the other way around. For example, Holm, Günzel and Ulhøi [47] mention how several cases of value destruction impede BMI. The cases range from complying with third-party standards due to cooperation with sales intermediaries to competing with users due to new ICT involving users in value creation and diffusion. However, they miss to explore the underlying mechanisms and impacts more thoroughly. In contrast, research on the government as destructive trigger for BMI has been widely investigated so far. For example, Demil and Lecocq [21] illustrate how governmental regulation reduced revenues and how deregulation increased costs during the phase of BMI. We argue that the concept of value destruction provides avenues for fruitful research, especially when investigating how BMI destroys value for the actors in the ecosystem. At present, research is concentrated on only one side of the coin, value creation, but neglects to explore value destruction as the other, as important side of the coin. Engaging with the proposed concept provides additional insights on the emergence, mechanisms and consequences of value destruction. Therefore, contributing to the other, the negative side of BMI. Following this concept helps not only to understand how BMI affects primary stakeholders, but also how it impairs secondary actors in the ecosystem. We feel that negative externalities in particular provide interesting phenomena to explore in future endeavors. Therefore, we are calling for exploration of the following research questions: How do customers, suppliers, complementors, competitors etc. inhibit firms from aligning their BMI with ecological, societal, and financial goals? How and to which degree do the negative externalities of BMI affect stakeholders that are not part of the firm's direct network? Evidence and motivation for negative externalities can be observed at Uber and Airbnb [60]. At Airbnb for example, hosts do not pay lodging taxes, therefore municipalities lose tax revenues and hotels suffer from unfair competition. Moreover, landlords find their long-term tenants turning into short-term landlords, unjustly enriching themselves and skirting rent stabilization laws. Another group of indirect stakeholders, neighborhoods, claim to be overrun by visitors bringing noise, trash and traffic. In sum, the negative externalities of Airbnb can decrease the amount of housing and increase renting prices [61]. Consequently, homes for residents who work within the city, participate at votes,

build families, or simply have no other place to go, are being diminished. During the investigation of externalities, research should not only focus on case studies of constructive BMI; insights from destructive BMI can enhance the field and provide new perspectives. Patterns for the design and strategies for the governance of sustainable business development could emerge in multiple-case studies of constructive and destructive BMI and their impact on the economic ecosystem.

7 Limitation and Conclusion

Several limitations affect the results of our study. First, the literature search might not cover all relevant studies due to the choice of keywords. For example, alternative terms for the concept of stakeholder such as partner, competitor, employee, government etc. might yield further relevant articles. Second, the applied coding process simplifies the results of the studies to make them comparable. Similar subcategories were assigned to more generic top categories. In the course of this process, some insights might have been lost and may not be represented in our results. To conclude, we uncovered latent mechanisms and outcomes of value creation and destruction by applying an open, axial, and selective coding approach to synthesize implicit insights of the 33 articles identified by our keyword search. Abstracting from individual findings, we attempted to construct a conceptual framework relating prevalent mechanisms to specific outcomes and stakeholders, hence, clarifying the reciprocal relationship of BMI and stakeholders. We identified two relationships as main results on how BMI creates value for stakeholders. First, BMI creates economic returns for third parties by altering resources and processes. Second, BMI creates product/service access to customers by altering resources and processes as well. Reversing the direction of impact to stakeholders influencing BMI, the main result emerges from management creating strategic orientation for BMI by providing their knowledge. Last, we outlined potential avenues for future research. We recommend to study the design of BMI from an ecosystem perspective. The new level of analysis will provide further insights into the concept of BMs and is highly relevant in practice. Moreover, we think that future research needs to explore the destructive side of BMI. Investigating the negative consequences of BMI will contribute to a more holistic understanding of BMI. By reviewing existing literature and deriving issues for future research, our study contributes to information systems literature in several ways. First, we provide an overview on research related to the beneficial and destructive impacts between BMI and stakeholders. The overview highlights new insights that were previously incorporated implicitly in the literature. Second, we summarize mechanisms and outcomes related to value creation and destruction across all studies. In doing so, we identify and illustrate the key concepts currently being touched on by scholars in the field of BMI. Third, we expand existing theory on BMI by identifying and explaining those antecedents of BMI which Foss and Saebi [3] call stakeholder demands. Addressing their proposed gap number two, we provide insights about internal and external stakeholder demands and illustrate what Aspara, Lamberg, Laukia and Tikkanen [12] call “initiatives of other stakeholders than managers (or investors).” Moreover, we contribute to theory on outcomes of BMI by

taking an ecosystemperspective. Instead of investigating what outcomes BMI has for the focal firm, we explain what outcomes BMI has for its stakeholders. Fourth, we derive specific issues for future research that are rooted in existing research but show how our understanding of BMI and its design can be enhanced. Finally, our study is relevant for practice by laying out which impacts practitioners need to consider when engaging in BMI. The issues we identified will prove to be useful in practice and will further advance the applicability of the scientific findings during BMI.

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The Digital Transformation of the Healthcare Industry (P7)

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ORIGINAL RESEARCH

The digital transformation of the healthcare industry: exploring the rise of emerging platform ecosystems and their influence on the role of patients

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Abstract While traditional organizations create value within the boundaries of their firm or supply chain, digital platforms leverage and orchestrate a platform-mediated ecosystem to create and co-create value with a much wider array of partners and actors. Although the change to two-sided markets and their generalization to platform ecosystems have been adopted among various industries, both academic research and industry adoption have lagged behind in the healthcare industry. To the best of our knowledge current Information Systems research has not yet incorporated an interorganizational perspective of the digital transformation of healthcare. This neglects a wide range of emerging changes, including changing segmentation of industry market participants, changing patient segments, changing patient roles as decision makers, and their interaction in patient care. This study therefore investigates the digital transformation of the healthcare industry by analyzing 1830 healthcare organizations found on Crunchbase. We derived a generic value ecosystem of the digital healthcare industry and validated our findings with industry experts from the traditional and the start-up healthcare domains. The results indicate

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8 new roles within healthcare, namely: information platforms, data collection technology, market intermediaries, services for remote and on-demand healthcare, augmented and virtual reality provider, blockchain-based PHR, cloud service provider, and intelligent data analysis for healthcare provider. Our results further illustrate how these roles transform value proposition, value capture, and value delivery in the healthcare industry. We discuss competition between new entrants and incumbents and elaborate how digital health innovations contribute to the changing role of patients.

Keywords Platform ecosystem · Ecosystem analysis · Healthcare · Digital transformation · Digital health · Health information technology

1 Introduction

Health spending continues to consume large shares of public spending (OECD Stat 2020). Against the backdrop of an aging society, which further increases the burden on healthcare systems, healthcare actors are seeking solutions to both cost and quality issues. For example, Kohn et al. (2000) report that on average around 75,000 preventable deaths occur each year in the United States and that health information technology (health IT) is a promising solution to this problem. Indeed, health IT has been recognized as a driver of enhanced clinical outcomes (Garg et al. 2005) and as a cost-saving lever (Hillestad et al. 2005), yet adoption of health IT is slow (Romanow et al. 2012; Kruse et al. 2016).

Research indicates multiple reasons why key stakeholders in healthcare have been slow to adopt health IT and leverage opportunities afforded by digital transformation (DT)—defined by (Vial 2019) as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies"—despite its promise for business value (DesRoches et al. 2008; Hsia et al. 2019).

First, healthcare is a complex and pluralistic public good marked by constant interaction across a varied set of individuals and organizations (Blumenthal 2011; Hansen and Baroody 2020; Davidson et al. 2018; Ozdemir et al. 2011). The healthcare industry primarily comprises various types of patients (e.g., physical traits and medical history), professional groups (e.g., physicians, nurses, administrators, and insurers), clinical organizations (e.g., hospitals, testing laboratories, and care facilities), treatment options, healthcare delivery processes, regulators (e.g., state agencies, policy-makers and credentialing entities), non-governmental organizations, and new digital intermediary firms (Fichman et al. 2011; Agarwal et al. 2020). Due to large costs involving the treatment of illnesses, the healthcare industry has evolved into an insurance-based industry. Insurance companies thereby contract healthcare providers and cover payments for various services provided by healthcare providers to their patients. Similarly, products produced by drug and medical devices manufacturers are generally prescribed by healthcare providers and compensated by insurance companies. Insurance companies, healthcare providers, and suppliers are strictly regulated by governments (Hansen and Baroody 2020). For example, in form of the

Health Insurance Portability and Accountability Act. As a result of healthcare's complexity and regulation, health information silos emerged and interoperability of health IT between key stakeholders is lacking, which hamper efficiency, undermine coordination of care, and increase costs (Gupta and Sharda 2013; Hansen and Baroody 2020; Kellermann and Jones 2013; McClellan et al. 2013).

Second, adoption of health IT is often resisted by powerful actors in healthcare delivery (Bhattacherjee and Hikmet 2007). The resistance stems from various factors such as professional norms [physicians regard tasks aside from patient treatment as administrative nuisances (Fichman et al. 2011)], adverse influence [powerful, tech-averse physicians affect other's use of health IT (Venkatesh et al. 2011; Davidson et al. 2018)], threats to professional autonomy (physicians aim to maintain the status and refuse new technology (Walter and Lopez 2008)), and privacy concerns [due to hacked medical devices (Meskó et al. 2017) as well as absent and opaque app privacy policies (Sunyaev et al. 2015)]. Shifting towards the organizational level, Ozdemir et al. (2011) demonstrate that providers lack the incentives to implement health IT systems or share their data due to competitive concerns. Such proprietary strategizing however, not only impedes the digital transformation of healthcare, it also means that healthcare provider can't leverage the full amount of patient data available across systems (Romanow et al. 2012). Additional barriers of organizations to adopt health IT include initial and ongoing costs (DesRoches et al. 2008; Jha et al. 2009), technical support, technical concerns (Kruse et al. 2016), the loss of productivity during the transition, and concerns about future obsolescence of purchased health IT (McClellan et al. 2013). Lastly, even if organizations adopt health IT, individuals often avoid using it (Kane and Labianca 2011).

Third, patients are another significant cause why the digital transformation is slowly unfolding within healthcare. Healthcare information is highly personal (Fichman et al. 2011) and the more patients perceive medical information as sensitive the less they are willing to disclose (Malhotra et al. 2004) or to adopt new health IT (Li et al. 2016). Anderson and Agarwal (2011) further demonstrate that individuals do not trust governments and for-profit organizations with electronic health systems and that their unwillingness to disclose health information is higher when information is requested from governments. When it comes to data protection, Kellermann and Jones (2013) and Wachter (2015) argue that patients encounter insufficient access to and control over health data as witnessed by Sunyaev et al. (2015) who stress that privacy policies of mobile health apps are often absent or opaque.

Lastly, health IT itself represent a significant factor for healthcare's slow digital transformation. Kellermann and Jones (2013) and Spil and Klein (2014) for example argue that few health IT suppliers build products that are easy to use. Consequently, physicians are frustrated that health IT requires lengthy data entry and disrupts rather than assists their practice. Such systems could even seriously harm patients as observed by Han et al. (2005) who identified an unexpected increase in patient mortality with EHR system implementation. Also, the validity of health sensors, digital health devices, and smartphone applications to offer reliable and high-quality data remains unsure (Meskó et al. 2017). Plante et al. (2016) found for example inaccuracies in a popular application for measuring blood pressure.

However, recent advances in technology and policy as well as increasing amounts of health data and venture capital are rapidly changing the status quo of the digital transformation of healthcare. Significant advances in IT have been made in terms of collection, storage, processing, analysis, and distribution of data enabling new forms of healthcare. New opportunities for data collection have been provoked especially by the sophistication of mobile technologies and wearables (Oldenburg et al. 2015; Agarwal et al. 2020). Smartphones as well as wearables are equipped with plenty of sensors ranging from accelerometers and microphones to GPS sensors and gyroscopes (Sharon 2016) and enable the capture of longitudinal, real-time health information such as blood pressure, sleep pattern, and heart rate from vast amounts of people (Li et al. 2016). Advances in health platforms (e.g. Apple HealthKit or Google Fit) also allow the bundling of fitness and medical data from different sources and make these available for sharing with healthcare professionals (Sharon 2016). When it comes to advances in storage and processing, cloud computing platforms such as Amazon Web Services are largely lowering the fixed costs of setting up health analytics, and big data processing solutions like Hadopp are now mature and deployable (Agarwal et al. 2020). Advances in data analysis are particularly made in machine learning, artificial intelligence, and natural language processing (Choi et al. 2016). These groundbreaking techniques help to better understand and make novel inferences from newly generated health data such as Twitter data (Sinnenberg et al. 2017). Advances in the distribution of data are reflected by online health communities (Yan and Tan 2014; Goh et al. 2016), mobile software platforms, open data initiatives, and telemedicine. Mobile software platforms for example enable developers of mobile health apps to instantly reach billions of consumers. In 2017 there were around 325,000 health apps available on all major app store; 78,000 more than the year before (Research2Guidance 2017). Open data initiatives such as the European Open Science Cloud (EU Commission 2020) or the US HealthData Initiative (HealthData.gov 2020) are also gaining momentum and fostering the proliferation of health data. Although not directly relating to distribution of data, telemedicine represents an increasingly used technology to distribute healthcare in form of virtual patient-provider communication to patients experiencing geographical, temporal, and cultural problems to face-to-face communication (Meier et al. 2013). These major advances in IT also make new forms of healthcare possible. Virtual reality, for example, has been an effective and safe adjunctive therapy for pain management in the acute inpatient setting (Mosadeghi et al. 2016). In contrast, voice technology such as Alexa might be used to offer vetted advice to common health questions like "What are the symptoms of appendicitis?" thereby relieving healthcare providers by allowing elderly and blind patients who are unable to access the internet to receive advice for common illnesses (Downey 2019).

Next to advances in IT, policy-makers and venture capital reflect two additional factors for the rise of digital transformation within healthcare. For instance, the US introduced in 2016 a penalty, in form of reduced reimbursements, for healthcare providers if they do not comply with meaningful use requirements. These policies had significant effects. Hospitals for example, increased their use of certified EHR systems from 72% in 2011 (Henry et al. 2016) to 96% in 2017 (ONCHIT 2018). In terms of funding, statistics report that digital health funding increased from 1 billion US dollars in 2010 to 14 billion US dollars in 2019 (Mikulic 2020). Big tech firms

are especially making considerable efforts to enter healthcare through venture capital funding and acquisitions. Amazon for example invested in Grail, a cancer-detection start-up and Apple acquired Beddit, which develops sleep-monitoring software (Singer 2017).

To the best of our knowledge, most studies within the IS community exploring the digital transformation are primarily concerned with an intra-organizational perspective, such as the transformation of processes, products, and services, organizational structures, or business model (Kaltenecker et al. 2015; Hansen and Sia 2015). Current academic literature of digital transformation in healthcare also follows this trend by either exploring the digital transformation of traditional institutions (Mircea et al. 2010; Roehrs et al. 2017), health information technology (Agarwal et al. 2010), electronic health records (Kane 2015), big data (Kane 2017), mobile applications (Botha et al. 2018) or single components of the digital health industry such as mHealth (Handel 2011; Kumar et al. 2013; Luxton et al. 2011) or eHealth (Oh et al. 2005).

However, research on digital transformation should also take an inter-organizational perspective into account (Jacobides et al. 2018; Puschmann 2017), particularly since digital transformation may substantially influence inter-organizational partnerships in ecosystems when value is co-created among multiple and novel stakeholders (Sarker et al. 2012). As early as 1991, Bakos addressed the transition from linear links to two-sided markets (Bakos 1991), and Parker et al. (2016) more recently postulated a transition from simple two-sided markets to more complex platform-mediated structures. However, these transformations seem almost totally absent from the evolution of the healthcare ecosystem and marketplace (Clemons 2018).

Therefore, the present study aims to understand the digital transformation of the healthcare industry from an ecosystem rather than a firm-level perspective. Consequently, we focus on the impact of new organizations that build upon the opportunities of the digital transformation instead of exploring how the digital transformation changed the processes and structure of incumbents. Drawing upon the methodology of Gordijn and Akkermans (2001) to model and analyze ecosystems, we aggregated organizations with similar characteristics and value streams into market segments and grouped them into generic roles to answer the following research questions:

RQ1 During the digital transformation of the healthcare industry, which generic roles and value streams are adopted by emerging organizations?

RQ2 How do these emerging organizations change patient treatment and shape the role of patients?

RQ3 How can these emerging organizations compete against existing healthcare and technology incumbents?

The remainder of this paper is structured as follows: first, we analyze the underlying literature of digital platforms and ecosystem analysis; second, we describe our methodology; third, we present the generic roles and the generic value network of the digital healthcare industry; and lastly, we discuss the results and briefly present implications and future research.

2 Theoretical background

2.1 Digital platforms

In recent years, companies drawing upon platform-based business models have increased substantially in number and size (Evans and Gawer 2016). Their emergence has altered the way people interact (e.g., Facebook), search for information (e.g., Google), buy products (e.g., Amazon) and utilize services (e.g., Airbnb). By drawing upon value co-creation, ecosystem orchestration and facilitating transactions, digital platforms transform linear value chains into platform-mediated two-sided markets (de Reuver et al. 2018; Constantinides et al. 2018; Schreieck et al. 2016). We define digital platforms according to Constantinides et al. (2018) and Parker et al. (2016) "as a set of digital resources— including services and content—that enable value-creating interactions between external producers and consumers."

In contrast to traditional organizations, digital platforms do not necessarily hold physical assets or produce the final service. For example, Airbnb has little in common with hotels of linear value chains, and Apple does not actually produce every application within their AppStore. Rather, digital platforms emphasize and facilitate core interactions between communities of the platform ecosystem, comprising consumers, producers, and third party actors (Parker et al. 2016; Jacobides et al. 2018). Both examples illustrate that digital platforms set architectural and governance rules to balance platform control, engage participants, and co-create value for one another (de Reuver et al. 2018; Parker et al. 2016; Ghazawneh and Henfridsson 2013; Tiwana 2015). In many instances, platforms therefore force organizations to change the way they operate and capture value; and can severely limit their ability to add value and to reach and to serve customers (Schreieck et al. 2019; Clemons 2018).

Digital platforms create value in two fundamental ways. First, by facilitating transactions and second, by offering technological building blocks that are used by complementors to develop new products and services (Parker et al. 2016; Cennamo 2019; Evans and Gawer 2016). Platforms that facilitate transactions are referred by Evans (2012) as exchange platforms which "create value by helping two or more different types of users, who could benefit from getting together, find and interact with each other, and exchange value." Hence, these platforms intermediate dyadic relationships (Rochet and Tirole 2003; Armstrong 2006) and efficiently match buyers and sellers by reducing frictions such as search costs and information asymmetry. In contrast, platforms that offer technological building blocks, aim to orchestrate industry innovation by co-creating value with external complementors. According to Tiwana et al. (2010) these innovation platforms are defined as "the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it, and the interfaces through which they interoperate." Platform owner of innovation platforms provide software connectors called application programming interfaces and software developer kits, which allow complementary innovators to leverage digital affordances and create generativity in the platform ecosystem (Hein et al. 2019). Additionally, some

authors argue for community platforms which refer to "a passive agent that enables individuals to access messages from, and disseminates messages to, other members" (Butler et al. 2014). These platforms aim to unite various actors interested in similar content and supporting them in generating and disseminating their content among community members.

Digital platforms do not only change the nature of competition (Cennamo 2019) and strategy (Parker et al. 2016), they also affect consumers by allowing them to co-create value within the ecosystem (Hein et al. 2020). For example, digital platforms in the sharing economy can be conceptualized as evolving organizations composed of actors who collaboratively share, consume, and compete (Gerwe and Silva 2018). Thus, the roles of actors in an ecosystem are not fixed, but can evolve (Gawer 2014). An example is Airbnb, who provides a scalable integration of consumers, providers, and prosumers (Hermes et al. 2020c) into their platform-mediated ecosystem. Airbnb orchestrates these user roles by utilizing governance mechanisms such as defining the degree of openness and rating mechanisms (Tiwana et al. 2010) and incentivizes consumers to engage in the role of provider. Hence, they become prosumers (Hermes et al. 2020c).

2.2 Ecosystem analysis

In order to create value, ecosystems with actors comprising unique, super-modular/super-additive, or non-generic complementarities require a specific structure of relationships (Jacobides et al. 2018; Clemons 2018). Various methods exist to model, visualize, and analyze ecosystems, such as heuristic, conceptual, mathematical, and ontological methods, or cluster analysis (Basole et al. 2018). We focus our attention on the e3-value methodology by Gordijn and Akkermans (2001), which is a rigorous, conceptual modeling approach for ecosystem analysis and visualization (Böhm et al. 2010; Riasanow et al. 2017, 2020). Its aim is to define how economic value is created and exchanged within a network of actors. It offers a graphical approach that helps define and analyze multi-enterprise relationships by aggregating similar organizations into market segments. The main concepts of e3-value are the following (Gordijn and Akkermans 2003):

- Actors: refer to economically and often legally independent entities. They are represented by rectangles.
- Market segments: refer to a set of actors that exhibit common characteristics and that value objects equally. They are represented by three rectangles.
- Value objects: refer to objects, such as services, goods, or money, exchanged by actors. They are represented as text next to the value exchanges;
- Value ports: refer to actors signaling that they want to offer or request value objects. This concept allows the abstraction of internal processes. They are represented by triangles.
- Value interface: refer to ingoing and outgoing value offerings. Actors can have one or more value interfaces. This concept represents the mechanism of economic reciprocity. They are represented by small rectangles with rounded edges.
- Value exchange: refer to actors willing to exchange value objects. They are represented by arrows connecting two value ports.

3 Methodology

The present study was guided by the e3-value methodology proposed by Gordijn and Akkermans (2001) and Gordijn and Akkermans (2003) and built upon the work of Böhm et al. (2010), Riasanow et al. (2017), and Riasanow et al. (2020). The e3-value methodology is a rigorous modeling concept used to define and visualize how and with whom economic value is exchanged. We first conducted a literature review to identify the entities and value streams of the traditional healthcare industry. We then conducted a second literature review to identify the entities and value streams of the digital healthcare industry and then built the initial e3-value models of both industries. Thereafter, we analyzed the organizational data from the Crunchbase database of new healthcare organizations and conducted expert interviews to iteratively refine our e3-value models until all data was coded and insights from experts reached theoretical saturation. The iterative refinement process is illustrated in Fig. 1. We ended the process after three iterations.

3.1 Literature reviews

Both literature reviews were built upon the review process and categorization of concepts proposed by Webster and Watson (2002). However, our goal was to go beyond a descriptive review towards a review of understanding the digital transformation and its entities and value streams (Rowe 2014). According to Reis et al. (2018), the number of articles on digital transformation significantly increased after 2013. We therefore employ the year 2013 as proxy for the beginning of literature about digital transformation. Consequently, our first literature review ranged until 2013 to assess the market segments and value streams within the traditional healthcare industry, whereas the second literature review started in 2014 to assess new market segments and value streams within the digital healthcare industry. For the traditional health industry we used the following query to scan scientific databases: ((“Health care system” OR “health care industry” OR “health care”) AND (stakeholder OR “value network” OR “value chain)) and the following query for the digital health care industry: ((“Health care” OR healthcare) AND (digitalization OR digitization OR “digital transformation” OR “digital innovation”)) and (“Digital health” AND “innovation”). After refining the initial hits and conducting a backward and forward search, we obtained 56 articles for the traditional industry and 64 articles for the digital industry. Each article was reviewed for entities, their descriptions, and value streams. Additional information about the search process is listed in Appendix D.

3.2 Data extraction and screening

We used Crunchbase, a socially curated database of organizations, organizational members, and investors to extract organizational data to code market segments and value streams to model our ecosystems. According to Basole et al. (2018), Crunchbase data is suitable to model ecosystems due to a large number of entries.

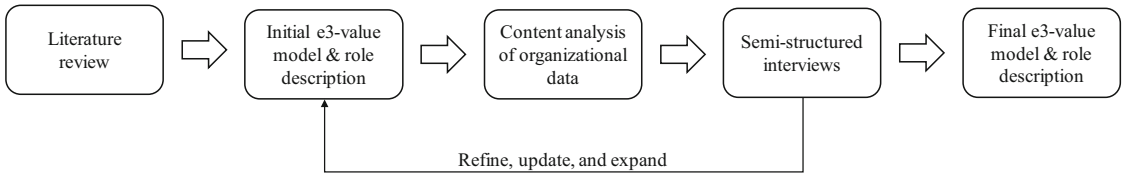

Fig. 1 Research process

Crunchbase offers a comprehensive database of incumbents and startups (Marra et al. 2015). Additionally, start-ups at all funding stages are listed in the database, which allows researchers to capture business model innovations (Marra et al. 2015; Perotti and Yu 2015). All entries on Crunchbase are verified before they are released online. Crunchbase, therefore, allows the extraction of a comprehensive overview of traditional and novel organizations related to an ecosystem and related technologies.[1] In cases where Crunchbase did not provide sufficient information, we used the organization's website, press articles, and news articles to derive the according market segment and value streams. We used the following search terms in the company description to determine the list of healthcare-related entities: mHealth, eHealth, digital health, telehealth, telemedicine, and wearables. These keywords corresponded to digital technologies or trends in the healthcare industry (Iyawa et al. 2016). This led to a list of 1987 globally emerging and established organizations within healthcare. A total of 157 companies were excluded from the coding list because they either did not demonstrate any relevance to the healthcare industry, were closed and no longer active, or referred to actors of the traditional healthcare ecosystem.

3.3 Coding of market segments and value streams

With the remaining 1830 emerging organizations, we used structured content analysis, including an inductive category development based on Mayring (2010) and Miles and Huberman (1994) to identify the market segments and value streams within the traditional and digital healthcare industry. First, one of the coders used the organizational descriptions derived from Crunchbase to develop codes for the market segments. For example, the market segment Telemedicine provider is connected to concepts such as: online service, real time, medical consultation, and asynchronous communication, see Table 1.

Next, driven by the codes and the organizational descriptions from Crunchbase, descriptions for the market segments were developed, for example see Table 2.

Afterwards, the organizational descriptions and the descriptions of the market segments were given two additional raters, who independently coded the organizations to the market segments. All raters compared and discussed their coding for calibration purposes. Our aim was to establish intercoder reliability to ensure a consistent and reliable coding of the market segments. For this purpose, we used Fleiss's Kappa as measure for the validity of the intercoder reliability. Fleiss's Kappa allows for the computation of the intercoder reliability of k raters (Fleiss

[1] For data gathering we used a Crunchbase Premium account, since the free account limits the use (and amount of) available company data.

1971) and ranges from 0 to 1, with 1 indicating an almost perfect agreement among raters. In each of the three iteration rounds, three raters independently coded a sample of 100 organizations to become familiar with the refined coding scheme. Throughout the coding, the raters discussed discrepancies to reach consensus and equal understanding for each description of the market segments. After coding the three samples, Fleiss's Kappa indicated an intercoder reliability of 0.76 in the first round, 0.81 in the second round, and 0.84 in the third round, reflecting acceptable intercoder reliability (Fleiss 1971). Therefore, we decided to have one rater code the remaining organizations. The total number of organizations for each new market segment in the digital healthcare industry is listed in Appendix C.

3.4 Visualization and validation

In the next step, we used the e3-value method to visualize the traditional and digital healthcare ecosystem based on the identified market segments and value streams. Similar market segments were grouped into generic roles. The expert interviews were conducted in Germany with healthcare experts or founders of digital health companies using a semi-structured approach (Myers and Newman 2007). The interviewees have significant experience in healthcare and digital technologies and are working either in a leading position or in information technology-related functions. Table 3 provides additional information about the interviewees. The e-3 value models and the description of the market segments were sent to the interviewees in advance. This allowed them to become familiar with the models and prepare feedback. Three of the interviews were conducted in person. The rest were conducted via online or phone conversations. Interviewee 1 and 2 were interviewed in the first iteration, interviewee 3 and 4 in the second iteration and the remaining interviewees in the third iteration. Six of the interviewees were working for companies representing the traditional healthcare industry (Interviewee 1, Interviewee 2, Interviewee 3, Interviewee 8, Interviewee 9, Interviewee 10). The rest of the interviewees were employed in companies that emerged through the digital transformation in the healthcare sector (Interviewee 4, Interviewee 5, Interviewee 6, Interviewee 7). All interviews were recorded, transcribed, and inductively coded.

4 Results

4.1 Generic roles and value streams of emerging organizations of the digital healthcare industry

The results indicate that during the digital transformation of the healthcare industry emerging organizations converted into 15 new market segments and 3 new data collection technologies. Of the 15 new market segments, 9 market segments are represented by three new generic roles, 3 market segments are extending traditional generic roles, and 3 market segments are not represented by generic roles. The results also demonstrate that organizations are not bonded to one market segment. In contrast, most organizations occupy multiple market segments. Docandu for

Table 1 Example of the coding process

Organization	Crunchbase description (extract)	Coded market segment
Zava	Zava is an online doctor service in which real GPs prescribe real medicines in real time. Zava offers trustworthy, affordable and regulated medical consultations without the need for a face-to-face visit. (…) And you don't have to see a doctor in person. (…) Simply complete a medical questionnaire, place your order and their doctors will check the treatment you've requested is suitable for you (…) Their service doesn't end when you receive your order. If you have any questions at all about your treatment or condition, you can contact one of their doctors free of charge	Telemedicine provider

Table 2 Example of the derived description of the market segment

Market segment and description	Example(s)
Telemedicine refers specifically to the use of IT for remote clinical services such as consultations, diagnosis, treatment, engagement and monitoring (HealthIT.gov 2019). Emerging organizations have been identified among remote medical consultation, patient engagement platforms, and remote monitoring	Teladoc, eVisit, Physitrack, Airstrip Technologies

Table 3 Overview of the interviews

Interview #	Duration	Interviewee's position	Domain
1	55:29	Business Development Director	Medical Device Manufacturing
2	37:59	Controlling and Business Analysis	Medical Device Manufacturing
3	28:54	Incubation Manager Healthcare	Medical Device Manufacturing
4	33:57	Co-Founder	BioMarker Collector
5	36:16	Co-Founder	Digital Insurance Company
6	34:15	Co-Founder	Administration Software
7	25:34	Founder	Data Science and Business Consulting
8	20:36	Clinical Consultant	Medical Device Manufacturing
9	54:16	Manager Digital Healthcare R&D	Medical Device Manufacturing
10	36:52	Consultant Healthcare	Business Consulting

example uses AI to estimate diseases based on symptom input, offers online medical consultations, and provides a medical record to manage personal health data. Table 4 depicts the generic roles, market segments, and descriptions of the emerging organizations. Figure 2 illustrates the value streams among them. The presentation

of the generic roles within the traditional industry and the ecosystem visualization can be found in Appendices A and B.

4.2 Value proposition transformation

We observed that the emerging organizations adopt value propositions that are significantly different from those of traditional organizations. Interviewee 4 summarized the value proposition transformation as follows:

> "There is a shift from a reactive healthcare service to a proactive one, to really try to improve and foster your health and try to get healthier, prevent getting sick, instead of trying to get healthy again when you are sick." (Interview 4)

As a result, the value proposition transforms from an acute view of healthcare, in which the hospital is the center of care, toward one in which connected and remote care is focused on prevention. Most of the new market segments in the digital healthcare industry act upon this transformation towards prevention by concentrating on self-care, preventive telemedicine, and disease prediction. Organizations focusing on self-care provide users with simple applications ranging from nutrition guides and fitness videos to intelligent applications which track activities and offer health recommendations. Organizations leveraging preventive telemedicine connect healthcare provider, relatives and patients by offering continuous and remote monitoring tools and alert systems to notify users before diseases break out. Disease prediction refers to organizations adopting novel, digital technologies such as big data, machine learning, and artificial intelligence to predict treatments, diseases and health risks. For example, the market segment of intelligent diagnostics offers healthcare provider AI-based models to detect diseases early on. The rise of these new market segments and their shift towards prevention has especially been enabled through new technologies in the domain of collecting and digitally capturing health data, improvements in methodologies for data analysis, and cloud computing.

4.3 Value capture transformation

Although these new roles might trigger additional efficiency and reduce costs of healthcare services (Bardhan and Thouin 2013), the interviewees shared a more critical perspective, especially regarding the emergence of intermediaries. Interviewee 5 illustrated the problem as follows:

> "Now more actors have to coordinate with each other, which requires more overhead. […] All this stuff is supposed to increase effectiveness, increase efficiency. But it is also increasing costs. And the question is, can we actually really pay for that?" (Interview 5)

The increased cost caused by the continuous emergence of new market segments was a major concern that was also mentioned by Interviewee 7. Both interviewees argued that new market segments increase costs by placing themselves within the existing value chains and by adding new services to the value chains. Hence, these

Table 4 Description of the new market segments and generic roles of the digital healthcare ecosystem

Generic role	Market segment	Description
Information Platforms	Online Community	Online communities promote collaboration, discussion, and distribution of information among members. They allow members to track progress with clinical scales, learn more about their condition, share information, and receive emotional support from peers (Smith and Wicks 2008; Frost and Massagli 2008). Examples: Citizen Health and PatientsLikeMe
	Online Learning Platform	Online learning platforms are used by students, patients, and healthcare provider and offer information and tools to support education delivery and management. Students take online courses to build skills and advance their medical care. Patients learn about diseases, treatments, and various forms of support. Healthcare providers share medical insights, learn about new therapies and reduce time spent on patient education. Example: Navinata Health
	Doctor Recommender/ Online Scheduler	Doctor recommenders and online schedulers allow patients to search for specialists, book online appointments, view recommendations, write comments, and ask questions (Terlutter et al. 2014). Examples: Jameda and ZocDoc
Services for Remote and On-Demand Healthcare	Telemedicine Provider	Telemedicine refers specifically to the use of IT for remote clinical services such as consultations, diagnosis, treatment, engagement, and monitoring (HealthIT.gov 2019). Emerging organizations have been identified among remote medical consultation (e.g., Teladoc, eVisit), patient engagement platforms (e.g., Physitrack, DocJournal), and remote monitoring (e.g., Airstrip Technologies)
	Biomarker Collectors	Biomarker collectors are health-testing companies that offer at-home lab testing kits. These kits allow patients to derive detailed insights about their health. For example, biomarker collectors harness DNA to yield personalized information about food sensitivity, metabolism, or important blood values. Examples: EverlyWell and myHeritage
	Simple and Intelligent Apps for Self-Care	Simple and intelligent apps for self-care refer to native as well as web applications that are used by consumers without direct involvement of healthcare providers to retrieve fitness and wellness information, self-monitor health parameters, and leverage recommendations. Hence, drawing on various functionalities to self-manage their health. For example, Headspace provides simple information about meditation, whereas FitBit uses wearables to offer activity and health tracking and Docandu leverages artificial intelligence (AI) to predict diseases

Table 4 continued

Generic role	Market segment	Description
Data Collection Technology	IoT/Wearables	Wearables are hardware devices that collect the health data of the body by behavioral sensing. They can be for personal use or for gathering data relevant for specialists by connecting to medical infrastructure, such that specialists can perform long-distance assessments (Hiremath et al. 2014)
	At Home Lab Kits	These kits allow patients to collect a sample (e.g., blood or urine) at home which they can forward to a laboratory for testing
	Mobile Devices	Mobile devices, such as smartphones, are equipped with plenty of sensors ranging from accelerometers and microphones to GPS sensors and gyroscopes (Sharon 2016) and enable the capture of longitudinal, real-time health information such as stress level, sleep pattern, and walking distance
	Blockchain-Based Personal Health Records (PHR)	Blockchain-based PHRs compose a distributed ledger of health records by providing access through smart contracts and offering tools to protect patient privacy (Roehrs et al. 2019). Blockchain-based PHR are designed to represent a single version of the truth that is digitized and validated by consensus of servers within the network. Example: proof.work
Market Intermediaries	Health eCommerce	Health eCommerce refers to digital companies that offer various healthcare-related services and products. Example: Your.MD
	ePrescription	ePrescription refers to software that electronically generates prescriptions. Its aim is to enable an error-free and understandable prescription, which is directly sent to a pharmacy from the point of care. Furthermore, it can be used by care teams to administer medicines or by pharmacies to review orders and manage the supply of medicines (Kierkegaard 2013). Example: DoseSpot
	Healthcare Planner	A healthcare planner aims to improve employees' health. Its digital solutions are sold to employers comprising personalized healthcare plans and recommendations for their employees (Baum et al. 2013). Example: Provata Health

Table 4 continued

Generic role	Market segment	Description
Data Management & Analysis for Healthcare Provider	Intelligent Population Health Management	An intelligent population health management provider builds on actionable patient data to offer predictive analytics based on AI. The predictions involve, for example, information on upcoming threats, diseases, or effects of drug use, and help in identifying risks. These types of information are used to improve both clinical and financial outcomes (Phillips USA 2019). Examples: InsightRX and cover2protect
	Intelligent Diagnostics	Intelligent diagnostics comprise healthcare-related data sets and algorithms. It offers diagnostic models based on AI and can be bought or subscribed for by a healthcare provider (Interview 7). Examples: MD.AI and Skin Analytics
	Cloud Service Provider	A cloud service provider offers software-, platform-, and infrastructure-as-a-service security services and app development (Böhm et al. 2010). Examples: MedStack and Chino.io
	Augmented and Virtual Reality Provider	Augmented or virtual reality provider use smart glasses or smartphones in combination with immersive technology to assist healthcare providers in physical, therapeutical, and emotional healthcare. Examples: FeelsGood and AppliedVR
Investors and Consultants	Incubator/Hub/ Accelerator	Incubators, hubs, and accelerators focus on supporting start-ups by offering consultations, capital, and services. Examples: CME Hub and Health Capital Helsinki

new market segments not only increase the coordination costs of traditional organizations, they are also likely to reduce the generic roles available to them.

Consequently, organizations in traditional roles are facing an increasingly complex and intertwined industry. The rising complexity leads to higher costs in terms of identifying valuable actors, coordinating an increasing number of actors, and drawing on their services. According to the interviewees, these costs will either lower the profit margins of traditional healthcare organizations or increase the prices for patients; hence, increasing the total cost of healthcare. While this reflects an interesting insight, we argue that it omits efficiencies stemming from improving early intervention and prevention. In other words, it is most unlikely that new levels of interaction and reducing illness will increase the total cost of healthcare or they would hardly be adopted. We argue that the costs of coordinating services will go up, at least initially, whereas the total cost of services delivered and the need for further care will all be reduced and the quality of care improved. More significantly, as the coordination costs of traditional organizations goes up, their roles are reduced, and their revenues are reduced as a result, improvement in patient care and in system productivity may not be reflected in higher profits for traditional participants in the healthcare industry.

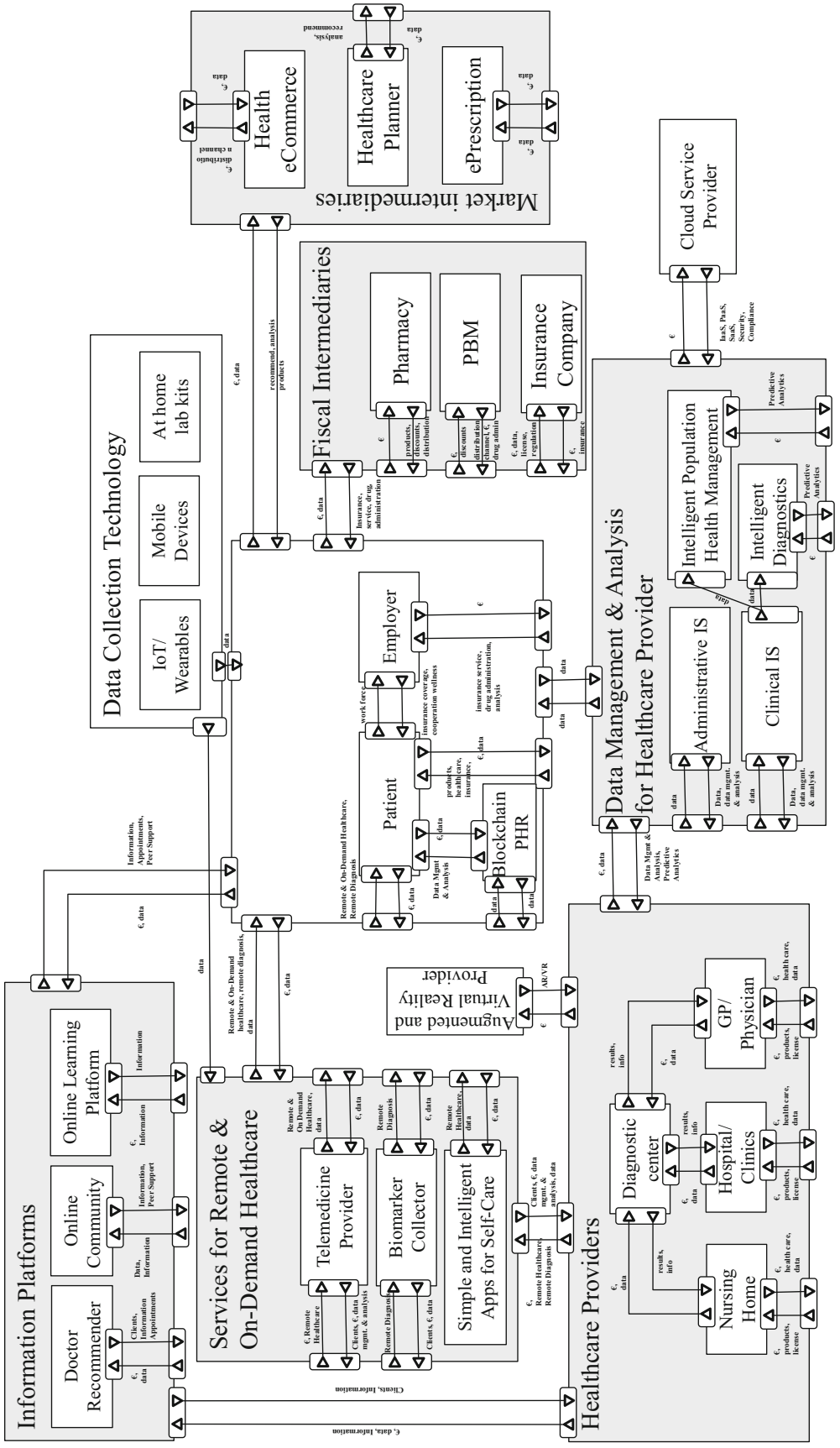

Fig. 2 Ecosystem visualization of the digital healthcare industry. Market segments have been depicted as actors for better readability. The grey rectangles around multiple market segments represent generic roles. To further improve readability and reduce complexity traditional generic roles have been omitted (manufacturer, purchaser, investors and consultants, political and humanitarian groups, researchers, and regulators) as well as the value streams between cloud service provider and information platforms, fiscal and market intermediaries, and services for remote and on-demand healthcare

In regard to prices covered by patients, the analysis reveals a slowly emerging transformation towards personalized prices. Fitsense, for example, uses consumer data captured by devices and wearables to help insurances to provide the right kind of protection at the right price. Although Fitsense represents the only organization within our case base to offer such services, we argue that the proliferation of real-time data and comprehensive consumer profiles will increasingly transform the value capture of the healthcare industry towards a personalized one.

4.4 Value delivery transformation

4.4.1 Platformization

The results demonstrate that the acute view of healthcare delivery transforms towards one in which connected and remote care focused on prevention is delivered from various actors. Such connected, network-based value delivery has been induced into the healthcare industry due to emerging new organizations with emerging new roles leveraging platform-based business models. Among the 15 new market segments we observed that a large part of them adopted exchange-based platforms. These include telemedicine providers, doctor recommenders, some apps for self-care, and health eCommerce. While telemedicine providers facilitate interactions among healthcare providers and patients, for example through video conferencing (e.g., Doctor Insta) or engagement platforms (e.g., Physitrack), doctor recommenders facilitate searching, reviewing and making contact (e.g., Jameda). Apps for self-care match users and fitness trainers (e.g., FitWell).

Regarding community-based platforms we found the market segments of Online Community and Online Learning Platform are building on this platform type. Figure 1, for example, is a social networking platform for healthcare professionals to post and comment on medical images, whereas PatientsLikeMe offers patients a platform to connect with others who have the same illness and to monitor and share their experiences with the objective to improve outcomes.

In terms of innovation platforms, we found no market segment that builds upon this type of platform. Rather, innovation platforms are explored by incumbent firms such as Apple, Google, or Nike. Nike for example launched the Nike+ Accelerator which enables external developers to build sports software using Nike's technology and data. Although we could not identify a distinct market segment leveraging innovation platforms, our case base indicates that a small number of emerging organizations are experimenting with this platform type. Fitbit, for example, offers Web APIs and a development environment to draw on the generativity of external app developers.

4.4.2 Remote and on-demand healthcare

While we observed that patients interact directly with healthcare providers in the traditional healthcare value chain, we found that this interaction is increasingly mediated by services for remote and on-demand healthcare, information platforms, and healthcare intermediaries in the digital industry. Today, patients can access medical information and services through various online platforms and apps without

the need to physically visit their healthcare providers. Interviewee 9 provides a concrete example for the benefits of remote and on-demand healthcare:

> "Instead of making an ECG once a month or once a year, you can have a wearable that collect much more data that gets the information about arrhythmia or something that otherwise would obviously be missed. So, with the abundance of sensors suddenly it increases the information content and the possibilities of utilizing this." (Interviewee 9)

Hence, traditional approaches to individual, acute, episodic, and facility-oriented healthcare are transforming toward longitudinal, connected, and remote healthcare even to the point where the central roles of hospitals and primary care physicians are slowly being supplemented, or even replaced, by new organizations such as telemedicine provider. The demand of remote and on-demand healthcare stems from consumers who are increasingly looking for care that can be delivered continuously; on their schedule, at a time and place of their choice. That is because technological advancements such as increases in processing power and storage capacity, 5G, cloud computing, and omnipresent data collection technology allow mobile health apps, personal devices (from sensors to wearables), and telemedicine providers to experience unprecedented scale and generativity, reduced IT costs, and service availability. As a result, consumers can leverage services for remote and on-demand healthcare to stream an unprecedented variety of data and analyses to healthcare providers. In return healthcare providers can draw on these services for continuous care to better engage patients in their own care by providing information, coaching, and tools to support each patient adopt behaviors to improve health outcomes. The platform character of these services allows the integration of the patient's personal network of family members, physicians, and social peers into this digital and remote healthcare process. For instance, family members can be provided with actionable information and alert notices, social peers can be integrated to help modify the patient's health behavior through gamification, and various healthcare providers and their IT can be integrated to manage the patient's health so that the healthcare services delivered are consistent and coordinated.

4.4.3 Patient empowerment

In the traditional healthcare industry, patients interact with a small number of roles that mainly consist of healthcare providers and fiscal intermediaries. Only a small fraction of patients ever interact with manufacturers. Additionally, we also observed an irregular and low interaction frequency between patients and healthcare providers. For example, outpatients rarely interact with healthcare providers or fiscal intermediaries. The process usually involves a couple of visits in a narrow timeframe until the treatment ends. Future visits will generally occur after a longer and unknown time interval. Hence, while the interaction is short-term and asynchronous, the involvement of the patient is also rather passive. Patients primarily wait for information without proactively asking for it or challenging the opinions and suggestions of their healthcare providers. As a result, patients have become fully dependent on the processes, information, and decisions of healthcare providers and systems.

However, the interaction and the communication between patients and healthcare providers as well as the self-involvement of patients are slowly being changed because of the digital transformation of the healthcare industry. Patients are confronted with a much higher number of previously unknown roles, such as information platforms, services for remote and on-demand healthcare, and market intermediaries. In contrast to the traditional healthcare industry, patients also interact far more often with healthcare providers. This interaction is increasingly mediated by third parties such as information platforms, blockchain-based personal health records, and services for remote and on-demand healthcare. These complementary services are not only increasing the interaction frequency between patients and healthcare providers; they are also providing patients with the option of informing themselves upfront, choosing suitable care providers, controlling and securely sharing personal data, and thereby becoming an active actor in the interaction with healthcare providers and prosumer of healthcare services. Doctor recommenders, for example, allow patients to rate and review doctors and thereby produce value for other users of the platform. Similarly, blockchain-based personal health records allow patients to control who can access their data and by allowing, for example, intelligent diagnostics to access that data, patients co-create value in form of better datasets and algorithmic outcomes.

Therefore, we identify patient empowerment as a crucial result of the transformation of patient involvement. Consumers have the opportunity to be better informed and make more informed choices about their health and the services they want to acquire. Interviewee 10 provides a possible explanation for the increased empowerment of patients:

> "The first part is patient centricity. […] Digital transformation is absolutely supporting this movement because digital companies are giving the tools to healthcare providers to center on the patient. […] The patient has got all this information which was not disclosed to him in the old system." (Interviewee 10)

5 Discussion

The study results indicate that the emerging digital transformation of healthcare is leading to a plethora of novel market segments, generic roles and value streams as well as the blurring of the distinction between healthcare and information technology industry. While some roles *reinvent existing solutions* by digitalizing distribution and services, others build upon digital innovations to offer *new medical procedures*. At the same time some market segments offer completely *new digital services* for problems that have existed before the digital transformation. Emerging companies reinventing existing solutions are either competing with existing healthcare incumbents or complementing the offerings of these incumbents. In contrast, emerging companies offering new digital services face strong competition from incumbent technology firms. Platform giants such as Google, Amazon, Apple and Microsoft are building the digital infrastructure of the digital healthcare ecosystem and are increasingly aiming to exploit their ability to deploy solutions

that do not require strong medical competence. These platform giants also already control vast amounts of customer-focused data, including health data from wearable devices and lifestyle data from activities scheduling. Large amounts of health-related information can be inferred from an individual's speed of motion (from GPS), health concerns (from searches), and even diet (from online restaurant reservations and online restaurant ordering); none of this information is currently explicitly covered by healthcare privacy, and in most jurisdictions using this information within a single firm, to benefit the individual, would not be forbidden.

By leveraging customer data from related industries, self-training algorithms (machine learning) and major information technology resources and capabilities, these platform giants enjoy a significant advantage over almost all emerging companies that are focusing on technical rather than medical solutions. Since regulation of the digital healthcare ecosystem has yet not been moving fast, this enables big platform operators to quickly launch new customer-facing services without facing regulatory barriers. Hence, emerging companies face a so called red ocean (Kim 2005) when competing with incumbent healthcare firms on the basis of reinventing existing solutions and a red ocean when competing with incumbent platform operators on the basis of offering new digital services. A competitive path that involves less competition with established and dominant firms might therefore comprise building upon digital innovations to offer new medical procedures. On the one hand, big platform operators don't have the medical competence to compete in this domain and on the other hand, existing medical companies face multiple challenges of downsizing their current business model in favor for new business opportunities (Velu and Stiles 2013; Christensen et al. 2016). While these conditions are not sufficient to demonstrate that this path is indeed a blue ocean, it seems more fruitful for emerging companies to compete against equivalent new entrants compared to well-equipped incumbents. However, this path requires new entrants to develop significant medical skills in addition to technical skills to move into areas that will not immediately be dominated by big tech or big pharma.

Our observations suggest that the healthcare industry is indeed following the inevitable progression that Bakos (1991) and Parker et al. (2016) predicted so many industries would follow. The healthcare industry is moving from simple linear value chains to two-sided markets mediated by central marketplaces, and then to complex interacting multi-sided markets mediated by platforms with super-modular/super-additive value creation (Jacobides et al. 2018; Clemons 2018). High tech companies and software developers have recognized that control over a platform gives large platform operators irresistible competitive advantage; consider Microsoft's destruction of Netscape, or Google's ability to block competitors from Android devices (European Commission 2018; Edelman and Geradin 2016). Traditional retailers are finding that it is difficult to compete with platforms like Alexa when they move into home shopping, and traditional manufacturers are finding that it is difficult to function without cooperation with existing platform operators when they moving into smart homes and autonomous vehicles; even in traditional companies, platform operators' control of customer data is emerging as a source of competitive advantage (Schreieck et al. 2019). However, it seems likely that existing medical

systems facing platform operators and platforms like Android and iOS will enjoy significant advantages due to their existing control of patient data.

The transformation of the patient–healthcare provider relationship is guided by various digital technology applications. Patients begin to evolve from consumers of the healthcare service into prosumers co-creating value with healthcare providers due to digital technologies and intermediaries enabling patients to co-create new services with various roles within the digital industry (Zhang et al. 2015; Hardyman et al. 2015; Lucas Jr et al. 2013; McColl-Kennedy et al. 2012; Vial 2019). Therefore, organizations have a growing interest in engaging patients with digital technologies to profit from the co-creation of value (Saldanha et al. 2017; Lusch and Nambisan 2015). For example, patients using IoT-wearables, digitizing daily nutrition intake or sharing medical experiences are co-creating value with various healthcare providers. On the one hand, their personal health data enables their physicians to provide better care and leverage preventive medicine, and on the other hand, accumulated health data provides the breeding ground for new diagnostic software and better algorithms. Additionally, patients become more and more empowered and self-reliant. The use of digital technologies encourages patients and consumers to look for more information about health, illnesses, medical treatments, and therapies (Agarwal et al. 2010). Patients can use medical social media platforms to share experiences and health-related data with others. At the same time, comparison portals empower patients to rate and recommend healthcare providers (Lupton 2013), which allows patients to share their individual experiences among each other. Lastly, the development of sensors, wearables, and IoT devices and the connectivity between these mobile devices and computers are the key concepts driving remote and on-demand healthcare services, which alters the patient–healthcare provider relationship toward the digital realm (Shah and Chircu 2018).

6 Limitations and future research

This study has several limitations. First, our analysis of the empirical data was limited by the subjective coding and the interpretation of the authors due to the qualitative research paradigm that we followed. Different coding and a different theoretical framework might have led to different findings. That is, we might have ended up with slightly different groups of market segments. However, we tried to counteract this limitation by establishing intercoder reliability and by validating our findings with industry experts. Second, our study did not reveal how traditional healthcare organizations should manage the implications of the digital transformation. We did not address possible changes to strategy and we did not assess the impact on internal processes and structures. Rather, we concentrated on detecting the interorganizational changes and emerging market segments within the healthcare industry. Third, our results are limited by cross-sectional information provided by the Crunchbase database. Future research could explore other methods such as econometrics to include more time-dependent and objective information. A second avenue of future research relates to platform competition in highly regulated industries such as healthcare. In various consumer-facing industries such as social

media, food delivery, or online search for example platform competition is very likely to reflect winner take all markets (Katz and Shapiro 1994) demonstrating market convergence due to platform envelopment (Eisenmann et al. 2011; Hermes et al. 2020b). However, sensitive health data, complex clinical trials, control over core-assets, and patent-intensity might alter the common rules of platform competition (Cennamo 2019) which has usually been investigated in less regulated industries (e.g. Meyer and Cennamo 2019; Cennamo and Santalo 2013). Exploring how different industry structures shape platform competition seems therefore fruitful especially as insights for platform regulation might emerge. A third avenue for future research is to compare the impact of the digital transformation in further industries and to compare and synthesize findings to derive more robust ecosystem theories about digital transformation. Lastly, new health IT will become intensely personal and potentially invasive. We therefore call for the investigation of how individual rights to privacy, organizational demands for personal health data, and societal benefits of large-scale exchanges of health data can be integrated into existing regulations on data ownership and data governance.

7 Conclusion

Given the lack of prior empirical research on the digital transformation of the healthcare industry and the lack of an inter-organizational perspective of digital transformation, our research is intended to advance the understanding of which new market segments emerged as a result of the digital transformation and how they changed the role of patients. We therefore applied a structured content analysis to inductively explore the transformation of healthcare by leveraging the Crunchbase database and interview data. The results indicate 8 new roles within healthcare, namely: information platforms, data collection technology, market intermediaries, services for remote and on-demand healthcare, augmented and virtual reality provider, blockchain-based PHR, cloud service provider, and intelligent data analysis for healthcare provider. Our results further illustrate how these roles transform value proposition, value capture, and value delivery in the healthcare industry. Finally, we address the role of patient data as a source of sustainable competitive advantage, both for medical records platform operators and smart phone platforms like Android and iOS. Medical records platform operators have existing health data, while Android and iOS have lifestyle data; new entrants without access to either will be unable to compete.

Our theoretical contribution is twofold. First, our results advance the literature on digital transformation by contributing a macro and interorganizational perspective of the digital transformation of the healthcare industry. This is theoretically important as the digital transformation represents more than an intra-organizational phenomenon. Second, we provide empirical evidence on how the logic of platform-mediated two-sided markets disrupted traditional linear value chains within the healthcare industry and on what platform types have and have not been adopted by emerging organizations. Lastly, we advanced the literature on the changing role of patients towards co-creators of value (Füller et al. 2014; Wirtz et al. 2019; Zhang

et al. 2015; Hardyman et al. 2015) by illustrating how the role of patients has evolved during the digital transformation of healthcare.

For practitioners within traditional health organizations, the ecosystem models support strategic positioning and competitive analyses. The derived value networks provide practitioners with a macro perspective which eases decision-making about where to strive for a competitive advantage and where to give up sovereignty. Furthermore, the new value streams help to better understand and serve customers, especially digital natives, who have already been digitalizing their daily life activities and now engage in value co-creation and call for innovative healthcare solutions. For practitioners of emerging organizations, we illustrate promising markets and outline where and why they might face so called red oceans (Kim 2005).

For healthcare policy-makers the implications of the study are twofold. First, policy-makers need to develop regulatory frameworks that address the tensions between (1) corporate privatization of health data and access to health data for public research, (2) protection of individual health data and societal benefits of large-scale exchanges of health data, and (3) benefits of personalized medicine and individual rights to privacy (Van Dijck et al. 2018). Hence, policy-makers need to develop shared policies at the international level to determine whether data flows are owned privately, corporately, or collectively and to foster open health data flows to reduce power asymmetries (Sharon 2016; Hermes et al. 2020a). Second, policy-makers need to investigate whether the changes in data collection warrants regulatory intervention to safeguard data validity and quality. Prior work has already raised concerns about data collected through wearables and mobile apps. For example, self-reported data could lead to intentional or nonintentional false reporting, data believed to be generated by the person of interest could be generated by someone else (sharing of devices) (Sharon 2016), and the devices themselves might report in accurate data (Plante et al. 2016; Murakami et al. 2016).

Appendix A: Generic roles of the traditional healthcare industry

See Table 5.

Table 5 Description of the market segments and generic roles in the traditional healthcare industry

Generic role	Market segment	Description
	Patient	The patient is a private person receiving healthcare services, treatment, or diagnosis from healthcare providers. On an individual level, patients pay their healthcare provider either out-of-pocket or indirectly through health insurances. Furthermore, there can be a payroll tax on employers and employees through which the costs of health insurance can be shared (Kumar et al. 2011)
	Personal Health Record (PHR)	PHRs contain health data related to the care of a patient and are maintained by the patient (Fichman et al. 2011). Health data includes for example patient-reported outcome data. With PHR, patients can choose what information to add and remove and with whom to share it with in a secure and compliant manner (Roehrs et al. 2017)
	Employer	Employers share the costs for insurance with their employees (Kumar et al. 2011). Employers can also provide corporate health programs to their employees to prevent sickness (Interview 4)
Fiscal intermediaries	Insurance Company	Insurance companies accept premiums from patients, employers, and the government. In return, they reimburse healthcare providers for taking care of patients (Kumar et al. 2011). Insurance companies currently try not only to cover the costs for healthcare services but also to incentivize their customers to stay healthy in exchange for discounts (Interview 4)
	Pharmacy Benefit Manager (PBM)	PBMs interact with pharmacies and beneficiaries. They decide on pharmacy charges and provide beneficiaries with access to a nationwide network of pharmacy providers, with whom the PBMs have contracts to offer services and drugs at lower prices. Furthermore, PBMs are able to earn additional revenues through contracting pharmaceutical companies, owning a mail-order facility, or repacking and selling data to the pharmaceutical industry (Garis et al. 2004)
	Pharmacy	Pharmacies can be defined as service shops and be classified, for example, based on the type of merchandise sold or the number of stores. An "independent" pharmacy has less than four stores, whereas "small chains" can have between four and 10 stores under a chain. "Large chains" include more than 10 stores (Jambulingam et al. 2005)

Table 5 continued

Generic role	Market segment	Description
Purchaser	Distributor	Distributors or wholesalers are non-manufacturing stakeholders that sell products to merchants, retailers, and contractors, but do not sell in significant amounts to end-users. Distributors simplify product, payment, and information flow owing to their role as an intermediary. Distributors bridge the gap between the goods and the services offered by individual producers and the demand of industrial or retail customers (Fein 1998)
	Group Purchase Organization (GPO)	GPOs facilitate group buying on a large scale by aggregating the demands of several buyers. GPOs negotiate a lower purchase price with the seller by using the collective purchasing power of the buyers and further lower the buyers' procurement cost by reducing the unit search and transaction costs through scale (Saha et al. 2010)
Manufacturer	Drug Manufacturer	Drug manufacturers focus on the discovery, development, manufacture, and commercialization of drugs and medications (Shah 2004; Paul et al. 2010). The most important stakeholders to interact with the drug manufacturers are physicians, pharmacists, and the Group Purchasing Organization (Kelle et al. 2012)
	Medical Device Manufacturer	Medical device manufacturers aim to make medical devices available for use. Medical devices as defined by FDA "range from simple tongue depressors and bedpans to complex programmable pacemakers with micro-chip technology and laser surgical devices. In addition, medical devices include in vitro diagnostic products, such as general purpose lab equipment, reagents, and test kits, which may include monoclonal antibody technology " (FDA 2018)

Table 5 continued

Generic role	Market segment	Description
Healthcare Provider	Hospital	A hospital is an institution providing medical and surgical treatment and nursing care for sick or injured people (Oxford 2019b)
	Practitioner	Practitioners provide healthcare services to patients, prescribe medication, perform operations, and determine diagnosis. In this study, practitioners comprise doctors, nursing teams, care teams, dentists, physiotherapists, etc. (Interview 10)
	Clinic	A clinic is an establishment or hospital department in which outpatients receive medical treatment or advice, especially of a specialzed nature (Oxford 2019a)
	Diagnostic Center	Diagnostic centers are healthcare providers, including laboratory services, radiology, and nuclear medicine (Interview 7)
	Nursing Home	A nursing home is a facility for the stationary care of elderly or disabled individuals. Nursing homes are occupied by individuals who do not need to be hospitalized but cannot be taken care of at home
Research	Research Institution	Research institutions are agencies, organizations, or universities that aim to foster innovation and collaboration in the research and development (R&D) area of healthcare. A distinction can be made between academic R&D (pure fundamental research and clinical trials) and commercial R&D (e.g., drug production)
Regulators	Regulation Authority	Regulatory authorities use standards to improve data review (e.g., in pharmaceutical companies) (Hammond et al. 2009). Furthermore, they regulate and classify medical devices, assuring patient access to "high quality, safe, and effective medical devices and avoiding access to products that are unsafe" (WHO 2019)
	Government	The government uses money generated from taxes to reimburse healthcare providers
Investors and Consultants	Business Consultant	Many hospitals and care facilities need support when planning and implementing health information systems. In these cases, hospitals are advised to recruit external consultants to develop an according strategy (Brigl et al. 2005)
	Investor	Private equity investors provide funds to companies in the form of growth or equity capital. They often pursue opportunities regarding a large healthcare provider with a stable reimbursement environment, such as acute care services, labs, or nursing homes (Robbins et al. 2008; Stevenson and Grabowski 2008)

Table 5 continued

Generic role	Market segment	Description
Data Management and Analysis for Healthcare Provider	Administrative Information System	The administrative information system manages administrative, financial, and legal operations of healthcare providers. Software components include patient management patient accounting (PMPA), which is responsible for patient registration, admission, and discharge as well as a billing system and an electronic data interchange (EDI) system for insurance reimbursement (Choi et al. 2010)
	Clinical Information System	The role of clinical information systems is to support the clinical activities of healthcare providers. The software components include for example electronic medical records (EMR), electronic health records (EHR) picture archiving and communication systems (PACS), and computerized physician order entry (CPOE) (Choi et al. 2010)
Political and Humanitarian Groups	NGO	According to the United Nations "a non-governmental organization (NGO) is any non-profit, voluntary citizens' group which is organized on a local, national or international level.[..] NGOs perform a variety of services and humanitarian functions, bring citizens' concerns to Governments, monitor policies, and encourage political participation at the community level" (United Nations 2020). Example: Doctors of the World
	Foundation/ Charity	A private foundation is a non-profit charitable body initiated by a single benefactor. For example, the Bill & Melinda Gates Foundation. In contrast, a public charity supports its activities by funds collected publicly
	Association	Associations represent groups whose members pursue a shared political, economic or social interest and strive to promote these through the political process

Appendix B: Ecosystem visualization of the traditional healthcare industry

See Fig. 3.

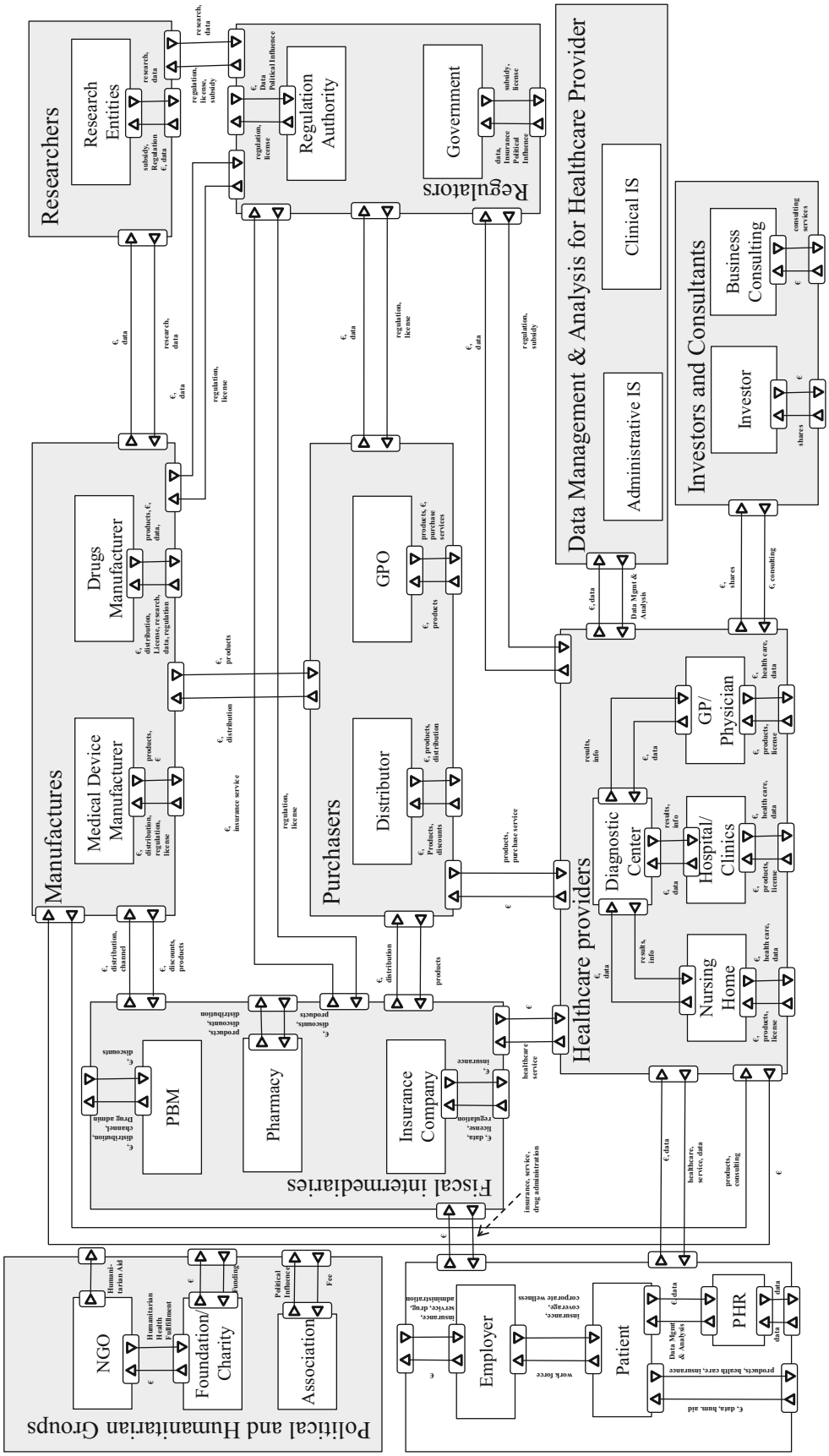

Fig. 3 Ecosystem visualization of the traditional healthcare industry

Appendix C: Amount of organizations for each new market segment in the digital healthcare industry

See Table 6.

Table 6 Number of organizations per market segment

Role	Market segment	Number of organizations
Information Platforms	Online Community	19
	Doctor Recommender/Online Scheduler	51
	Online Learning Platform	20
Platforms for Remote & On-Demand Healthcare	Telemedicine Provider	443
	Biomarker Collectors	11
	Simple and Intelligent Apps for Self-care	1047
	Blockchain PHR	8
Market intermediaries	Health eCommerce	61
	ePrescription	21
	Healthcare Planner	33
Data Management and Analysis for Healthcare Provider	Intelligent Population Health Management	43
	Intelligent Diagnostics	47
	Cloud Service Provider	157
	Augmented and Virtual Reality Provider	8
Investors and Consultants	Incubator/Hub/Accelerator	30

Appendix D: Literature search process

Search process for the traditional healthcare industry

Search #	Search string	Database/ # of results	
		EBSCOHOST	Emerald Insight
1	*"Health care system"* AND *"stakeholders"* (AND KEYWORD = *"health care"*[a])	376 articles	256 articles
2	*"Health care industry"* AND *"stakeholders"* (AND KEYWORD = *"health care"*)	222 articles	111 articles

Appendix continued

Search #	Search string	Database/ # of results	
		EBSCOHOST	Emerald Insight
3	*"Health care"* AND *"value network"* (AND KEYWORD = *"health care"*)	119 articles	85 articles
4	*"Health care"* AND *"value chain"* (AND KEYWORD = *"health care"*)	167 articles	255 articles

[a]Only used for Emerald insight search to further refine the results

The search yielded 1406 unique results which were refined to 150 results based on scanning title and abstract. After assessing the full text of the articles 38 results remained. The forward and backward search yielded 18 additional results.

Search process for the digital healthcare industry

Search #	Search string	Database/ # of results			
		EBSCOHOST	Emerald Insight	IEEE Xplore	ACM Digital Library
1	*("Health care" OR "healthcare")* AND *("digitalization" OR "digitization" OR "digital transformation")*	164 articles	87 articles	74 articles	256 articles
2	*"Health care"* AND *"digital innovation"*	183 articles	110 articles	49 articles	43 articles
3	*"Digital Health" AND "innovation"*	107 articles	31 articles	182 articles	87 articles

The search yielded 1117 unique results which were refined to 179 results based on scanning title and abstract. After assessing the full text of the articles 53 results remained. The forward and backward search yielded 11 additional results.

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A Taxonomy of Platform Envelopment (P8)

A Taxonomy of Platform Envelopment: Revealing Patterns and Particularities

Completed Research

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Abstract

Platform envelopment describes a competitive move whereby a digital platform enters an adjacent market. On one hand, it might enable to dethrone an established platform. On the other hand, it might give rise to the creation of platform conglomerates, which increases the concentration of private power. Therefore, platform envelopment has recently attracted significant attention from regulators and scholars. However, the traditional view of platform envelopment does not consider recent platform envelopment practices observed in research and practice. In this study, we aim to determine and structure the complexity of platform envelopment. We investigated 20 cases and developed a taxonomy of platform envelopment. We further encoded these cases into the comprehensive taxonomy and derived platform envelopment patterns and particularities. Our work contributes to research by establishing a foundation for the conceptual understanding of platform envelopment. Regulators can use this taxonomy to classify platform envelopment cases and determine potentially anti-competitive conduct.

Keywords

Digital platforms, platform envelopment, envelopment patterns, taxonomy, case study.

Introduction

"Platform envelopment," a term coined by Eisenmann et al. (2011), describes the competitive behavior of a digital platform whereby it enters an adjacent market already served by an established platform. By tying together services in the origin market with those offered in the adjacent market, the enveloper creates a multi-platform bundle and forcecloses user access to the established platform. Platform envelopment is, however, a double-edged sword. On the one hand, it enables a new platform to dethrone an established platform (Suarez and Kirtley 2012). The resulting changes in platform leadership might foster the development of technological discontinuities (Tushman and Anderson 1986) that allow new markets and services to emerge (Bower and Christensen 1995). On the other hand, platform envelopment can promote the creation of platform conglomerates, as witnessed by giant platform operators such as Amazon, Alibaba, and Google, which leads to the concentration of private power (Clemons et al. 2019; Moore and Tambini 2018; Wu 2018). This increases the likelihood that the interests of a few platform conglomerates will steer collective outcomes by becoming too big to fail and too big to regulate (Zuboff 2019). Such platform conglomerates also surround themselves with so-called "kill zones"—sectors not worth investing in, since defeat is guaranteed (Kamepalli et al. 2020)—thereby reducing venture capitalists' willingness to fund

competitive startups (Khan 2016), which ultimately reduces consumer choice and inhibits effective competition.

While platform envelopment as proposed by Eisenmann et al. (2011) helps to explain competition between rival platforms (e.g., Windows and Internet Explorer versus Netscape), it does not take into account the recent platform envelopment practices that have been observed in the literature as well as in practice. The theory neither incorporates the envelopment of orchestrated complementors, be it digital platforms (Kang 2017), physical products (Zhu and Liu 2018), or digital services (Foerderer et al. 2018), nor does it delve into the versatile role of, and the mechansmis used by, a core platform to interfere with its rivals—by rejecting updates (Kafka 2016), promoting its own platform through self-preferencing (Khan 2016), or supporting inter-platform integration (Li and Agarwal 2016). Moreover, this theory does not account for different digital platform types such as innovation and transaction platforms.

Besides increasing scholarly attention, these types of envelopment are also increasingly attracting regulatory scrutiny. For example, Amazon is currently being investigated for merchant mining and enveloping bestselling items (European Commission 2019) and Apple for enveloping music streaming (European Parliament 2019) and mobile payment (CPI 2019). Apple has for example rejected Spotify's updates in the AppStore multiple times (Kafka 2016) and only recently granted Spotify access to Siri, which is a crucial interface to reach customers (Spotify 2019). However, Apple is still blocking Spotify from being available as the default music player (Spotify 2019). Similarly, Apple is blocking access to the iPhone's contactless payments chip called the Near-Field Communication interface.

Our objective is, therefore, to capture and synthesize the versatility of platform envelopment and systematically identify its distinct characteristics and conceptual strucutures, augmenting the explanatory power of platform envelopment theory and initiating further theory-building. This is particularly important because taxonomies enable deeper understanding and analysis of complex domains (Nickerson et al. 2013), such as platform envelopment dynamics. For research purposes, a taxonomy provides an organizing structure for a body of knowledge. Specifically, in the case of platform envelopment, a taxonomy provides the groundwork for better understanding the strategic behavior of, and dynamics among, the different types of entities involved and the mechanisms used in platform envelopment. Policy scholars can use this proposed taxonomy to develop new regulatory policies for platforms, economists can investigate the welfare gains and losses of different envelopment practices, and strategy scholars can develop strategies on how established platforms can defend themselves against different types of envelopment. In practice, the proposed taxonomy offers an analytical framework for policymakers, envelopers, and defenders. The decomposition of complex envelopment practices allows policymakers to more fully understand where and in which form different types of envelopment become anti-competitive conduct. The taxnomy supports envelopers strategizing about different trade-offs, such as interfering with *versus* taking a *laissez-faire* approach to a target platform and defenders can use it to assess enveloper threats and derive competition-driven repositioning.

Therefore, this paper aims to answer the following research question: *What dimensions and characteristics distinguish the various types of platform envelopment?* This study contributes to the call for developing a taxonomy for the purpose of distinguishing between digital platform types (Constantinides et al. 2018; de Reuver et al. 2018). To fill the existing void in the literature, this article creates a taxonomy for platform envelopment and establishes its characteristic patterns and particularities. In the next section, we outline the theoretical background upon which this taxonomy is based. Subsequently, we present a three-step research approach that consists: of (1) creating a case base, (2) developing a taxonomy based on the identified cases and extant literature, and (3) empirically deriving platform envelopment patterns and particularities by applying the taxonomy to the selected cases. Finally, we discuss the anti-competitive outcomes and practices promoted by platform envelopment and potential regulatory remedies

Related Work

Types of Digital Platforms. In general, digital platforms encompass two types: transaction platforms and innovation platforms (Cusumano et al. 2019; Schreieck et al. 2016). **Transaction platforms** operate as intermediaries between two or more user groups and facilitate transactions for users to share, trade, or access a variety of goods and services (Cusumano et al. 2019). These platforms create

value by enabling the interactions of distinct user groups (Hermes et al. 2019; Rochet and Tirole 2003). Usually, the value of users increases with the number of users on the other side of the platform (Caillaud and Jullien 2003), a phenomenon referred to as *indirect network effects* (de Reuver et al. 2018). While the concept of transaction platforms can be found in various non-digital business models, digital technology enables the efficient scaling of such platforms. By contrast, **innovation platforms** "consist of common technological building blocks that the owner and ecosystem partners can share in order to create new complementary products and services, such as smartphone apps [...]" (Cusumano et al. 2019). Innovation platforms leverage three key features: the platform core, boundary resources, and complements. Along with users and complementors, these features refer to the *platform ecosystem*. The *platform core* is usually owned by the platform leader and described as an extensible code base that provides basic functionality to modular services (Tiwana et al. 2010). Each *modular service* is a software sub-system capable of extending the functionality of the platform core (Baldwin and Woodard 2009). *Boundary resources* (Ghazawneh and Henfridsson 2013) are interfacing and supporting resources, such as application programming interfaces (APIs), software development kits, and online marketplaces, that allow the platform leader to orchestrate complementary innovation by co-creating value with external complementors (Hein et al. 2019b). While *complementors* are the actors that develop, for example, applications or hardware, *complements* refer to the individual apps or hardware themselves (Hein et al. 2019a).

Platform Envelopment. Eisenmann et al. (2011) proposed platform envelopment as a new approach to how platforms can overcome barriers to entry and conquer other platform-mediated markets. Eisenmann et al. (2011) define platform envelopment as the "entry by one platform provider into another's market by bundling its own platform's functionality with that of the target's so as to leverage shared user relationships and common components." Hence, the enveloper ties its services in the origin market with those offered in the targeted market and creates a multi-platform bundle that leverages shared user relationships. In the next step, the enveloper forecloses the target platform access to the core platform and users and thereby captures the network effects of the target platform (Cennamo 2019).

A related stream of platform envelopment research extends Eisenmann et al.'s (2011) original conceptualization to explore the envelopment of complementary platforms (Foerderer et al. 2018; Kang 2017; Li and Agarwal 2016; Wen and Zhu 2019). This stream understands platform envelopment as platform owners entering their ecosystem by either developing applications on their own or acquiring third-party applications, thereby competing directly with their complementors. Kang (2017), for example, studied the coopetitive dynamics between Google's launch of Google Fit and complementary health tracking applications on Android and defines such intra-platform envelopment as "the platform owner's action of releasing a product whose functionality overlaps with that of the products already offered by platform complementors." Similarly, Li and Agarwal (2016) investigated the effect of Facebook's acquisition and integration of Instagram on complementary markets and revealed the trade-off of intra-platform envelopment. On the one hand, it allows integration efficiency between the core platform and the new platform. On the other hand, it discourages third-parties from contributing to the ecosystem as they fear the platform owner will capture their rents.

All in all, platform owners leverage the synergies of the core and the new platform by generating super-additive (Schreieck et al. 2019) and super-modular value (Jacobides et al. 2018) for consumers. Thus, after envelopment, the value of a multi-platform bundle becomes greater than the sum of the values of the individual constituent platforms. These interactions not only increase value for the consumer, they also enable the collection of a vast amount of data, which empowers the platform to leverage data across business lines to further expand its competitive position (Khan 2016; van Dijck et al. 2019).

Methodology

Since the theory on platform envelopment (Eisenmann et al. 2011) does not take into account contemporary envelopment practices, a case-based approach with various platform envelopment cases is most fitting (Yin 2017). Multiple, qualitative case studies provide an opportunity to gain an in-depth understanding (Yin, 2014) as well as conduct generalizable, cross-case analyses (Larsson 1993). Our methodology has three phases. First, we set up a case base comprised of 20 platform envelopment cases. The unit of analysis for these cases is the platform, not the platform company itself. Second, we developed a taxonomy in three iterations: (1) developing a preliminary taxonomy based on extant literature, (2) finalizing the taxonomy

based on the empirical cases, and (3) evaluating the taxonomy based on additional cases. In the last step, we derived platform envelopment patterns and particularities *via* qualitative cluster analyses as a cross-case analysis (Yin 2017) using constant comparison (Eisenhardt 1989; Weking et al. 2019b).

Creating a Case Base. Our method for case collection built upon the work of Larsson (1993). First, we identified cases with which we were already familiar. Second, we conducted a case search to identify new cases. The case search consisted of different search strategies and sources, which helped to reduce case collection bias (Larsson 1993). We relied on extant literature (e.g. Edelman and Lai 2016; Eisenmann et al. 2011; Foerderer et al. 2018; Iacobucci and Ducci 2019) as well as on business reports, news articles, and websites. To find these potential sources, we used web searches and scientific databases. We considered all active cases that involved platform envelopment and for which sufficient information was available. We aimed to capture a variety of platform envelopment practices such as internal development *versus* acquisition (Li and Agarwal 2016), envelopment of complementors (Zhu and Liu 2018) *versus* competitors, intervening with the target (Spotify 2019) *versus* taking a *laissez-faire* approach, and enveloping by leveraging control over an operating system (European Commission 2018) *versus* an online service (European Commission 2017). We identified 20 cases in total. We stored all data in a central case base (Yin 2017) and tried to find additional sources for each case. When possible, we triangulated the data by synthesizing the findings from all sources for a case, which helped us to build a more profound understanding. Such data triangulation helps to increase the construct validity of a case study (Yin 2017). Table 1 provides a list of all cases.

Table 1: Overview of Cases Analyzed

Iteration	Core Platform	New Entity	Analyzed Sources
Second Iteration: 14 relevant envelopment cases	Airbnb	Airbnb Adventures	4
	Amazon Marketplace	Third-party products	6
	Android	Google Photos	6
	LinkedIn	Job Listings	5
	Windows	Internet Explorer	7
	Android	Google Fit	6
	Android	Google Chrome	4
	Google Search	Google Hotel	5
	Google Search	Google Shopping	7
	Facebook	Instagram	6
	App Store	Apple Music	4
	iPhone	Apple Health	5
	Facebook	WhatsApp	4
	Spotify	Ringer	5
Third Iteration: Six relevant envelopment cases	Android	Google Search	6
	Uber	Uber Eats	4
	Google Search	Google Flight	5
	iPhone	Apple Pay	5
	iOS	Apple Music	4
	Fire OS	Prime	4

Developing a Taxonomy. We applied the iterative method of Nickerson et al. (2013) for the purpose of taxonomy development. This method has proven in several information systems studies to derive valuable knowledge about underlying organizing structures (e.g. Weking et al. 2019a). Moreover, it follows a holistic approach to successfully combine theoretical knowledge and empirical insight. In the first step, we defined two meta-characteristics (MCs) based on the concept of platform envelopment proposed by Eisenmann et al. (2011): core platform and new platform. Next, we used the eight objective and five subjective ending conditions utilized by Nickerson et al. (2013) for terminating the iterative method. For example, Nickerson et al. (2013) proposed checking after each iteration if "at least one object is classified under every characteristics of every dimension" (objective) and if "the number of dimensions allow the taxonomy to be meaningful without being [...] overwhelming" (subjective). Then, we iteratively developed the taxonomy. In the first iteration, we applied the conceptual-to-empirical approach and derived dimensions and characteristics based on extant literature. The second iteration consisted of the empirical-

to-conceptual approach whereby we applied the taxonomy to 14 case studies and conducted a qualitative structured data analysis (Miles et al. 2013). We coded the case information and empirically derived characteristics (within-case analysis) (Yin 2017). Then, we classified the cases within the taxonomy and, if necessary, added further characteristics and dimensions to the taxonomy until all cases were included. For example, we reframed the MC "new platform" to "new entity" to deal with the fact that it is not only platforms that get enveloped but also physical products and digital services. Table 2 provides an overview of how qualitative raw data were aggregated into the taxonomy.

Table 2: Exemplary Coding Extract

Source	Relevant paragraph	Taxonomy dimension	Taxonomy characteristic
(Li and Agarwal 2016)	• "After the acquisition, Facebook continued to run Instagram as an independent application [...]." • "[...] a partial integration was made [...] between Instagram and Facebook."	• Origin • Availability • Relationship with the core	• Acquired • Outside of core platform ecosystem • Simple integration

We dropped and synthesized characteristics and dimensions to keep the taxonomy lean without losing discriminative power. The third iteration also applied the empirical-to-conceptual approach. We used the taxonomy to code an additional six cases (Miles et al. 2013). Again, we used multiple sources and triangulated the data to corroborate results (Yin 2017). The analysis and comparison of the cases did not require adding or modifying any of the characteristics or dimensions. All of the other ending conditions were met. We, therefore, stopped the process as the resulting taxonomy can be applied to all cases.

Derivation of Platform Envelopment Patterns. The platform envelopment patterns have been derived using a qualitative analysis approach. First, we encoded the cases in a matrix in which each row of the matrix represented a case and each column represented a dimension in the taxonomy. Each cell, then, represented the specific characteristic of each case for a chosen dimension. Based on the matrix, we performed a qualitative cluster analysis as a cross-case analysis (Yin 2017) using constant comparison (Eisenhardt and Graebner 2007). The analysis of similarities and differences across cases revealed three platform envelopment patterns and four sub-patterns as well as two platform envelopment particularities.

Results

Taxonomy. The derived taxonomy for platform envelopment actors consists of four MCs and 11 dimensions with two to four distinct characteristics for each. Table 3 illustrates the taxonomy structure.

Table 3: A Taxonomy of Platform Envelopment

MC	Dimension	Characteristics			
Core platform	*Type of platform*	Innovation platform		Transaction platform	
	Envelopment direction	Vertical		Horizontal	
	Position in layered architecture	Hardware and Operating System	Operating System		Online Service
	Target	Competitor		Complementor	
	Interaction with target	Interference		Laissez-faire	
	Market dominance	Yes		No	
New entity	*Type of entity*	Innovation platform	Transaction platform	Digital service	Physical product
	Origin	Self-developed		Acquired	
	Part of platform conglomerate	Yes – exponential super-additive value		No – limited super-additive value	
	Availability	Inside of core platform ecosystem	Outside of core platform ecosystem		Inside and outside of core platform ecosystem
	Relationship with core platform	Simple Integration	Self-preferencing		Pure Bundle

Platform Envelopment Patterns. We identified three patterns and four sub-patterns for platform envelopment. At the highest level, we differentiated between horizontal envelopment of platform competitors (Pattern 1), vertical envelopment of platform competitors (Pattern 2), and vertical envelopment of platform complementors (Pattern 3). We refer to competitors as entities that are not orchestrated through boundary resources by the enveloper. Vertical envelopment refers to enveloping entities that represent one side of a transaction platform (e.g., moving from general search to specialized search) or that are part of the ecosystem of an innovation platform (e.g., moving from mobile operating systems to apps). In contrast, horizontal envelopment refers to enveloping entities outside of the platform's direct network. For Pattern 1 and Pattern 3, we identified two sub-patterns. For Pattern 1 we differentiated between internal and external envelopment and for Pattern 3 between soft and radical envelopment.

1. Horizontal Envelopment of Platform Competitors (n = 5). The first pattern refers to platform competition between the new platform and the target platform. No specific relationship exists between the core platform and the target platform. The core platform thereby moves into the space of horizontally competing platforms by integrating a new platform to offer the same value proposition to the targeted market. This type of envelopment does not comprise self-preference or bundling practices and follows a *laissez-faire* interaction with the target platform. *Internal Envelopment* refers to the phenomenon in which a new platform is only available inside of a core platform. Airbnb, for example, aims to envelop TripAdvisor's platform by integrating similar platform functionality of Airbnb Adventures into its core accommodation-sharing platform. Similarly, Spotify is acquiring The Ringer to integrate additional podcasts into its core music streaming platform. *External Envelopment* refers to the phenomenon whereby a new platform is only available outside of a core platform. Facebook, for example, acquired WhatsApp and offers it independently of its own app center and social network. Similarly, Uber built UberEats and operates it as a standalone platform independent of its core ride-hailing platform.

2. Vertical Envelopment of Platform Competitors (n = 4). The second pattern refers to platform competition between the new platform and the target platform as well. The core platform is used by the target platform to reach users. The core platform thereby moves into the space of vertically competing platforms by self-preferencing a self-developed or an acquired platform in order to offer the same value proposition to the targeted market. This type of envelopment uses self-preferencing practices (such as higher rankings and prominent placements) as well as interference mechanisms (such as demoting rivals, algorithmic opacity, and limiting interoperability) to envelop vertical platform competitors. A typical example is Google Search and Google Shopping (European Commission 2017; Iacobucci and Ducci 2019). In this case, Google Search, as a dominant entry point for consumers to online information, is leveraged for prominent Google Shopping placement and to demote rivals in its search results. According to the European Commission (2017), Google abused the algorithmic black box of Google Search and included criteria to deliberately demote competing services such as Foundem (Manne 2018).

3. Vertical Envelopment of Platform Complementors (n = 9). The third pattern refers to platform competition in a coopetitive setting. While the target platform complements the core platform, it competes with the new platform at the same time. The core platform thereby moves into the space of a vertically complementing platform to offer the same value proposition to the targeted market. This can happen in two ways. *Soft Envelopment* refers to the phenomenon by which the enveloper offers a new platform but does not use its core platform to self-preference or bundle its new platform, nor does the core platform interfere with complementary platforms. Hence, the platform company launches the new platform and simply integrates it with its core platform without further using its core to jump start its new platform. Google's launch of Google Fit provides an example of this sub-pattern (Kang 2017). *Radical Envelopment* refers to the phenomenon by which the enveloper offers a new platform and uses its core platform to self-preference or bundle its new platform and interfere with target platforms. Hence, the core platform deliberately privileges its new platform and deliberately aims to block target platforms. The current battle between Apple and Spotify illustrates this pattern (European Parliament 2019). Apple, for example, pre-installs Apple Music on its iPhone operating system (iOS), sets Apple Music as the default for Siri, and disregards its own App Store rules (Spotify 2019). At the same time, Apple uses its App Store policies to reject updates from Spotify and uses control over its iOS to delay Spotify's access to Apple's smart watch and smart speaker (Spotify 2019).

Platform Envelopment Particularities. We identified two platform envelopment particularities that support the finding that not only are digital platforms being enveloped, but so are physical products

and digital services. The **envelopment of physical products (n = 1)** refers to the phenomenon wherein a digital transaction platform enters into a third-party sellers' product space to compete against them directly. Thus, the platform itself resells third-party products in its own marketplace. This form of envelopment allows the enveloper to leverage economies of scale, which it can use to reap higher profits or lower costs for consumers (Zhu and Liu 2018). The related case stems from Amazon, which uses its marketplace to envelop the product spaces of its complementors (European Commission 2019; Zhu and Liu 2018). In contrast, the **envelopment of digital services (n = 1)** refers to the phenomenon in which a digital innovation platform enters its ecosystem to envelop existing digital services already provided by its complementors. Therefore, the platform itself now offers the service that had previously been solely offered by its complementors. This approach also reflects vertical envelopment, but targets a different type of complementor than traditional platform envelopment. This form of envelopment allows the enveloper to leverage new data streams to improve its competitiveness. The related case stems from Google, which released its photo app in 2015 (Foerderer et al. 2018).

Discussion, Limitations, and Future Research

Our findings suggest two interdependent areas for regulatory discussion: vertical envelopment and anti-competitive envelopment practices. While vertical envelopment reduces the revenue of complementors and can, therefore, induce them to leave the platform, it also offers multiple advantages to the platform owner. Vertical envelopment offers the possibility of capturing the rents of complementors and competitors, increasing integration efficiencies (Li and Agarwal 2016), creating super-additive and modular value (Jacobides et al. 2018; Schreieck et al. 2019), and controlling platform evolution. By leveraging vertical envelopment, platform owners are increasingly converging towards platform conglomeration. Platform conglomerates not only profit from network effects and winner-take-all dynamics, they also profit from self-reinforcing data feedback loops, meaning that they can leverage data from one platform to improve another platform or to build a superior platform. Such *platform conglomerate advantages* enable platform owners to sustain market dominance in their core platform(s) and easily establish new dominant platforms, harnessing even more data and reinforcing the feedback loop (Khan 2016; van Dijck et al. 2019). As a result, traditional incumbents as well as startups that do not profit from these advantages lack critical consumer and market knowledge and big data sets to leverage new technologies such as artificial intelligence. Hence, platform conglomerate advantage impedes new market entry, creates immense barriers to entry, increases the concentration of private power, and restricts effective competition.

Aside from the problems of vertical envelopment, our results also illustrate how envelopment practices can be anti-competitive. From the perspective of the core platform, two types of envelopment practices should be considered: first, how to treat complementors and competitiors, and second, how to treat the new platform. Amazon, for example, uses standard agreements with independent sellers on its platform to collect and analyze their transaction data (European Commission 2019). This allows Amazon to identify successfully selling products or products that Amazon could help to improve by integrating them with complementary Amazon services. At the same time, Amazon can use its control over the marketplace to easily promote these products and demote competing ones. Since Amazon is also one of the largest marketplaces, it can sell large amounts of these products and thereby builds up significant bargaining power towards the suppliers of these products (Foerderer et al. 2018). By exploiting its bargaining power, Amazon can sell these products at a lower cost, outcompeting the product complementors and further strengthening its market dominance. While Amazon is under regulatory scrutiny for such practices (European Commission 2019), Google has already been fined for similar practices such as tying, prominent placement, and demotion of rivals (European Commission 2017; European Commission 2018) and Apple is also under investigation for limiting interoperability (European Parliament 2019) and denying access to its NFC chip for mobile payments (CPI 2019).

Instead of scrutinizing and regulating single anti-competitive practices, we propose reevaluating the concept of vertical envelopment. Our findings suggest that vertical envelopment leads to conflicts of interest, for example, Amazon owning and participating in its own marketplace, Google owning general search and participating in specialized search, or Apple owning the App Store and participating in its own ecosystem. These vertical envelopments create tensions that often involve anti-competitive conduct, either between the core platform and the target or the core platform and the new entity. Related industries, such as American banking, faced similar challenges in the past. As a result, banking laws were changed to require

the separation of banking and commerce (Shull 1999) and prohibit banks from entering markets other than those in the business of banking. The laws are maintained to ensure the fair and efficient allocation of credit, prevent the concentration of power in the banking industry and counteract possible anti-competitive banking practices (Khan 2016). Similar to banks, platform conglomerates are prone to concentration and conflicts of interest. Moreover, their core platforms can be considered critical infrastructure (e.g., Amazon's marketplace or Google Search). Therefore, in order to limit these issues, it might be worth drawing on related laws and considering banning or restricting vertical envelopment practices.

Our work contributes to platform research by extending the original theory on platform envelopment by integrating: (1) the view of intra-platform envelopment and (2) how a core platform interacts with new and target platforms. Our taxonomy, thereby, augments the boundaries of platform envelopment and eases the differentiation between other platform entry strategies (Karhu and Ritala 2020). Regulators can use our taxonomy to classify platform envelopment cases for the purpose of deriving potential anti-competitive conduct. While this taxonomy cannot be used to identify anti-competitive conduct *per se*, it can enable the early identification of cases that might be prone to anti-competitive behavior. For example, the taxonomy's patterns reveal that radical platform envelopment and vertical envelopment of platform competitiors is, for the most part, accompanied by anti-competitve conduct. In addition, this taxonomy can assist in the determination of whether potentially anti-competitive conduct is occurring between the core platform and the new platform or between the core platform and the target platform. Envelopers can this the taxonomy to formulate strategies and make decisions regarding various trade-offs and the associated risks, such as acquiring a target platform (integration risk) *versus* building its own platform (risk of late entry), or interfering with a target platform (risk of regulatory scrutinity) *versus* taking a *laissez-faire* approach to the target platform (risk of single-homing and failing to solve the chicken-and-egg problem). Defenders can use the taxonomy to assess the threat of platform owner entry (e.g., soft *versus* radical envelopment) and derive competition-driven repositing (Wen and Zhu 2019).

This study has several limitations. First, we use products/platforms as unit of analysis which reflects our framing of vertical and horizontal envelopment. We regard for example the move from a core platform (e.g. iOS) into its complementary market (e.g. music streaming apps) as vertical envelopment. Other conceptualizations are possible. For example, Apple's selling of the iPhone (including Hardware, iOS, and the AppStore) can be regarded as one line of business and Apple's move into music streaming as another line of business. Thus, it is possible to argue that Apple is horizontally integrating and only uses one line of business (iPhone) to distribute and sell another horizontal line of business (music streaming). Second, the taxonomy has not been externally validated by confirmatory expert interviews or focus groups. Third, the taxonomy has been developed with the aim to theoretical understand the versatility of platform envelopment and therefore incorporates as diverse cases as possible. Changes to corporate conduct (such as Google unbundling its shopping service from search) are not reflected in the cases. Finally, platform envelopment is a dynamic interplay whereas the taxonomy is limited to a static point of view.

Our review of existing literature reveals that most scholars take the perspective of the enveloper. Within this perspective, future work can draw on the three patterns identified herein and investigate their performance. Previous envelopment cases have indicated that not all envelopment attacks are successful so it is fruitful to better understand why some envelopment strategies succeed and others do not. Since platform envelopment is dynamic in nature, the author's call for longitudinal studies to reveal how changes in strategic behavior influence envelopment performance. Besides extending our understanding of the enveloper, we propose future research to take the perspective of policymakers, consumers, and defenders in addition to envelopers. Future work on platform regulation can use our taxonomy and patterns to derive new policies such as restricting vertical envelopment and prohibiting interference. Future work should thereby assess which policy interventions might limit potentially anti-competitive conduct without reducing the efficiencies generated by platform conglomeration. Future work taking the consumer perspective into account is encouraged to explore the impact of platform envelopment on consumer welfare. While recent work indicates that platform envelopment can reduce innovation and increase prices as well as shift innovation to new apps (Wen and Zhu 2019), the question remains whether the welfare gain is larger than the welfare loss. Lastly, we encourage an exploration of the target's perspective to analyze their strategic defensive moves against envelopment attacks. Case studies and configurational analyses might reveal which interplay of factors is most suitable to fending off envelopment attacks.

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Moving beyond the Build-or-Join Decision (P9)

Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms

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Abstract

Companies that operate digital platforms are growing rapidly. Theoretical and empirical research has largely explored digital platforms in the context of digital-native companies. Only a small set of research explores how incumbent firms transition into the platform economy. However, this stream of research has studied incumbents under the assumption that they can either build a platform or join an existing platform. In contrast, the results of our multiple case study demonstrate that incumbents pursue multiple platform strategies simultaneously and that their strategic options range from building and joining a platform over investing in and acquiring a platform to using white-label platforms. The white-label strategy uses the platform technology of a white-label platform owner to match the users of the incumbent with the complementors of the white-label platform. Based on the results, which further illustrate the motivations to pursue each strategy, we discuss strategic differences between asset-heavy and asset-light incumbents.

1. Introduction

Six out of the ten most valuable brands in 2019 were launched by platform companies [1], several of which had existed for a surprisingly short time. By leveraging the generativity of their ecosystems [2], platform companies are disrupting traditional business landscapes by changing well-known business processes such as the creation of value, and expectations of consumers [3, 4].

To compete in the platform economy, incumbent companies must rethink their business models [5] and find new ways of creating value for their customers [6]. Otherwise, they might ultimately be displaced by new and rapidly growing platform companies [7]. However, incumbents face several challenges when entering the logic of platform ecosystems. On the one hand, they are accustomed to controlling all aspects of their business, such as the supply chain, distribution, and customer relationships [6, 7]. On the other hand, they are less agile than their new digital-native competitors, because their change is slowed down by organizational rigidity and structural inertia [8]. To combat the disruptive platform competition, incumbents are increasingly adopting platform thinking [9, 10] and establishing new platform ecosystems [5, 6]. Incumbents from highly diverse industries, such as banking, insurance, healthcare, transportation, steel distribution, and energy, are beginning to embrace platform business models [11, 12].

Although research on digital platforms made significant advances on the dynamics of platform emergence, platform orchestration, as well as platform strategies and platform competition (see [13, 14] for an extensive review), theoretical and empirical work has largely explored digital platforms in the context of young digital platforms [15, 16]. Only a small set of research explores how incumbent firms transition into the platform economy and how they need to change to benefit from platform economics [5, 7, 10, 17-19].

However, this stream of research has studied incumbents under the assumption that they can either build a platform or join an existing platform [3, 6], neglecting that incumbents can pursue multiple strategies (e.g. building and joining simultaneously). In addition, incumbents' platform strategies are largely investigated around the building and joining strategy, neglecting that incumbents also invest in platforms, acquire platforms, and utilize white-label platforms. To shed more light on platform strategies of incumbents, we pose the following research question: *What strategies do incumbents follow towards participation in the platform economy, and what are their motivations?*

To this end, we conduct a multiple case study with three incumbent firms from the chemical, construction, and banking industry. Our study makes two contributions. First, we extend the existing

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platform literature by empirically investigating the perspectives of incumbents. Second, and more specifically, we contribute to the discussion on how and why incumbent firms transition into the platform economy. Our results demonstrate that platform strategies cannot always be reduced to a simple build-or-join decision. In contrast, incumbents pursue multiple platform strategies at the same time. Their strategic options range from building and joining a platform over investing in and acquiring a platform to leveraging white-label platforms (that is, using the platform technology of a white-label platform owner to match the users of the incumbent with the complementors of the white-label platform). The two asset-heavy companies in our study largely draw on investing and joining strategies to avoid antitrust issues and build new sales channels. In contrast, the asset-light company is particularly engaging in the building and white-label strategy to remain in control of customer access and market-level data. All case companies agreed that it is crucial to enter the platform economy to pre-empt external companies from building strategically relevant positions.

The remainder of this paper is structured as follows. Section 2 analyzes the literature on platform strategies for incumbents and Section 3 describes our methodology. In Section 4, we present the intra-case analyses of three incumbents and in Section 5 the cross-case analysis. The paper concludes and presents limitations and future research in Section 6.

2. Theoretical Background

2.1 Digital Platform Ecosystems

Digital platforms have received significant attention from economics, technology management, information systems, and strategic management [13, 14]. Although different definitions of the term digital platforms exist across disciplines, the consensus is that digital platforms provide the basis for complementary products and services that can be developed and offered on the platform by third parties [8, 20]. Drawing from Evans and Gawer (2016) [21] and Cusumano, Gawer, and Yoffie (2019) [6], we distinguish between two distinct platform business models: innovation platforms and transaction platforms. An innovation platform refers to the technological foundation (e.g. iOS) on which complementors (e.g. software developers) develop complementary innovations (e.g. applications). Together with users, an innovation platform and its complementors form a platform ecosystem. A platform ecosystem describes a not fully hierarchically controlled coordination structure that integrates different actors through the directions set by a central company [22]. A transaction platform facilitates transactions between sellers and buyers (e.g. e-commerce platforms such as Amazon Marketplace or eBay) who would otherwise have difficulty finding each other. Platform owners refer to companies that exercise intellectual property rights and develop the technology of the platform. Platform providers refer to companies that represent users' primary point of contact with the platform [23]. Platform orchestrators refer to companies that are entitled to orchestrate the ecosystem by setting governance rules. Some companies pursue multiple roles. For instance, Google owns the platform Android and is also entitled to its orchestration while Samsung represents the platform provider as it sells the platform through its smartphone to users. In the present paper, we use the term platform owner to describe companies that reflect owners, providers, *and* orchestrators and the term platform provider (orchestrator) to describe companies that *only* provide (orchestrate) the platform.

2.2 Platform Strategies

The first strategy describes that an incumbent can enter the platform economy by *investing in a digital platform* separated from its organizational structure [24]. When following this strategy, the incumbent has two options. Either creating and investing in a spin-off (option A) or investing in an existing platform company (option B). Both options allow the incumbent to gain experience and learn about the platform's business model, success factors, and changing customer behaviors without having to adapt its existing business model. Hence, the incumbent can reap the benefits of what Zhang et al. (2018) call the Invest-Learn-Act strategy [18]. The disadvantage of this strategy is that the incumbent can't fully control the development of the platform and that the platform might move into directions detrimental to the incumbent's strategy. However, the higher the investment, the more control can be exercised.

The second strategy describes that an incumbent can enter the platform economy by *building a digital platform* integrated into its organizational structure [5]. For example, General Electric built an innovation platform by opening up its Predix operating system to external developers to harness complementary innovations and to equipment manufacturers to increase the side of application users [6]. Building a platform is advantageous when the market is relatively new and existing actors or technologies are not mature. The strategy also benefits the integration of the platform into the incumbent's existing

structure and permits it to establish a keystone or leadership position in the market. The keystone position provides the opportunity to take advantage of network effects and to access market-level data, which can be used to enter the complementary or a new market more easily. However, the building strategy's challenges are that it is costly, time-intensive, and requires cooperation from other companies [10, 25]. To succeed, firms generally need deep pockets and a long-time horizon. Maybe even more challenging is that managers have to solve various platform challenges (e.g. build an installed base, pricing on each side, and governance mechanisms [19] and need to overcome the mindset of command and control [10, 17].

The third strategy describes that an incumbent can enter the platform economy by *acquiring a digital platform* and integrating it into its organizational structure [6]. That is, for example, the case for AccorHotels, who integrated the Onefinestay platform to be able to offer luxury properties in London to compete against emerging platforms within the hotel industry such as Airbnb [6]. The main advantage of acquiring a platform is that time-to-market is strongly reduced. However, this strategy requires incumbents to have mastered new, platform-specific management skills [19] such as facilitating open innovation and stimulating economic activity without exercising tight control. The challenge of buying a platform is to retain key talent, integrate the platform into legacy systems, and counteract cultural rejection [6].

The fourth strategy describes that an incumbent can enter the platform economy by *joining a third-party digital platform* [6]. When following this strategy, the incumbent has three options. They can join the supplier/complement producer side (option A), join the buyer/consumer side (option B), or join both sides as "prosumer" (option C). Joining a platform creates the opportunity to profit from platform economics such as increased reach and lower costs. However, once the third-party platform has become successful and established a dominant position, it might turn to become the incumbent's largest competitor. In the last years, it has been common for Amazon to act as a retailer on its marketplace and for Apple to compete with complementors on its innovation platform. Especially if the incumbent has not invested in the platform, it has almost no possibilities to influence the platform's decisions to its own advantages (exceptions are key complementors who are crucial to the platform's success).

Based on the proposed platform strategies, we argue that an incumbent uses a *multi-platform strategy* if it engages in at least two strategies (e.g. build and join) or uses a strategy at least twice (e.g. join two platforms). When an incumbent transitions from one strategy to another, we consider both exclusively pursuing the new strategy and pursuing multiple strategies at the same time as a multi-platform strategy.[1]

3. Methodology

We designed a multiple case study incorporating multiple semi-structured interviews and extensive online research. The qualitative case study approach is appropriate for investigating phenomena in a real-life context [26, 27]. We considered the perspective of incumbent companies that had decided to build or join one or more digital platform ecosystems. By analyzing both inter-case and cross-case patterns, we derived several industry-specific as well as some overarching patterns.

To explore how incumbents strategize within these rapidly changing environments, we chose a mixed sample of three large organizations. The case companies were selected under three essential selection criteria: (1) incumbents in their industries, meaning that the companies were established and operating successfully in their industries, (2) incumbents from different industries with different levels of digital maturity to avoid industry bias [28], and (3) incumbents that were actively involved in one or more digital platform ecosystems (as defined by Hein et al. [2]). The final sample comprised three case companies, one operating within the construction industry (a business-to-business [B2B] industry), the second in the chemical industry (a B2B industry), and the third in the banking industry (a B2B/business-to-consumer [B2C] industry). All three incumbents originated before 1960, employed between 6,000 and 20,000 employees at the time of the study, and collected revenues between 2 and 20 billion euros.

In total, we conducted 11 semi-structured expert interviews. To strengthen the credibility of the results, we triangulated the interview data with additional secondary data as the main source of empirical material (see Table 1) [29].

Firm	List of qualitative data
ChemistryCo	CEO (Chemical Marketplace) (38:33 min)
	CDO (ChemistryCo) (1st 32:16 min, 2nd 15:00 min)
	Business Development Manager (Chemical Marketplace) (43:44)
	CIO (ChemistryCo) (38:10 min)

[1] We thank the anonymous reviewer for this comment

	2 public interviews with CDO (ChemistryCo) 2 public blog posts describing platform trends within the industry
ConstructionCo	CEO (Product-finder Platform) + Head of Digital Innovation Lab (ConstructionCo) (53:30 min)
	Member of Digital Board (ConstructionCo) (56:39 min)
	Head of Business Development IoT (ConstructionCo) (45:38 min)
	Leader Business Unit Smart Building (ConstructionCo) (26:31 min)
	1 Press release about the company 1 Blog posts describing platform trends within the industry
BankCo	Head Digital Commercial Offering & Processes (BankCo) (41:55 min)
	Product manager of Transaction Platform 2 (BankCo) (44:42 min)
	Lead of Innovation Platform (BankCo) (27:58)
	5 public interviews with/ self-authored articles of the lead of the innovation platform (BankCo) 1 public speech of the company CEO (BankCo) 1 public interview with the company CDO (BankCo) 1 public interview with the white-label platform CEO
	7 press releases/ News articles on incumbent's platform strategy 4 Blog posts describing platform trends within the industry

Table 1: List of qualitative data

We analyzed the interview transcripts and additional selected data sources following the grounded theory methodology [30]. First, 168 open codes were generated from the transcripts and the data used for triangulation. Second, the similarities among the codes obtained by open coding were identified by axial coding. Consequently, 22 subcategories were grouped into eight categories. Table 2 is an example of the coding scheme.

Interview statement and exemplary open codes (underlined)	**Subcategories**	**Categories**
In the end, one concluded that it is unlikely that these offers will actually be successful afterwards, it is perhaps more likely that someone like Amazon, eBay, or Google will discover the whole thing for themselves[1]. Then let's rather build something from within the chemical industry that bundles these areas of expertise, as I said earlier, but then operates independently[2].	1) Pre-empt external platform companies 2) Industry acceptance	1) Incumbent motivation 2) Reason for spin-off

Table 2: Illustration of a coding scheme

Through an intra-case analysis, we investigated in detail the motives for the different platform strategies pursued by incumbents entering the platform economy and related them to the companies' industries. In the discussion, we elaborate on the differences and similarities among the pursued multi-platform strategies, along with their driving motivations.

4. Results

4.1. Case 1: ChemistryCo

Case description. ChemistryCo is an established, globally operating incumbent, leading a specific area of the specialty chemicals industry. Various sources confirmed the low digital maturity of this chemical industry. Until recently, only a small number of digital platforms have existed in this industry, leaving opportunities for introducing new platform ecosystems [31]. A few years ago, ChemistryCo started a digital transformation initiative focused on the development of digital business models along the value chain. Out of this initiative, the company founded a digital platform startup that developed a transaction platform called Chemical Marketplace. This platform connects buyers of chemicals to chemical suppliers of all sizes. It also plans the provision of additional services based on analytics. The incumbent is taking further platform initiatives; for example, the first considerations on an innovation platform are being formulated as part of the company's R&D.

ChemistryCo' multi-platform strategy. The company initiated the development of the Chemical Marketplace transaction platform, which was built by a new separated platform organization. Hence, ChemistryCo became the *investor of the created spin-off*. After birthing the idea of an online marketplace for the chemical industry, the market was screened for existing solutions. The analysis at that time revealed no adequate platform in the western area. ChemistryCo decided to fill this gap and build something new.

We identified that the company had three reasons to separate the platform as a spin-off. The most commonly reported reason for separating the platform from the organization is industry acceptance. The incumbent soon realized that unless the platform was independent and separated from the parent company, *"[Chemical Marketplace] would have become an extended sales arm of [ChemistryCo], not accepted by the market and then you are not a marketplace"* (CDO, ChemistryCo). For this reason, the data worlds of the two companies are completely separated and ChemistryCo is not treated differently from other participants of the ecosystem. Second, *"according to the antitrust laws of most countries, you are not allowed to sell complementary competing products on your own webshop. Because then, you would gain insight into customer relations, prices, and quantities and that is*

an antitrust" (CIO, ChemistryCo). Article 101 of the TFEU prohibits "agreements between undertakings" that can prevent or restrict competition [32]. When platform owners compete with complementors on the platform, they can potentially gain insights into competitively sensible information (e.g. prices), which might violate the above principle. To prevent the flow of information contrary to antitrust law, incumbents tend to spin off their platform operations as separate platform companies [33]. The third reason for separation was to cope with the different culture and competencies needed to operate the new platform. Separation from the founding company enables the platform company to attract the required workforce and achieve the required time to market. *"Everyone who worked there […] made a conscious decision to work for a startup rather than for a large chemical company and these are very different working environments"* (CEO, Chemical Marketplace).

ChemistryCo revealed two motivations for investing in a spin-off. First, expecting that the platform trend from the B2C sector will spill over into the B2B sector, the company decided that by initiating a platform from within the industry, they could pre-empt platform startups or technology companies from outside the industry. Second, as a venture capital provider, ChemistryCo receives a share of the platform's revenues and aims to generate a positive return on investment when selling its shares.

However, ChemistryCo is not only the initiator and investor of Chemical Marketplace but also *joined the platform as a complementor* to use it as an additional sales channel.

Besides joining the transaction platform of the spin-off, the CDO also stated that: *"When we sell in regions where [Chemical Marketplace] is not active, for example in China, we also use existing platforms in these regions."*

In summary, ChemistryCo pursues multiple strategies (investing in spin-off, joining the spin-off's transaction platform, and joining transaction platforms of existing firms) at the same time in contrast to pursuing exclusively one strategy after another. While no synergies arise from joining multiple transaction platforms, ChemistryCo leveraged synergies between investing in a spin-off and joining the spin-off's platform. That is, by initiating and contributing to a new platform made by industry insiders, ChemistryCo pre-empts external companies from entering, which may represent a form of strategic vulnerability or future risk [34].

4.2. Case 2: ConstructionCo

Case description. ConstructionCo is an incumbent enterprise in the construction supply industry, leading the field of building envelopes. As the chemical industry, the construction industry is very complex and has a low level of digital maturity: *"It's only been 1.5 years since the whole digitalization process really began to feel an upswing"* (Member of Digital Board, ConstructionCo). Yet some of the majors in the industry, including ConstructionCo, have actively engaged in digitization and investments in digital companies and technology. A few years ago, ConstructionCo created a digital roadmap, exploring and developing digital solutions for different work phases accompanying typical construction projects. This roadmap inspired ConstructionCo's manufacturer-independent product-finder transaction platform (called Product-finder Platform), which extends beyond the core business of the company. The idea for this business model was then realized by founding a spin-off. Besides, the company is currently in the process of developing an IoT platform.

ConstructionCo's multi-platform strategy. The company decided to *create and invest in a separated spin-off*. The Product-finder platform enables a manufacturer-independent comparison of building products. Product-finder Platform satisfies our definition of a transaction platform because it digitally brings together planners and manufacturers.

As the reason for separation from the founding company, ConstructionCo identified the need for industry acceptance in the sense that "*we wanted to be a manufacturer-independent and neutral platform* (CEO, Product-finder Platform).

ConstructionCo revealed two motivations for investing in a spin-off. First, to pre-empt invading platform companies. According to the CEO of the Product-finder Platform, it is better to *"shape than be shaped"* as this strategic move allows to avoid high margins, negative dependencies on possible external platforms, and loss of control. As digital leaders, they can better serve the interests of their industry. Second, as an investor, ConstructionCo is also entitled to a proportionate revenue share of the spin-off's sales. In this respect, the company sees itself as a strategic partner who aims to establish a long-term business model in the market and a continuous revenue stream for itself.

In addition to investing in a spin-off transaction platform, ConstructionCo also *joins the platform as a*

complementor by publishing its product information on top of the platform. In order to reach customers in geographic regions that the Product-finder platform does not address, ConstructionCo participates in transaction platforms of existing firms.

Moreover, ConstructionCo regularly screens the market for potential startups and technologies to invest in. Although this focus is not limited to platform companies, ConstructionCo took a *majority stake in a transaction platform* where architects and building product manufacturers can inform and exchange information about new products with videos.

Lastly, ConstructionCo is currently *developing an Internet of Things (IoT) platform* that will transfer the building envelope to the digital world and serve as a second business in addition to the traditional product business. To avoid dependencies and high fixed payments to external companies, and to ensure the development of know-how within its own company, ConstructionCo decided to build a new platform. The IoT platform is currently restricted to internal developers but might open up to third-party developers in the future, potentially turning into an innovation platform.

In summary, ConstructionCo pursues multiple strategies (investing in a spin-off and an existing firm, joining the spin-off's platform and transaction platforms of existing firms, and developing an innovation platform) simultaneously in contrast to pursuing exclusively one strategy after another. ConstructionCo leveraged synergies between investing in a spin-off and joining the spin-off's platform in the sense that ConstructionCo contributes to the success of a platform made by industry insiders. Hence, it pre-empts external companies from entering the industry, which may represent a future risk.

4.3. Case 3: BankCo

Case description. BankCo is an incumbent full-service bank within the banking and financial services industry. Its customers include private clients, medium-sized companies, corporations, the public sector, and institutional investors. As customer expectations increase and more fintechs enter the market, banks have been under pressure to digitize for some time, so the industry is already digitally mature. With the ongoing digitalization of the industry and the blurring ecosystem boundaries, platforms are increasingly becoming the method of choice for incumbent financial services institutes, especially in the retail and commercial banking fields. Alongside the incumbents that are establishing themselves as platform owners and orchestrators, tech giants are gradually trying to invade the banking business with their platforms. Consequent to these developments, companies in the industry must decide whether to build or join one or more platform ecosystems. Our case company regards its customer relationships as its core competency. For this reason, it decided to become a platform owner and orchestrator. During the last two years, our case company has initiated and implemented numerous platform-based business models, including transaction platforms and an innovation platform.

BankCo's multi-platform strategy. BankCo has *built a marketplace* on which it no longer offers only its own financial products, but also external products provided by complementors. On top of Transaction Platform 1, BankCo *offers several key services* that are supplemented by so-called "beyond banking" offers, such as accounting tools provided by fintechs. Hence, BankCo is simultaneously platform owner and non-competing complementor of Transaction Platform 1.

The company revealed four motivations for building a transaction platform. By positioning itself as a platform owner, BankCo can access the customer data generated on the platform, and hence develop new business models and implement new features. The importance of this argument was heavily emphasized: *"We believe that what we learn from these usage patterns and why a customer likes a product from another bank, from another provider, more than our own is worth much more than the few 100 product deals"* (Head Digital Commercial Offering & Processes, BankCo). Closely related to the above motivation, BankCo stated no desire to become a pure complementor because direct access to its customers is necessary for customer retention and must not be lost. *"In the digital age, contact with customers is only maintained by those who offer them the best products, even if these are third-party offers"* (Vice Chairman of the Management Board, BankCo). The company perceives tech giants, which also position themselves as platforms within the banking industry, as its greatest threat. Against this concomitant threat, the company is accelerating the pace of its own platform initiatives to pre-empt industry outsiders from entry. By positioning itself as a platform owner, BankCo also expects to increase its margins: "*Whoever has the customer access gets the sales margin. And that grows from year to year. In contrast, the pure producer margin is getting smaller and smaller"* (CDO, BankCo). This statement demonstrates that besides leveraging platforms for customer access (and hence gaining insights that

improve the company's offerings), the company utilizes the platform's mediation service as a profitable business model.

In addition to Transaction Platform 1, BankCo *uses a white-label platform to provide Transaction Platform 2,* which customers can use to access deposit products offered on top of the platform by third parties. This white-label strategy describes the establishment of a transaction platform that integrates a white-label platform solution operated by an external company, instead of developing the platform infrastructure inhouse and from scratch. In our case, the marketplace frontends of Transaction Platform 2 are connected to a separately running instance of a white-label platform solution provided by a fintech. The complementary banks that offer deposit products are connected to the backend of the fintech platform. This backend is connected to the incumbent's frontends, which represents the customer interface of the platform. BankCo neither develops nor runs the platform technology; instead, it provides and orchestrates the platform. That means BankCo provides the platform interface to match offers with respective customers and is entitled to determine who is allowed to offer its products on the platform.

To illustrate, see figure 1. At the center is the white-label platform owner (fintech) who connects complementary banks, who offer deposit products, to its platform.

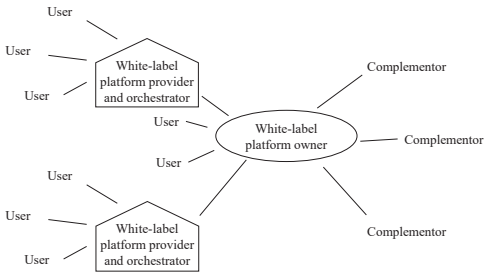

Figure 1: White-label platform strategy

In the simple case, the white-label platform owner matches these complementors to users in the sense that users can use the platform to decide which deposit they want to receive. However, if the user has no bank account for the complementary bank, she needs to open a new one. In the worst case, she would have to open multiple bank accounts to obtain multiple deposits. In order to counteract this inconvenience, the white-label platform owner partners with other banks as these have the possibility to use the user's existing bank account to manage multiple external deposits. Hence, users can access various third-party deposit products under the existing bank account without having to continuously create and switch bank accounts. Instead, users can handle deposit administration centrally. We termed these "partner banks" as white-label platform provider and orchestrator to illustrate that they provide and orchestrate the white-label platform under their own corporate brand[2]. As a result, the white-label platform strategy connects an incumbent who controls the user side with a platform company who controls the complementor side by granting the incumbent access to the platform.

In addition to the motivations identified for building Transaction Platform 1, BankCo named specific motivations for choosing the white-label platform strategy. On the one side, the company saves the costs of building a platform from scratch, and on the other side, BankCo can leverage the existing complementor ecosystem of the fintech to immediately offer various third-party products. Potential disadvantages of this strategy comprise strategic dependency, lack of control over technology development, and limited adoption of platform technology know-how.

Besides engaging in two transaction platforms, BankCo has *built an innovation platform* which provides third-party complementors access to a wide range of data and services via developer APIs. The decision to build the innovation platform was encouraged by the following motivations. First, the innovation platform is seen as an enabler for the the company's entire platform business model. By providing open APIs, the bank allows third-party developers to develop solutions that BankCo cannot develop itself. Moreover, by providing the best offer, the bank can differentiate itself from the competition, maintain existing customers, and win new customers. Second, BankCo financially participates in some of the solutions developed on the platform, and hence benefits from the growth of other companies. Furthermore, BankCo regards the complementor ecosystem of the innovation platform as a future opportunity for gaining partners in its marketplaces. Finally, BankCo monetizes the APIs, which reflects a new source of revenue.

In summary, BankCo pursues multiple strategies (building a transaction platform, joining the transaction platform, building an innovation platform, and using a white-label transaction platform) at the same time in contrast to pursuing exclusively one strategy after another. Although BankCo does not leverage any synergies between platform strategies

[2] Although the white-label platform owner neither provides the platform interface to the users of the "partner bank" nor is he entitled to its orchestration, we refer to him as owner as he provides the platform to its own users which he is also entitled to orchestrate.

yet, the decision to join its Transaction Platform 1 as a complementor can generate synergies (e.g. preferential treatment of own complements) if BankCo decides to compete with complementors.

5. Discussion

The results provide initial evidence that industry characteristics influence platform strategies. In particular, the results indicate that customer group (B2B versus B2C), product type (physical product versus digital service), and sector-specific regulation influence the entry decision of industry outsiders, which again influences incumbents' platform strategies. In the following, we will use the term asset-heavy company (such as ChemistryCo and ConstructionCo) to describe companies that operate physical products in B2B industries and asset-light company (such as BankCo) to describe companies that offer digital services in B2C-oriented industries.

Industries that are characteristic by business customers, physical products, and restrictive regulation (such as the chemical and the construction industry) are more likely to reduce new entry and blurring industries, acting as significant barriers to entry. For instance, business customers require long-term and individually negotiated contracts, which reduce the applicability of standard prices and deliveries primarily adopted in B2C industries. Moreover, B2B markets have fewer customers than B2C markets, which limits the total value that can be extracted from network effects. While B2C industries are rather characterized by consumer homogeneity and significant network effects, within B2B industries, it is more difficult for industry outsiders to cope with the heterogeneity of business customers and harness network effects. In terms of the product type, producing physical products requires large investments in production facilities and compensating high variable costs. In contrast, digital services are characterized by marginal costs converting to zero. This is why it is less attractive and more difficult to enter existing product industries than industries with digital services. Lastly, sector-specific regulations represent another factor that influences new entry and blurriness of industries. On the one side, firms that operate in highly regulated industries acquired domain-specific knowledge such as reviewing whether the customer is allowed to acquire dangerous goods (e.g. chemical industry) or that products need to be sold through tenders (e.g. construction industries); knowledge which is difficult to obtain and to convert into operation as a new entry. On the other side, sector-specific regulation can also open an industry to new entry, as in the case of the Payment Service Directive in the financial industry.

To summarize, the results indicate that asset-heavy companies operating in highly regulated industries mainly pursue the invest and join strategies. In contrast, the asset-light company, which was recently confronted with an opening of the industry, follows the build and white-label strategies. Based on the brief review of how industry characteristics influence entry decisions, we argue that asset-heavy companies significantly differ in their platform strategies compared to asset-light companies because they are less threatened by external firms gaining control over the industry's value chain. We observe that companies within an asset-heavy industry do not each aim to build a platform and engage in platform competition with other incumbents. In contrast, we observe that the industry accepts one neutral platform and does not aim to initiate competition on the platform level.

However, the industry characteristics are not the only reasons why companies do not pursue the build strategy. Another reason is that asset-heavy companies largely perceive platforms as an additional sales channel and less as "vehicle" to secure their business in the future. Hence, if one platform already exists for a specific market (mainly in terms of geography), these companies decide to join the platform instead of building a platform from scratch. The last reason is that, at least in the European Union, antitrust enforcement begins to prohibit platform owners to also act as competing complementors on their platforms. Hence, asset-heavy companies risk regulatory intervention if they sell their products on their platform, rendering the building strategy unattractive. In order to counteract the possibility that a "neutral" platform develops in ways detrimental to the industry, some incumbents invest in platforms to ensure that the platforms act in the best interest of their respective industries.

Moving from asset-heavy industry to the asset-light industry, our findings illustrate that the asset-light company, which was recently confronted with an opening of the industry, pursues significantly different platform strategies; namely, the build and white-label strategy. The motivation behind these strategies can be attributed to the industry characteristics (deregulation in form of PSD2, digital services, and partially B2C), which reduce entry barriers and increase the threat of external firms gaining strategically relevant positions. That is, asset-light companies perceive a loss of control over customer access and market-level data, two components that critical to remain competitive and innovative in the future [34]. As a consequence,

asset-light companies are forced to compete on the platform level. Figure two summarizes the different platform strategies.

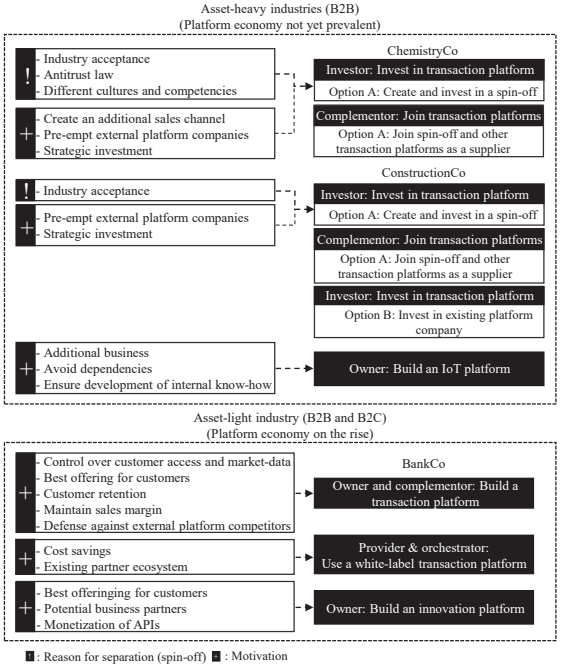

Figure 2: Multi-platform strategies followed by our case companies

6. Conclusions

Companies that operate digital platforms are growing rapidly. Theoretical and empirical research has largely explored digital platforms in the context of digital-native companies. Only a small set of research explores how incumbent firms transition into the platform economy and how they need to change to benefit from platform economics [5, 7, 10, 17-19]. However, this stream of research has studied incumbents under the assumption that they can either build a platform or join an existing platform.

In contrast, the results of our multiple case study on three incumbent companies from the chemical, construction, and banking industry demonstrate different insights. First, incumbents pursue multiple platform strategies simultaneously. They do not pursue exclusively one strategy after another. Second, platform strategies range from building and joining a platform over investing in and acquiring a platform to using white-label platforms. That is, using the platform technology of a white-label platform owner to match the users of the incumbent with the complementors of the white-label platform. Thus, the incumbent transitions into the role of a platform provider and orchestrator without becoming the owner of the platform. This strategy has the advantage of saving development and maintenance costs as well as immediately accessing an installed base of complementors. However, potential disadvantages include strategic dependency, lack of control over technology development, and limited adoption of platform technology know-how.

Moreover, our results provide initial evidence that industry characteristics influence platform strategies. We find that asset-heavy companies largely draw on investing and joining strategies, whereas the asset-light company is particularly engaging in building and white-label strategies. The invest and join strategies are primarily motivated by avoiding antitrust issues and building new sales channels. In contrast, the build and white-label strategies are mainly motivated by remaining in control over customer access and market-level data. Either way, all case companies agreed that it is crucial to enter the platform economy to pre-empt external companies from building strategically relevant positions.

For managers of incumbent firms, the results have three implications. First, the results demonstrate that managers should consider pursuing multiple platform strategies when transiting into the platform economy. This way, they can satisfy different customer groups and benefit from synergies. Second, the results indicate that managers should carefully consider whether they want to build a platform and join it as a complementor. Our case companies decided against this strategy as it reduces complementors acceptance of the platform and might lead to antitrust issues. Third, the new strategy of using a white-label platform reflects a promising strategy for managers who quickly need to solve the chicken-and-egg problem, remain in control over the orchestration of both sides, and do not want to build the platform technology.

Because our study is qualitative, it is necessarily limited by small sample size and low causal power. For future research, we encourage (1) to investigate other industries to extend our findings and draw conclusions from comparing different multi-platform strategies, (2) to consider how platform ownership (by a single company, consortium, or peer-to-peer network) influences multi-platform strategies, (3) to understand the competitive strategies for emerging winner-takes-all markets between native platform companies and incumbents (e.g. in the mobile payment context).

7. References

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