TECHNISCHE UNIVERSITÄT MÜNCHEN

TUM School of Management

Essays on B2B Electronic Marketplaces: Linking Theory with Entrepreneurial Practice

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Vollständiger Abdruck der von der TUM School of Management der Technischen Universität München zur Erlangung eines Doktors der Wirtschafts- und Sozialwissenschaften (Dr. rer. pol.) genehmigten Dissertation.

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Die Dissertation wurde am 09.03.2022 bei der Technischen Universität München eingereicht und durch die TUM School of Management am 15.04.2022 angenommen.

Abstract

This doctoral thesis deals with digital marketplaces that focus on electronic commerce between different companies. These electronic marketplaces (EMs) usually act as intermediaries or platforms between the supply and demand side in business-to-business (B2B) markets. Electronic commerce's relevance is increasing in numerous commercial and industrial contexts, which makes digital marketplaces increasingly important. In the private consumer sector, successful marketplaces have been in existence for several years now. They have already become part of the daily routine of many people. In business-to-business trading, digital marketplaces continue to be perceived as innovative or new, which makes them an interesting phenomenon and object of investigation. This phenomenon is examined in depth in this thesis, which should serve both science and practice.

First, the most recent literature on electronic marketplaces in a B2B environment is summarized based on an extensive literature overview. This overview shows that new research focuses have emerged over time in the field of B2B electronic marketplaces. Here, one focus deals with a holistic business model perspective on the phenomenon of B2B EMs. This perspective is important because the business model of an electronic marketplace became much more sophisticated than it was years ago. B2B EMs were once just matchmakers between supply and demand. This is still valid because most EMs support the so-called request for quotation (RFQ) process allowing a potential buyer to send requests to the respective supplier in order to receive a quote (open marketplace model).

However, the direct purchase of products and services is meanwhile also possible on some B2B EMs besides the established RFQ functionality (closed marketplace model). Consequently, these EMs aspire to become the transaction partner and would like to abandon the role of the one-time matchmaker. In addition, there are B2B EMs that gather information about suppliers and offerings from a variety of different marketplaces and web shops to display it in one user interface (meta-search marketplace model). These developments show that the business model of the electronic marketplace has changed over time in the B2B context. In other words, there is no longer one B2B electronic marketplace business model, but several different ones – each with distinct advantages and disadvantages for the platform participants and operator.

Second, these business models are described and analyzed in this thesis, contributing to the scientific discussion on B2B electronic marketplaces. In concrete terms, I developed and tested a new typology for B2B electronic marketplaces. Furthermore, relevant implications and consequences for the practice were derived out of this typology.

Third, adoption theory plays a major role when talking about digital business models that are generally perceived as new. In this context, I conducted a qualitative study on the challenges faced by several EM operators. My research extends and complements an existing adoption model with new findings that can be seen as another contribution to the research field of B2B electronic marketplaces.

Fourth, I dealt with behavioral economic aspects and the question, if it is possible to influence the behavior of website users with so-called trust-elements, e.g., seals, company logos, customer testimonials. For this purpose, an A/B testing experiment was carried out. This experiment contributes to the research field of human-computer interaction by showing the positive influence of trust-elements on users' behavior.

Fifth, besides the theoretical work in the beginning of this thesis and the mentioned experiment, I also conducted a case study dealing with a young B2B electronic marketplace venture. This is the first case study in which such a business model is validated with a so-called minimum viable product (MVP) according to the lean start-up method. This contributes especially to the research field of digital entrepreneurship. Furthermore, relevant aspects in the early phase of a new EM business model are discussed as well contributing to the scientific discussion on B2B electronic marketplaces.

Sixth, on the basis of a quantitative study with a sample of around 3,500 young companies from Germany, I show to what extent and in which dimensions e-commerce start-ups differ from other start-ups. Here, one key result is that e-commerce founders work more often part-time, tend to be younger, and are also less experienced but more risk-loving. Commonalities between e-commerce and non-e-commerce start-ups existed as well so that, for example, academics in the founding team increase performance indicators such as revenues, labor productivity, and profits.

Overall, this dissertation contributes with its multi-method approach new insights to the research field of B2B electronic marketplaces.

Zusammenfassung

Die vorliegende Dissertation handelt von digitalen bzw. elektronischen Marktplätzen, die sich auf den gewerblichen – also „Business-to-Business“ (B2B) – Online-Handel zwischen Unternehmen fokussiert haben. Derartige Marktplätze fungieren als Intermediär oder Plattform zwischen der Angebots- und der Nachfrageseite. Insgesamt nimmt die Bedeutung des Online-Handels in zahlreichen gewerblichen Kontexten zu, wodurch auch digitale Marktplätze immer wichtiger werden. Im Privatkonsumentenbereich existieren schon seit einigen Jahren erfolgreiche Marktplätze, die mittlerweile zum Alltag vieler Menschen gehören und kaum noch wegzudenken sind. Im gewerblichen Handel werden digitale Marktplätze hingegen weiterhin als innovativ oder neu wahrgenommen, was sie zu einem interessanten Phänomen und Untersuchungsgegenstand macht. Dieses Phänomen wird in der vorliegenden Arbeit anhand von verschiedenen Fragestellungen vertiefend behandelt, was sowohl der Wissenschaft als auch der Praxis dienen soll.

Zuallererst wird die aktuelle Literatur über elektronische Marktplätze im B2B-Kontext in Form einer Literaturübersicht zusammengefasst. Diese Übersicht zeigt, dass sich im Laufe der Zeit neue Schwerpunkte im Forschungsfeld der B2B-Marktplätze ergeben haben. Einer dieser Schwerpunkte beschäftigt sich mit einer ganzheitlichen Geschäftsmodellperspektive auf B2B-Marktplätze. Diese Geschäftsmodellperspektive ist insofern wichtig, da sich das einstige Marktplatzgeschäftsmodell über die Jahre verändert bzw. erweitert hat. B2B-Marktplätze werden heutzutage noch oft als digitaler Vermittler zwischen Angebot und Nachfrage angesehen. Diese Betrachtung ist im Allgemeinen durchaus zutreffend, da B2B-Marktplätze in der Hauptsache dafür sorgen, dass ein potentieller Käufer ein Angebot von einem Verkäufer auf digitalem Wege anfragen kann. Dieser digitale Prozess zur Anfrage eines Angebots (engl. *request for quotation process*, abgekürzt „RFQ“) ist typisch für „offene B2B-Marktplätze“.

Im Speziellen kann man jedoch auch festhalten, dass man auf manchen B2B-Marktplätzen mittlerweile Direktkäufe vornehmen kann, neben der klassischen RFQ-Funktionalität. Diese B2B-Marktplätze möchten zum Transaktionspartner werden bzw. streben an, die Rolle des „einmaligen Vermittlers“ zu verlassen. In der vorliegenden Arbeit wird diese Ausprägung eines B2B-Marktplatzes als „geschlossener Marktplatz“ bezeichnet. Zudem gibt es auch B2B-Marktplätze, die Lieferanten- und Angebotsinformationen in einer einheitlichen Nutzeroberfläche zusammenfassen, was in dieser

Arbeit als „Metasuch-Marktplatz“ benannt ist. Die auf einem Metasuch-Marktplatz dargestellten Lieferanten- und Angebotsformationen stammen in der Regel von offenen Marktplätzen und Webshops.

Derartige Ausprägungen des Marktplatzgeschäftsmodells im B2B-Bereich zeigen, dass sich etwas im zeitlichen Verlauf verändert hat. In anderen Worten ausgedrückt, könnte man sagen, dass es nicht mehr nur das „eine“ B2B-Marktplatzgeschäftsmodell gibt, sondern mehrere – jedes mit seinen spezifischen Vor- und Nachteilen für die Teilnehmer sowie den Betreiber der Plattform.

Die genannten Ausprägungen werden in der vorliegenden Arbeit beschrieben und analysiert, was einen Beitrag zur wissenschaftlichen Diskussion im Forschungsfeld der B2B-Marktplätze darstellt. Konkreter ausgedrückt, wurde von mir eine neue Typologie für B2B-Marktplätze entwickelt und getestet. Hieraus konnten zudem relevante Implikationen und Konsequenzen für die Praxis abgeleitet werden.

Ob eine digitales Geschäftsmodell von der jeweiligen Nutzergruppe angenommen und akzeptiert wird, ist ebenfalls ein wichtiger Aspekt im Kontext der oft als „neu“ wahrgenommenen B2B-Marktplätze. Mit Fokus auf den Herausforderungen von Plattformbetreibern habe ich eine qualitative Studie umgesetzt. Anhand der Erkenntnisse aus der Studie konnte ein bereits existierendes Modell zur Nutzerakzeptanz von neuen digitalen Geschäftsmodellen ergänzt und erweitert werden, was als ein weiterer Beitrag zum Forschungsfeld der B2B-Marktplätze angesehen werden kann.

Zudem beschäftigte ich mich auch mit verhaltensökonomischen Aspekten und der Frage, ob man das Verhalten von Nutzerinnen und Nutzern einer Webseite durch „vertrauensfördernde Elemente“ (engl. *trust elements*) beeinflussen kann, wie z.B. durch die Verwendung bzw. Darstellung von Gütesiegeln, Unternehmenslogos oder Kundenberichten. Um das herauszufinden, habe ich ein Experiment, genauer einen A/B-Test, durchgeführt. Das Experiment trägt zum Forschungsfeld der Mensch-Computer-Interaktion bei, da es unter anderem zeigt, dass vertrauensfördernde Elemente einen positiven Einfluss auf das Nutzerverhalten haben.

Neben der theoretischen Vorgehensweise zu Beginn der Arbeit und dem erwähnten Experiment, setzte ich auch eine Fallstudie um. Die Fallstudie handelt von einem jungen B2B-Marktplatzgeschäftsmodell und wie dieses anhand der sogenannten Lean Start-up Methodik validiert wurde. Dies trägt insbesondere zum Forschungsfeld des digitalen Unternehmertums bei. Es konnten ebenfalls relevante Aspekte für die frühe Phase eines

neuen B2B-Marktplatzgeschäftsmodells identifiziert werden, was als ein weiterer Beitrag zur Forschung zu B2B-Marktplätzen angesehen werden kann.

Darüber hinaus habe ich auch eine quantitative Studie mit einer Stichprobe von rund 3.500 deutschen Start-ups durchgeführt. Die Studie handelt hauptsächlich von den Unterschieden und Gemeinsamkeiten zwischen E-Commerce-Start-ups und Nicht-E-Commerce-Start-ups. Eine interessante Erkenntnis aus der Studie ist unter anderem, dass Gründerinnen und Gründer von E-Commerce-Start-ups häufiger nebenbei bzw. in Teilzeit an ihrer Unternehmung arbeiten. Sie sind in der Regel auch jünger, haben dementsprechend weniger Berufserfahrung und sind gleichzeitig auch risikoaffiner. Gemeinsamkeiten zwischen E-Commerce-Start-ups und Nicht-E-Commerce-Start-ups bestanden insofern, dass beispielsweise Akademikerinnen und Akademiker in einem Gründerteam gewisse Leitungsindikatoren, wie Umsatz, Produktivität und Gewinn steigern.

Zusammenfassend bringt die vorliegende Dissertation, mit ihrem Multi-Methoden-ansatz, neue Erkenntnisse hervor, die zum Forschungsfeld der B2B-Marktplätze beitragen.

Acknowledgements

During my PhD journey, I received a lot of support at various levels. I am very grateful to all the people and institutions involved. First and foremost, I was fortunate to have Hanna Hottenrott as my scientific supervisor. Thanks a lot, Hanna, for your tireless support and ongoing encouragement.

Second, I was very lucky to be accepted by the Hanns-Seidel-Stiftung directly at the beginning of my PhD journey. Without the encouragement of Thorsten Philipp, who now works at the TU Berlin, it would probably not have been possible. The foundation allowed me financial independence and flexibility over most of my PhD time. In addition, I met great people and had inspiring discussions at events and trips organized by the foundation.

Third, I would like to thank Claudia Doblinger for her willingness to serve as my second examiner. In addition, special thanks go to Michael Dowling from the University of Regensburg and Christoph Zott from the IESE Business School, who gave me both guidance when it was necessary.

Forth, thanks a lot to my colleagues and friends at the chair and the faculty, and the bachelor and master students, who helped me during my research projects or even served as co-authors. The TUM is an outstanding institution with many brilliant and talented people.

Fifth, I would also like to thank my former supervisor and Managing Director of Chemie-Cluster Bayern, Patrick Prühs, who made it possible for me to be involved in the practice besides my scientific activities.

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1 Introduction

1.1 Motivation

Electronic marketplaces (EMs) function as digital intermediaries between two or more parties, usually between buyers and suppliers (e.g., Malone et al. 1987; Bakos 1991; Bakos 1997; Baily & Bakos 1997, Kaplan & Shawney 2000; Giaglis et al. 2002; Holland 2002; Hadaya 2004; Alt & Klein 2011). For this reason, they are often called "matchmakers" (e.g., Evans & Schmalensee 2016) or "two- or multi-sided platforms" (e.g., Belleflamme & Peitz 2019a; Belleflamme & Peitz 2019b, Belleflamme & Peitz 2019c). Research in both business administration and economics, and in interdisciplinary fields such as the management of information systems, has been dealing with the phenomenon of electronic marketplaces. Due to the interdisciplinary nature of the topic, there is no uniform definition of this phenomenon (Saprikis et al. 2009; Wang & Archer 2007). Wang and Archer (2007, p. 91) define EMs as "places where buyers and sellers conduct transactions by electronic means". They further specify the nature of these places as "physical, virtual, or conceptual" (Wang & Archer 2007, p. 91). According to Standing et al. (2008), an EM can be described as an "inter-organizational information system that allows the participating buyers and sellers in some market to exchange information about prices and product" (Standing et al. 2008, p. 3).

In the business-to-consumer (B2C) sector, people are nowadays very familiar with platforms that act as intermediaries between at least two parties. Here, these platforms play an integral part in today's consumer behavior. Travels and accommodations can be booked, for example, on Booking.com or Airbnb, insurance can be bought via Check24, or virtually all household, entertainment, and electronic articles can be purchased on Amazon. These platforms mostly aggregate many vendors or providers, which makes it so attractive for the consumer to use them (e.g., Bakos 1997, Bakos 1998). In addition, prices can be easily compared, which provides a higher degree of transparency compared to offline markets (e.g., Evans & Schmalensee 2016).

In a similar, but still different way, electronic marketplaces also exist in the business-to-business (B2B) sector. Here, B2B electronic marketplaces bring together companies from the demand side with companies from the supply side (e.g., Kaplan & Shawney 2000; Chow et al. 2000; Dai & Kauffmann 2001; Pavlou 2002; Day et al. 2003; Janita & Miranda 2013; Deng & Wang 2016). In the early 2000s, B2B EMs received a lot of

attention from practitioners and scientists because they had a peak at the time of the dot-com bubble (Schmitt 2019). However, almost all B2B EMs of that time ceased operations during or shortly after the peak period (Schmitt 2019). Interest on the part of practitioners and scientists also declined as a result.

More recently, B2B electronic marketplaces were experiencing a new peak, which is why this topic became the research field of my choice. Both established companies as well as start-ups were initiating and pursuing the business model of a B2B electronic marketplace in certain industries. The example of the steel trading company Klöckner & Co SE, which founded a B2B electronic marketplace for steel in 2017 (under the name "XOM Materials"), is particularly well-known in the field. In 2019, I had the possibility to meet Gisbert Rühl, the former CEO of Klöckner and initiator of XOM Materials for a meeting at the start-up and corporate innovation fair "Bits&Pretzels" in Munich. His reasoning for the new "boom of B2B EMs" was that it must be possible to create a similar buying or selling experience in B2B as we have already in B2C, i.e., high price transparency or a general clarity across different product portfolios from various producers or distributors. There are many other examples of B2B electronic marketplaces besides Klöckner or XOM Materials that will be further discusses in the course of this dissertation.

Yet, the more I dealt with the topic scientifically, the more I experienced a feeling of dissatisfaction with the state-of-the-art in EM research. In particular, the existing literature did not correspond in relevant aspects to what B2B platform providers considered and experienced as highly relevant to the success of their EM models. This observation led me to several practice-oriented research projects that will be present in this dissertation.

1.2 Structure of the thesis & research objectives

In order to structure insights from existing research on electronic marketplaces (EMs), the first objective of this doctoral thesis is to review the most recent literature on electronic marketplaces focusing particularly on work related to EMs in a B2B environment. This is done based on an extensive literature overview which I present in **Chapter 1 / 1.3 Literature overview on B2B electronic marketplaces**.

Knowing the literature and perceiving practice activities from various companies evoked for the first time my feeling of dissatisfaction: I perceived that in practice,

different types of B2B electronic marketplaces exist that researcher did not describe before. This means that previous literature does not differentiate between different types of B2B electronic marketplaces. They still deal with the high-level definition of the "matchmaker" (e.g., Evans & Schmalensee 2016), which is often inaccurate because it does not capture today's variety of B2B electronic marketplaces. Therefore, one of the goals of this thesis is to develop a typology of matchmakers that takes into account the wide heterogeneity of EMs. This resulted in a new typology presented in **Chapter 2 / Essay 1 / B2B electronic marketplaces: Functions and consequences of the current operating models for commodity marketplaces** and in **Chapter 3 / Essay 2 / B2B electronic marketplaces in the chemical industry: A descriptive study.** Essay 2 can be understood as a validation of the newly developed typology from Essay 1. Thus, my first theoretical contribution to the literature on (B2B) electronic marketplaces lies in a validated and tested typology that describes different variants or operating models of B2B EMs, thereby discussing relevant implications for research as well as for practitioners.

To push the frontier of research further, I followed a qualitative research approach in which interviews were of particular importance. I conducted these interviews with relevant decision makers from different B2B marketplace operators. The interviews focused on the challenges faced by operators at the start of the venture. This is interesting because electronic marketplaces are often seen as a new purchasing and sales channel in the B2B sector. Consequently, a central question is whether a new EM is accepted and used by its target and user groups. Within the research field of B2B e-commerce, such a question addresses the literature stream that deals with the "adoption of B2B electronic marketplaces" (e.g., Driedonks et al. 2005; Standing et al. 2010). **Challenges affecting the adoption of B2B electronic marketplaces** are, therefore, the main topic of **Chapter 4 / Essay 3**. In this context, my research extends and complements an existing adoption model with new findings. This represents my second contribution to the research field of (B2B) electronic marketplaces.

As mentioned before, B2B electronic marketplaces are usually perceived as novel in the respective industry and are confronted with adoption hurdles. Trust is a central aspect when it comes to increasing the likelihood that a new product or service (= an innovation) will be adopted by the respective target or user group(s) (e.g., Urban et al. 2000; Gefen et al. 2003; Kracher et al. 2005; Chien et al. 2012; Cry 2013). So-called trust elements are used nowadays to increase the trust level of a website user in a respective website, such as logos of partner companies, seals of testing institutes, or testimonials from customers.

This topic is rather apart from the marketplace literature and can be assigned to the research field of "human-computer interaction" (e.g., Wang & Emurian 2005; Taddeo 2009; Beldad et al. 2010; Kim et al. 2010; Pengnate & Antonenko 2013; Seckler et al. 2015). Much of the research on trust elements in this field is based on experimental research usually taking place in a laboratory setting. Yet, the influence of trust elements can and need to be tested under real business conditions. To show this, we designed and performed an experimental field study which is presented in **Chapter 5 / Essay 4 / Website design and trust elements: A/B testing on a start-up's website.** This experiment used the methodology of A/B testing to generate findings that are not affected by the selection of users and other confounding factors that often hamper a causal interpretation of any findings. The experiment has shown that in our case the presence of trust elements on website variant A did not enhance the user's session duration compared to variant B (without trust elements). Practically, the users stayed the same time on the two variants, but more requests were made on the variant with trust elements. It can, therefore, be concluded that trust elements have a positive influence on user behavior. Here, the contribution to the field of human-computer interaction lies in the "real-life-scenario application" of the methodology on the website of a fictitious start-up.

According to the motto "practice what you preach", I became active as an entrepreneur in the field of electronic marketplaces besides my research projects, and quickly failed. To "fail fast" is a major idea of most innovation projects or start-up activities that is reflected by the concepts and approaches of a "minimum viable product" and the "lean start-up" (e.g., Ries 2011; Blank 2013; Frederiksen & Brem 2017; Dennehy et al. 2019; Shepherd & Gruber 2020). These models are located in the (digital) entrepreneurship literature (e.g., Nambisan 2017; Kraus et al. 2019; Sahut et al. 2021). In the form of a case study with qualitative and quantitative data, I examine these concepts in **Chapter 6 / Essay 5 / Validating the product-market-fit of a B2B platform venture with a minimum viable product: The Coating Radar case study**. The case shows how to test the idea of a new B2B marketplaces venture according to the lean start-up approach. It is the first scientific case study that addresses the validation of an early-stage B2B electronic marketplace venture what can be considered as a contribution to the digital entrepreneurship literature.

Chapter 7 / Essay 6 / E-Commerce start-ups: Characteristics and performance takes a founder-centered perspective by addressing the question of what characterizes e-commerce start-ups and, in particular, their founders and whether these characteristics

distinguish them from other start-ups. Understanding founder and firm characteristics of start-ups is crucial for developing theories on their performance (e.g., Cooper et al. 1988; Chandler & Jansen 1992; Lumpkin & Dess 1996, Lumpkin & Dess 2001; Hamilton 2001; Rauch et al. 2009). So far, we know relatively little about founder and firm characteristics of young e-commerce businesses, which is both surprising and alarming, as the e-commerce sector reached a new all-time high (OECD 2020). To identify differences and similarities between e-commerce start-ups and non-e-commerce start-ups, I built an econometric model to classify start-ups into e-commerce and other businesses. The data stems from the 2017-wave of the IAB/ZEW Start-up Panel with the reference year 2016 and includes information on 3,457 companies founded between 2010 and 2015. 845 (24.44%) of the 3,457 firms can be assigned to the group of e-commerce start-ups within the sample. The key result from the analysis of characteristics of e-commerce businesses is that e-commerce founders run their businesses more often part-time or as a side business. Furthermore, e-commerce founders tend to be younger and also less experienced. These findings contribute to the research stream on "part-time entrepreneurship" (e.g., Petrova 2012; Block & Landgraf 2016; Block et al. 2019). In addition, the results show that the performance drivers of e-commerce start-ups are quite comparable to those of offline businesses with founder experience and innovation efforts being important performance drivers.

In **Chapter 8 / Summary & future research,** I summarize the research projects while highlighting their main contributions to research and practice. Furthermore, possible future research directions are pointed out.

Within the research on which this dissertation builds, I have chosen a multi-method approach to deal with the broad research field of B2B electronic marketplaces adequately – from purely theoretical work combined with desk research to the application of qualitative, quantitative, and experimental methods. Table 1.1 presents the research questions and objectives of each essay.

Table 1.1: Research questions and objectives

Essay	Research question	Objective
1	How does a comprehensive typology for B2B electronic marketplaces look like?	Achieving a new typology for B2B electronic marketplaces that reflects the business reality
2	Is it possible to test and validate the developed typology?	Testing of the typology and deriving implications for the practice
3	What influences the adoption of current B2B electronic marketplaces?	Verifying and updating an existing adoption model
4	Do trust elements on start-ups' websites have a positive influence on the user behavior?	Proving the effect of trust elements on a website with an A/B testing experiment
5	How to test the idea of a new B2B electronic marketplace under resource constraints?	Pioneering application of the Minimum Viable Product concept and the Lean Start-up approach in the context of a B2B electronic marketplaces venture
6	What characterizes e-commerce start-ups and its founders, and are they different from other start-ups?	Identifying similarities and differences between e-commerce start-ups and non-e-commerce start-ups

1.3 Literature overview on B2B electronic marketplaces

The purpose of this overview is to review the scientific literature in the field of electronic markets (EMs) for the period from 2009 to 2019/20, and to supplement an existing literature review from Standing et al. (2010) that deals with the period from 1997 to 2008. The latest paper included in this overview was published in January 2020. The overview focused on the top 20 journals from the subject areas of "business, management & accounting" (BUSI) as well as "economics, econometrics & finance" (ECON). The subject areas are taken from the literature database SCOPUS. The journal selection was based on the SCImago journal rankings and the h-index. By using the most common search terms in the field of electronic markets, a preselection was carried out. The preselection contained 785 journal papers that were published in the mentioned period. The search terms were the following: "electronic market" ("e-market"), "electronic hub" ("e-hub"), "digital platform", "electronic exchange", "electronic intermediary", "two-sided market", "multi-sided market", "inter-organizational system", and "portal". The plural forms and abbreviations were also included in the search query.

After a human screening based on the abstracts, 264 papers remained. Regarding the screening, the only selection criterium was that the paper had to deal with electronic marketplaces, according to the general and most common understanding of electronic marketplaces: a market where demand and supply is brought together in a digital way by the use of internet technology. Another limitation was made within this sample by selecting the papers that had a clear focus on B2B electronic marketplaces. Twenty papers were identified which dealt with B2B EMs (see Table 1.2 and Appendix 1).

Table 1.2: Journal selection and publications focusing on B2B EMs (2009-2019/20)

TOP	Journals	Overall	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Strategic Management Journal	0												
2	Management Science	0												
3	Journal of Marketing	1						1						
4	Research Policy	0												
5	MIS Quarterly Management Information System	2			1			1						
6	Journal of Operations Management	1			1									
7	Journal of Business Research	1								1				
8	International Journal of Production Economics	2	1					1						
9	Journal of Business Ethics	0												
10	Journal of Marketing Research	0												
11	Information Systems Research	1				1								
12	Information and Management	1	1											
13	Journal of Banking and Finance	0												
14	Journal of Management Information Systems	1			1									
15	Decision Support Systems	2	1						1					
16	Journal of Product Innovation Management	0												
17	International Journal of Project Management	0												
18	European Economic Review	0												
19	International Journal of Production Research	2			1								1	
20	Industrial Marketing Management	6	1			1	2		1					1
		20	4	0	4	2	2	3	2	1	0	0	1	1

Standing et al. (2010) wrote one of the "latest" comprehensive literature reviews on EMs. They categorized the literature on electronic marketplaces into the following categories and subcategories (see Table 1.3).

Table 1.3: Research streams in the field of electronic marketplaces (Standing et al. 2010)

Category	**Subcategory 1**	**Subcategory 2**
Electronic Markets	General discussion	
	Efficiency	
	Pricing	
	Search costs	
	Product	
	Structure	
	Operational performance	
System	General system perspective	
	Auction	General
		Auction support systems
		Pricing
		Trust
		Auction types and strategies
		Revenue
	Knowledge management systems	Procurement/supply chain
	EM models	
	Trading mechanisms	
Adoption/Implementation	General adoption issues	
	Adoption approaches	
	Adoption in procurement and supply chain	
	Barriers/motivations	
Organizational issues	General organizational issues	
	Trust and security	
	Relationships and networks	
	Strategy	

I used the categories from Standing et al. (2010) but streamlined them by merging their categories and subcategories (see Table 1.4). Then, I assigned the twenty papers to these thematic categories.

This process also shows that a holistic business model perspective on electronic marketplaces was not common in the period from 1997 to 2008, but later on (e.g.,

Chakravarty et al. 2014; Muzellec et al. 2015). This aspect is noteworthy because the dissertation takes up the same perspective and also the theoretical rationale for the relevance of this dissertation can be derived from this aspect. This is discussed more specifically in chapter 1.3.7.

Table 1.4: Comparison of the categories

Categories in this overview	**Categories from Standing et al. (2010)**		
Category	*Category*	*Subcategory 1*	*Subcategory 2*
Operational performance and supply chain	Electronic Markets	General discussion Efficiency Pricing Search costs Product Structure Operational performance	
Pricing	System	General system perspective Auction Knowledge management systems EM models Trading mechanisms	 General Auction support systems Pricing Trust Auction types and strategies Revenue Procurement/supply chain
Adoption, strategies and behaviors	Adoption/Implementation	General adoption issues Adoption approaches Adoption in procurement and supply chain Barriers/motivations	
Ownership structure and trust	Organizational issues	General organizational issues Trust and security Relationships and networks Strategy	
Business model and revenues			

The following is a brief description of the twenty publications (see also Appendix 1), grouped according to the mentioned categories. Each category or section starts with the latest publication.

1.3.1 Adoption, strategies & behaviors

Loux et al. (2020) investigated a project-based B2B marketplace in the construction industry. They investigated the EM's pricing policy and its influence on the adoption of the EM by the respective target or user groups. The authors point out that the variants of affiliation cots may occur in a B2B context which both affect the decision to adopt the platform. Here, the authors differentiate between independent and interdependent affiliations costs. Independent affiliation costs arise after a user has joined the EM, e.g., costly changes of internal or inter-organizational processes. Interdependent affiliation costs are costs that depend on the adoption decision of other users. For example, further developments of the platform might be necessary with an increasing number of users what could be accompanied by additional costs for every EM participant.

Deng and Wang (2016) were interested in early-mover advantages for EM participants and if these advantages persist under competition. The underlying assumption of this study is that the marginal benefit of a participant's early entry on a marketplace is decreasing after a certain period because of “free-riding costs, resolution of technological or market uncertainty, as well as the incumbent inertia of early movers” (Deng & Wang 2016, p. 1). This assumption is supported by the authors, who analyzed several thousand firms using panel data models. Furthermore, “late movers” benefit from the first movers' efforts (e.g., educating the customer, creating the market) according to the authors.

Koh and Fichmann (2014) examined drivers of multihoming buyers. A user is multihoming when this user actively participates on multiple EMs that might compete with each other. Here, the underlying assumption is that buyers are never just active on one single marketplace, thereby intensifying competition between EMs. This might affect the EM operator’s strategy as well as the pricing strategies on the supply side.

Janita and Miranda (2013) investigated the antecedents of customer loyalty in traditional, non-digital B2B relationships as well as in the environment of an electronic marketplace. Their study took the seller's perspective on the variables that affect the

loyalty towards the electronic marketplace. Mainly the EM's image, perceived quality, and value influenced the sellers' loyalty.

Langer et al. (2012) examined the B2B buyers' behavior when a new electronic procurement channel is introduced. According to the authors, the "buyers often face inertia when they must give up their old channel habits and proven ways to interact with the seller, which creates various levels of resistance to the new technology" (Langer et al. 2021, p. 1213). Consequently, the buyers' decision to adopt a new procurement channel depends largely on the existence of this inertia.

Chien et al. (2012) developed several hypotheses based on the technology acceptance model (TAM), the concept of relational embeddedness, and the trust theory to explore the factors which affect the adoption of EMs. According to the TAM, "user's intention to use information systems depends on the perceived usefulness and perceived ease of use of the systems. Perceived usefulness refers to the degree to which a person believes that using a particular system can enhance his/her job performance" (Chien et al. 2012, p. 461). Relational embeddedness describes "a strong social attachment between exchange parties" (Chien et al. 2012, p. 463). The authors point out that the perceived ease of use of an electronic marketplace influences its perceived usefulness, and user's trust in the EM.

Koch and Schultze (2011) described and analyzed role conflicts in a B2B marketplace environment, using a case study approach. According to the authors, the main actors in this context are the platform operator as a "broker and the trading partners on the supply side and demand side. Each actor has different role expectations towards the market, accompanied by different goals, behaviors, and identities. Rosenzweig et al. (2011) focused on three strategic factors that influence the failure rate of an EM. Based on their analysis of 854 B2B marketplaces, the following factors were identified: industrial sector characteristics, ownership structure, and functionality of service offerings. For example, electronic marketplaces with a comprehensive service offering have a higher probability of success if these services facilitate collaboration between buyers and sellers. EMs supported by a consortium have also better chances to survive, in the authors' opinion. Schoenherr and Mabert (2011) investigated the differences between online and offline procurement environments from the buyers' perspective. They identified four main dimensions that influence the buyers' decision of choosing an online or offline process, and these were: purchase importance, supply market availability, future orientation, and item specification difficulty. Gunasekaran et al. (2009) examined the

current state of e-procurement in small and medium-sized enterprises (SMEs) in a specific region (south coast of Massachusetts). Based on their survey, the authors developed a theoretical framework for the adoption of e-procurement solutions in SMEs. The framework includes the following aspects: perceived implementation barriers, company readiness, perceived benefits, organizational performance, and critical success factors.

1.3.2 Ownership structure & trust

Yoo et al. (2011) compared two B2B sourcing channels with each other: "public marketplaces" and "private web services". Public marketplaces can be understood as electronic marketplaces that are owned by a third-party or consortium. Such an EM is open for everyone in the industry. In contrast, private web services are owned by one company and its partners. Such a web service is exclusively used by the owner and its partners. An example for a private web service might be a web shop which is run by a single firm. The authors come to the conclusion that a company should not focus on one of these channels. Instead, managers should develop both sourcing channels in the authors' opinion because the success of EMs is unclear.

Zhao et al. (2009) worked on the topic of ownership structures of EMs by comparing buyer-seller connections before and after the emergence of electronic marketplaces. Here, the authors dealt in particular with two market structures: oligopoly markets (market with a small number of firms), oligopsony markets (market with a small number of buyers and a theoretically large number of sellers). The authors show in their study how an EM affects existing market structures.

Pressey and Ashton (2009) developed a guideline for EM operators and participants on identifying "antitrust warning signs" and how to deal with these signs. Antitrust warning signs are, for example, obvious when an EM is "owned and controlled by dominant firms on either the supply or buying side of a market" or when "personnel working for the EM are on temporary assignment from a participating dominant firm" (Pressey & Ashton 2009, p. 471). The authors suggest: (1) to allow buyers and sellers to access other parties' prices but not showing their identity, (2) to conduct antitrust trainings for personnel, (3) to build technical barriers to critical information (e.g., firewalls), (4) to appoint a board of neutral members, and (5) to make regular audits and internal assessments.

1.3.3 Pricing

Leung et al. (2019) dealt with problems in the B2B pricing decision-making process, more precisely with the "request for quotation" (RFQ) process. According to the authors, many pricing and quotation processes in the B2B e-commerce context are highly subjective, unsystematic, and time-consuming. This is particularly due to the fact that often a single employee (e.g., sales manager) has to consider a number of factors in the pricing decision, such as the customer's willingness to pay or their purchasing history. The authors propose a pricing decision support system that should assist the supplier. The suggested system is based on the application of a fuzzy association rule mining approach that uncovers former hidden relationships between the different factors.

1.3.4 Operational performance & supply chain

Wang and Cavusoglu (2015) showed that EMs empower small and medium-sized manufacturing firms mainly in the following three areas: marketing capability, flexible production, and content management. The strengthening of these areas through the marketplace enhances the manufacturers' performance on the EM at the same time.

Chen (2013, 2014) analyzed the influence of a transaction market on the performance of a vertically decentralized dynamic channel system. In the study, such a system can be represented by a "vendor managed inventory" (VMI). The system of a VMI allows the seller to see the stock levels of the buyer. The seller can thus act independently, within the stock limits set by the buyer. This should lead to lower stocks on the demand side and consequently to lower costs.

Iyer et al. (2009) applied the contingency theory to the relationship between B2B e-commerce supply chain integration and performance. The contingency theory comes from organizational theory and states that an ideal decision or way, e.g., to organize a corporation or to lead a company, does not exist. There are always several variables that have a direct or indirect influence. The authors examined the variables that affect the performance of an organization in a B2B e-commerce context. Here, the demand unpredictability and the product turbulence can be mentioned in particular. A high demand unpredictability and a product turbulence can be usually found in innovative industries in which product life cycles are short.

1.3.5 Business model & revenues

Muzellec et al. (2015) have taken a business model lifecycle perspective on EMs by focusing on five internet ventures' value propositions. They describe how the value proposition of an EM might develop over time, with the objective of becoming stable. In addition, the authors point out that each EM has at least two areas to generate revenues: On the one hand, an EM that focuses on the B2C has various possibilities to generate income from the end customer. On the other hand, there is also a relationship to the business side, which can also be monetized.

Chakravarty et al. (2014) made a comparison between conventional (non-digital) B2B businesses and electronic marketplaces by stating that the customer orientation differs. According to the authors, a triadic relationship system applies in marketplace environments (seller-EM-buyer). For EMs, therefore, customer orientation towards both the seller and the buyer plays an important role. In this context, they also looked at the buyers' and sellers' concentration to understand how this influences the "total customer orientation" of an electronic marketplace.

1.3.6 Discussion

Reviewing the literature on B2B electronic marketplaces from 2009 to 2019/20, and considering the review from Standing et al. (2010), it becomes apparent that a holistic business model perspective on the phenomenon of B2B electronic marketplaces emerged rather after 2010 (e.g., Chakravarty et al. 2014; Muzellec et al. 2015). However, researchers tend to remain at a meta-level when it comes to (B2B) electronic marketplaces. EMs continue to be seen as intermediaries or matchmakers that bring supply and demand together. This meta-level perspective is still absolutely correct and undisputed.

Nevertheless, the marketplace business model in a B2B context has changed a lot in the meantime and has become much more "sophisticated". Today, the B2B marketplace business model includes a wide spectrum of different variants that the academic discourse has not yet covered. Consequently, little reconsideration of the phenomenon has taken place so far. This reconsideration is, however, necessary in light of several activities in the B2B e-commerce practice. This discrepancy between practice and science also highlights the relevance of the dissertation topic.

In summary, there is a lack of in-depth discussion of the marketplace business model in the B2B context. With this dissertation, I would like to add new aspects to the already existing and ongoing conversation on B2B electronic marketplaces by addressing a new level of detail. Here, broadly speaking, lies the overall contribution of this dissertation. This contribution is also illustrated by Figure 2.4 and Figure 2.5 (p. 29).

Nevertheless, there are also some limitations related to the chosen review approach. According to Webster and Watson (2002) "a high-quality review is complete and focuses on concepts. A complete review covers relevant literature on the topic and is not confined to one research methodology, one set of journals, or one geographic region." (Webster & Watson 2002, pp. xv). Here, the overview had the objective to provide a paper-focused approached by classifying papers to underlying concepts. However, the selection of the journals was also limited to certain journals in which much of this research had been published. Here, the main goal of providing an overview of existing research was to point out recent developments in the literature and the research gaps. Based on these insights, the following chapters aim to bridge these gaps with new insights on B2B electronic marketplaces.

2 Essay 1 – B2B electronic marketplaces: Functions and consequences of the current operating models for commodity marketplaces[1]

Abstract

Buying and selling in the business-to-business (B2B) sector is becoming a lot more digital by using B2B electronic marketplaces that bring together supply and demand through internet technologies. Such digital platforms and matchmakers are experiencing a "second spring" after their initial rise during the 1990's dot-com bubble boom. Since then, technical capabilities have developed immensely what influenced industrial procurement and sales processes as well. However, also electronic marketplaces changed significantly, and their variety increased what is hardly reflected in research. In this article, a new typology for B2B electronic marketplaces is described and discussed, especially from a functional perspective. Each function of an electronic marketplace comes with consequences for the platform's participants and its operator. The typology is based on observations from the current B2B e-commerce practice and represents a theoretical contribution to the field of B2B electronic marketplaces. It consists of three types: open marketplaces, closed marketplaces, and meta-search marketplaces. The proposed typology focuses on the platform's operating model and spotlights electronic marketplaces for commodities.

2.1 Introduction

In a business-to-business (B2B) context, electronic marketplaces (EMs) allow the digital exchange of information between a supplying and a demanding company, for example, about product details or prices (e.g., Strader & Shaw 2000). In contrast to the business-to-consumer (B2C) sector where products can be bought directly online, a request must often still be made in the B2B sector to receive an initial quote. This is also known as the "Request for Quotation" (RFQ) process. However, it can already be observed that direct purchasing via electronic marketplaces is gaining a foothold in B2B

[1] This chapter is based on the working paper *B2B Electronic Marketplaces: Functions and Consequences of the current Operating Models for Commodity Marketplaces*.

e-commerce. Consequently, new operating models for B2B EMs are emerging that have not yet received much attention from researchers. This might be due to the fact that these types have emerged especially in the last three to five years.

Electronic marketplaces also continue to cause confusion in B2B practice. Suppliers, in particular, are uncertain where they should offer their products: Which e-commerce channel is suitable, and what role do B2B marketplaces play? Which marketplace model is best for my company and my product?

Previous research has extensively examined the intermediary role of EMs between two or multiple sides (e.g., Bakos 1997; Kaplan & Shawney 2000). Their core function as "matchmakers" has been discussed in this context (e.g., Evans & Schmalensee 2016). More recently, important differentiations towards other e-commerce activities or procurement channels were made, e.g., web shops (e.g., Hudetz 2016; Hartmann 2019).

Nevertheless, answers to practice-driven questions such as the above are hard to find. Here, this article aims to provide first responses and also practical implications. From a scientific perspective, two contributions to the field of B2B e-commerce are made: On the one hand, an overview of the current state of the literature on typologies and classifications of electronic marketplaces is given. On the other hand, a new typology for B2B electronic marketplaces is proposed for commodity markets based on observations from the current practice. The typology focuses different operating models' functions and their consequences on the platform's participants and its operator.

A descriptive statistical analysis of a database on European B2B electronic marketplaces was conducted for this article's introduction to motivate the overall topic. The database includes 270 B2B electronic marketplaces[2], and was created by Hokodo (2020), a financial service provider for B2B EMs. The analysis shows, for instance, that new B2B EM ventures were especially founded in the middle of the previous decade (see Figure 2.1). Furthermore, the analysis indicates that B2B EMs in Europe are primarily concerned with services and less with the trade of physical goods or commodities (see

[2] Since new companies are constantly emerging in the field of B2B electronic marketplaces, a continuous screening of the market is difficult what has to be considered in these figures. Consequently, the numbers can only give an impression but cannot represent the exact market dynamics.

Figure 2.2). Within Europe, most B2B EMs originate from the UK, Germany, and France (see Figure 2.3).

Figure 2.1: European B2B EMs by founding year, 2009 - 2020 (Hokodo 2020)

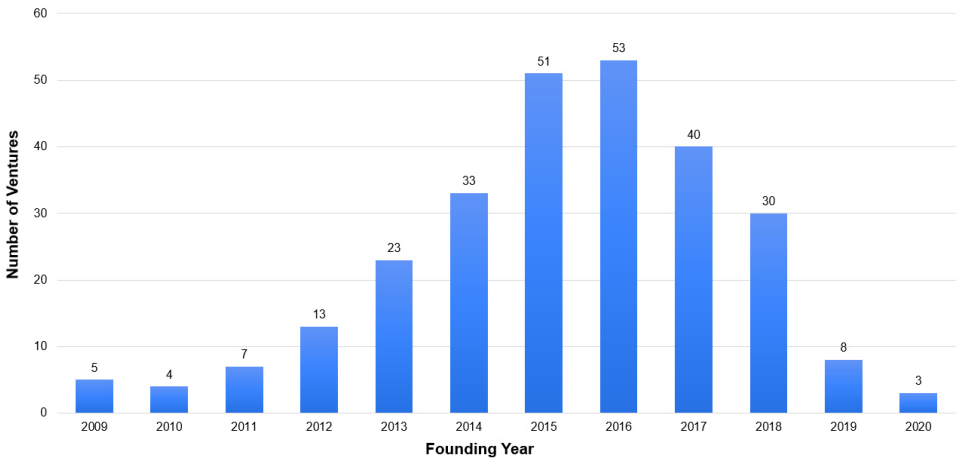


Figure 2.2: European B2B EMs by industry, 2009 - 2020 (Hokodo 2020)

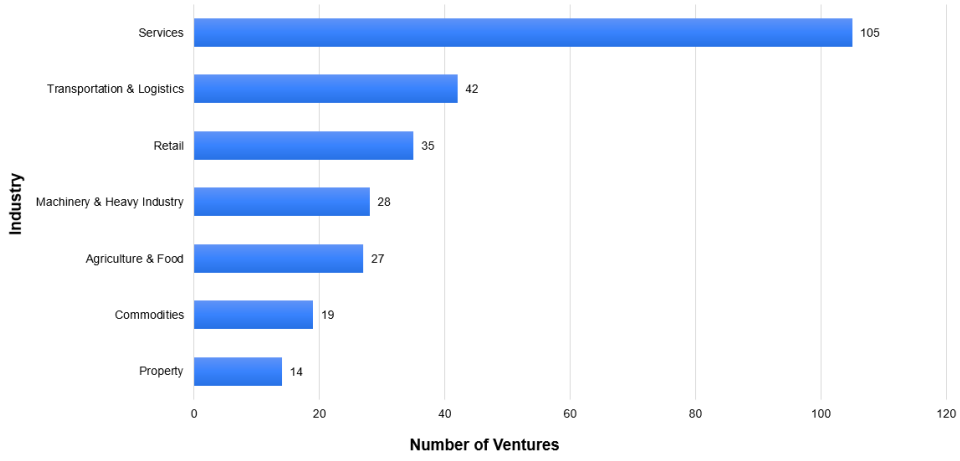
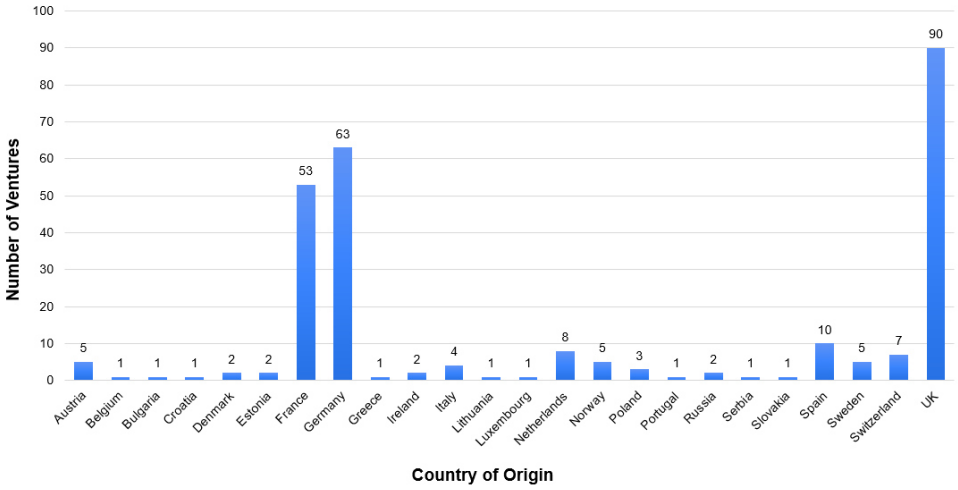


Figure 2.3: European B2B EMs by country of origin, 2009 - 2020 (Hokodo 2020)



2.2 Theoretical background

Electronic marketplaces can be seen as inter-organizational information systems that make it possible for different parties to exchange information about products and their prices (Strader & Shaw 2000) or conduct business transactions (Archer & Gebauer 2002). Usually, electronic marketplaces bring together supply and demand by the use of internet technology (Malone et al. 1987), which is why they are also often called “matchmakers” (Evans & Schmalensee 2016). Several efforts were already made to classify and categorize electronic marketplaces.

From an institutional or economic perspective, EMs represent intermediaries between sellers and (potential) buyers. Such platforms can exist both in B2C (Evans & Schmalensee 2016) and B2B markets (Timmers 1998; Chow et al. 2000; Thuong 2002) where they mostly achieve an aggregation of the supply side what should create in particular value for the demand side by lowering search and transaction costs (Bakos 1991; Bakos 1997; Kaplan & Shawney 2000; Giaglis et al. 2002; Markus et al. 2002; Thuong 2002; Klein & Alt 2015). Due to the centralizing character of an EM, the transparency on suppliers, offerings, and prices should be increased, which can also pose risks for the platform participants (Klein & Alt 2015).

From a functional perspective, EMs perform mainly three functions: (1) the matching of buyers and sellers, (2) the facilitation of information exchange and transactions, and (3) the providing of infrastructure (Bakos 1998). This also applies to non-electronic marketplaces (Giaglis et al. 2002). Here, further subcategorization can be made (see Table 2.1).

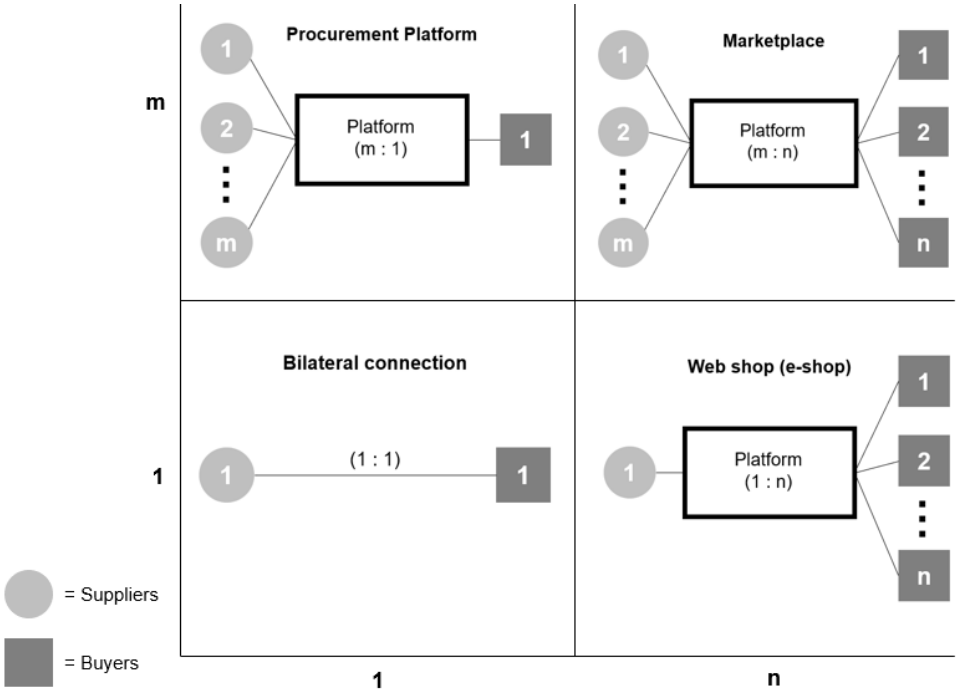
Table 2.1: Functional perspective on electronic marketplaces (Bakos 1998)

Primary market function	**Subfunction**
Matching	• Determination of product offerings • Searching for suppliers and products • Price discovery
Facilitation	• Logistics • Settlement • Trust
Infrastructure	• Legal • Regulatory

From a business model perspective, it can be stated that four different business models exist in the B2B e-commerce context (see Figure 2.4). These are: (1) a bilateral connection of two companies, (2) procurement platforms, where several suppliers are connected to only one buyer, (3) web shops (or e-shops), where one supplier offers its products to several buyers, and (4) marketplaces on which many suppliers can exchange and transact with many (potential) buyers (Hudetz 2016; Hartmann 2019).

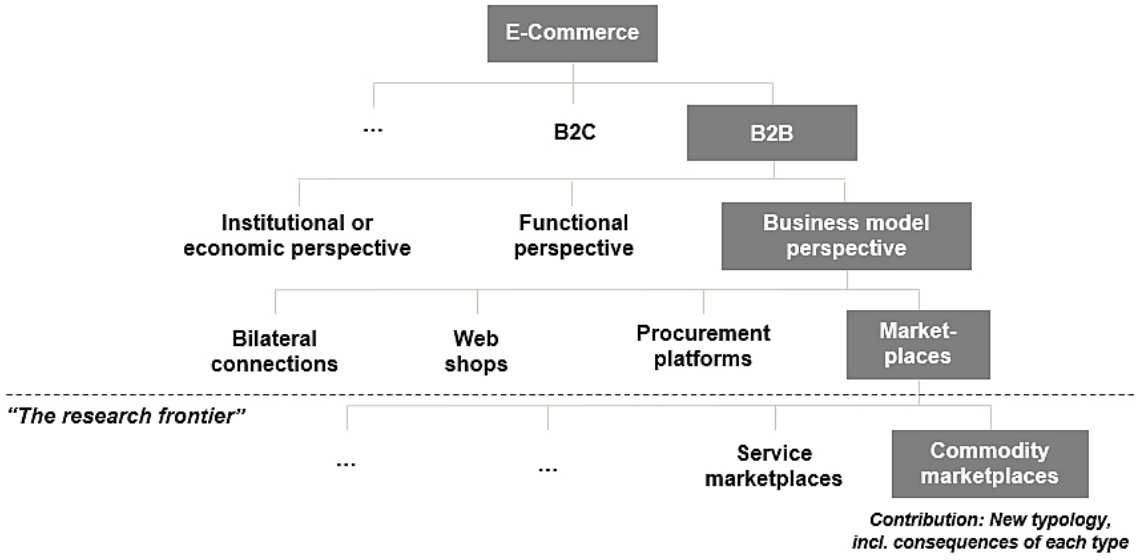
Furthermore, it is possible to classify EMs by the product offered via the EM (Johnston 2008, Klein & Alt 2015). Here, three product subcategories can be mentioned: (1) homogeneous goods (also called “commodities”) where buyers are mostly interested in low prices, (2) heterogeneous goods which are often difficult to find for the buyer because of their complexity, and (3) service offerings (Johnston 2008, Klein & Alt 2015).

Figure 2.4: Business model perspective on electronic marketplaces (based on Hudetz 2016)



It should be stated that the following content of the paper deals exclusively with different operating models for B2B commodity marketplaces. In other words, I deepen the upper right field of the illustration above. Figure 2.5 also intends to clarify the research process, the frontier of research, and the positioning of the paper's contribution.

Figure 2.5: Research frontier and contribution



2.3 Methodology

A new typology for B2B commodity marketplaces is proposed in this article. This complements and deepens the existing typologies and theories in the research field of electronic marketplaces. According to Doty and Glick (1994, p. 230) typologies are "a unique form of theory building" if they address the following criteria (Doty & Glick 1994, pp. 246-248):

1. "Typological theorists should make explicit their grand theoretical assertion(s).
2. Typologies must define completely the set of ideal types.
3. Typologies must provide complete descriptions of each ideal type using the same set of dimensions.
4. Typological theories should explicitly state the assumptions about the theoretical importance of each construct used to describe the ideal types.
5. Typological theories must be tested with conceptual and analytical models that are consistent with the theory."

Following this guideline, it can be said that (1) the central assertion of the proposed typology is that the operating model of a B2B electronic marketplace has major implications and consequences for the marketplace operator as well as for the demand and supply side of the marketplace. Here, the operating model also includes the functions of a B2B EM. The consequences of each operating model are examined in the discussion section. The typology consists of three types of electronic marketplaces: open marketplaces, closed marketplaces, and meta-search marketplaces. They represent the set of ideal types (2) of which each type is described in the same way (3). The assumptions are clearly stated and the theoretical importance is given (4). Since the typology is based on observations from the practice, an inductive theory building took place. Consequently, the theory is based on empirical observations and therefore tested (5), illustrated by 30 company examples.

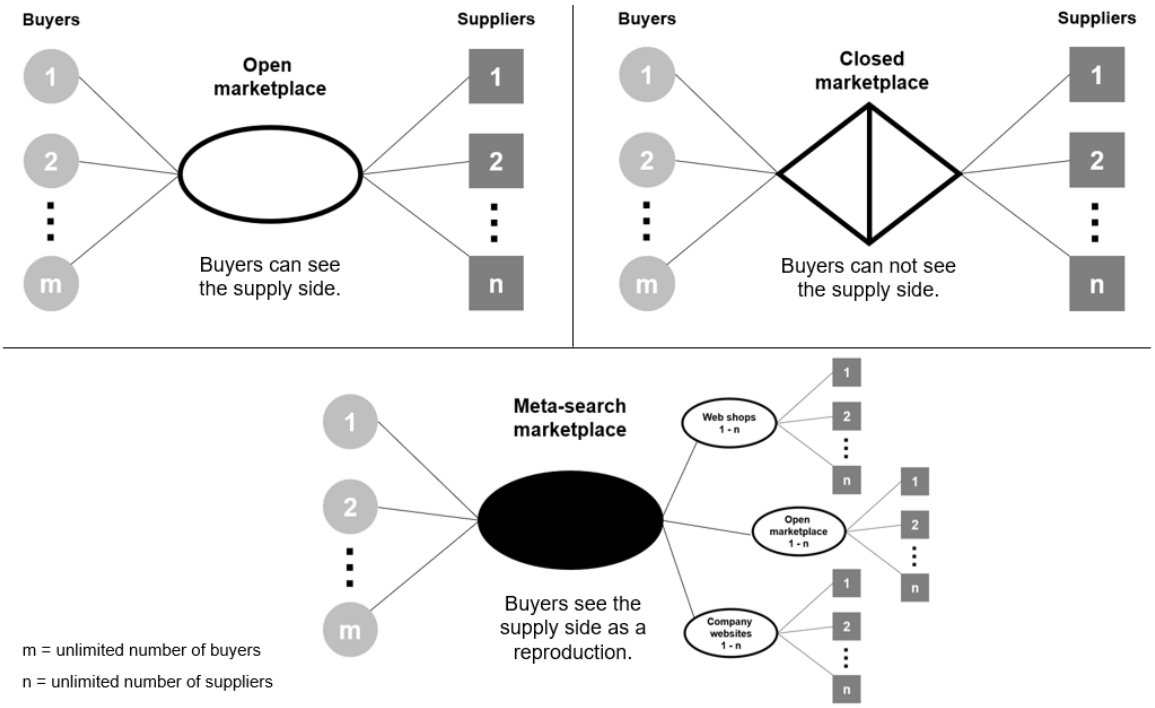
This sample was identified through desk research. In particular, the company websites were examined. For the selection of the company examples, one criterion was that the companies follow a marketplace business model in a B2B context. Consequently, supply and demand should be brought together electronically via a platform (m : n) that acts as an intermediary or matchmaker. Another criterion was that these marketplaces had to deal with commodities. Platforms from other sectors were excluded. There are several

definitions for the term “commodity”. A general definition for a commodity is a “substance or product that can be traded, bought, or sold” (Cambridge Dictionary 2020). Here, one could differentiate more precisely between manufacturing inputs and operation inputs (Kaplan & Sawhney 2000). Raw materials and components which are used directly in the production process can be seen as manufacturing inputs. These goods are needed for the end-product, whereas operating inputs represent already finished products, e.g. computers or copier paper (Kaplan & Sawhney 2000). For this paper both manufacturing and operating inputs can be seen as commodities.

2.4 The typology

The variety of B2B commodity marketplaces has increased significantly in the last few years. Looking at the existing typologies and classifications that can be found in the literature, the necessity to take a closer look at B2B electronic marketplaces in practice was evident. different types were identified by examining 30 B2B EMs (see Figure 2.6). The types can be considered as operational models for B2B commodity marketplaces.

Figure 2.6: Typology for B2B commodity marketplaces



2.4.1 Type 1: Open marketplaces

On open marketplaces, the demand side sees the different suppliers and their product portfolios. The main function of these EMs is that the potential buyer can contact the supplier directly and request a quote. This is also known as the request for quotation (RFQ) process. Open marketplaces always provide assistance in the RFQ process. Usually, a registration is required beforehand. Often, but not always, it is possible to complete the transaction on the marketplace so that the following (sub-) differentiation can be made within type 1:

A. In type 1-A, the EM acts as a matchmaker and thus supports the phase of purchase initiation by allowing the potential buyer to request for quotation from the seller. When a purchase is imminent, the purchase contract is concluded between the buyer and the seller apart from the platform. The parties thus leave the platform for the transaction.

Table 2.2: Examples for open marketplaces with type 1-A

Name	Commodity	Website
Matmatch	Ceramics, composites, metals, polymers, glass	www.matmatch.com
Techpilot	Drawing parts and components	www.techpilot.net
Indiamart	Various products from several industries (without specific focus)	www.indiamart.com
TradeInIndia	Various products from several industries (without specific focus)	www.tradeinindia.com
Made-in-China	Various products from several industries (without specific focus)	www.made-in-china.com

B. In type 1-B, the platform allows the potential transaction partners to conclude the purchase on the platform. The parties can thus stay on the marketplace for the transaction. For this, it is necessary that product prices are stored in the EM's database, and the process of submitting and receiving quotes needs to be integrated as well as payment systems. Depending on the packaging sizes, different price ranges

are usually displayed openly to the demand side. On such an EM it might be possible that the potential buyer and the seller can negotiate via a web-based chat.

Table 2.3: Examples for open marketplaces with type 1-B

Name	**Commodity**	**Website**
Mercateo	Various products from several industries (without specific focus)	www.mercateo.com
CheMondis	Chemical substances	www.chemondis.com
Conrad	Electronics	www.conrad.bizz
Pinpools	Chemical substances	www.pinpools.com
Kemiex	Chemical substances	www.kemiex.com
Cirplus	Recyclates and plastic waste	www.cirplus.com
Aliro	Agricultural and farming goods	www.aliro.trade
Sparox	Spare parts for the energy sector	www.sparox.eu
Metalshub	Metals and ferroalloys	www.metals-hub.com
Open Mineral	Metals and ferroalloys	www.openmineral.com
XOM Materials	Steel, metals, plastic	www.xom-materials.com
Schrott24	Old or waste metal	www.schrott24.de
Schüttflix	Bulk material from construction sites	www.schuettflix.de
proHops	Hops for brewery	www.prohops.de

C. In type 1-C, the supplying company has the option of operating a "flagship store" in its own corporate design within the EM. A flagship store can be described as a "shop in shop" concept that can be compared to physical shopping malls where all storefronts are customized in the respective company's design and brand appearance. Applied to the digital context, the respective supplier receives a special web shop environment on the EM, which is visually highlighted and often separated from competitive product portfolios. Here, one intention is to create a different user experience for the potential buyer so that it might seem to be directly on the respective company website.

Table 2.4: Examples for open marketplaces with type 1-C

Name	Commodity	Website
Alibaba	Various products from several industries (without specific focus)	www.1688.com
Knowde	Chemical substances	www.knowde.com
Molbase	Chemical substances	www.molbase.com

2.4.2 Type 2: Closed marketplaces

On closed marketplaces, the demand side does not see the supply side, so the potential buyer does usually not know from whom the product is made or produced. Here, the platform operator becomes the contractual partner and undertakes all obligations and liabilities (e.g., product quality, logistics). The transaction is consequently executed on the EM.

Table 2.5: Examples for closed marketplaces

Name	Commodity	Website
GoBuyChem	Chemical substances	www.gobuychem.com
Kreatize	Drawing parts and components	www.kreatize.com
Xometry	Drawing parts and components	www.xometry.com
Laserhub	Drawing parts and components	www.laserhub.com
Gasido	Industrial gases	www.gasido.de

2.4.3 Type 3: Meta-search marketplaces

On meta-search marketplaces, information on suppliers, their product portfolios, and product descriptions are automatically “reproduced” from many different websites, web shops (e-shops), and open marketplaces. This information is then displayed in the user interface of the meta-search marketplace. So-called web crawlers are usually used and programmed for this purpose, which search through the internet and duplicate the relevant contents.

Table 2.6: Examples for meta-search marketplaces

Name	Commodity	Website
Chembid	Chemical substances	www.chembid.com
Covalo	Chemical substances	www.covalo.com
Europages	Various products from several industries (without specific focus)	www.europages.com

2.5 Discussion

The buyer's perspective towards the supply side is of particular importance for typology. Thus, it is characteristic for an open marketplace that the potential buyer can see the different suppliers to start the RFQ process, whereas this is not possible on a closed marketplace. Here, the platform operator becomes the contractual partner what usually comes with a direct purchase option. Meta-search marketplaces work in the same way as open marketplaces, so that the potential buyer can also see a large number of suppliers and products. Meta-search marketplaces usually have a higher number of suppliers and products due to their aggregating character, which is even stronger than on open marketplaces.

As the description of the typologies shows, the choice of the operating model by the platform operator brings with it different functions for the supply and demand side (see Table 2.7). This choice also comes with various advantages and disadvantages for both sides as well as for the platform operator.

Table 2.7: Marketplace functions by type

Functions / Types	Search for products	Request for Quotation	Negotiation on the platform	Transaction on the platform
Open M. / Type 1-A	possible	possible	not possible	not possible
Open M. / Type 1-B	possible	possible	partly possible	possible
Open M. / Type 1-C	possible	possible	partly possible	partly possible
Closed Marketplaces	possible	partly possible	not possible	possible
Meta-search Market.	possible	possible	not possible	not possible

B2B commodity marketplaces that function as open marketplaces achieve high transparency across offerings and product portfolios from many different suppliers. Nevertheless, a supplying company might put itself in an unfavorable position when its products appear right next to products from a competitor. If the pricing is also displayed, the possible buyer might tend to order the cheaper product – if the products are comparable in terms of quality and other parameters. For this reason, most open marketplaces in the B2B context follow the request for quotation (RFQ) process and do not include product prices.

A clear separation between the open marketplace "subtypes" is often difficult in individual cases, as mixed forms are also possible. For example, it might be the case that only in one product category the RFQ process is supported by the platform (type 1-A), whereas in another product category a direct purchase of a product is possible (type 1-B).

In contrast to open marketplaces, the included pricing becomes the major advantage for closed marketplaces. Here, the supply side does not need to be afraid to become comparable as the products are only displayed with generic descriptions and without suppliers' information or contact details. Consequently, the EM sets the pricing and becomes the transaction partner for the buyer. This can be pretty comfortable either for the buyer and for the supplier. At the same time, the supplying company might lose power by making itself "invisible" to the buyer. The supplier becomes therefore dependent on

the EM. This might only be tolerable for small and medium-sized suppliers but not for large companies and corporations.

Meta-search marketplaces are dependent on the data quality of the websites, web shops, and open marketplaces from which they obtain their information. At the same time, these "data aggregators" have the advantage that they do not need to prepare content or product descriptions by themselves. Nevertheless, an internal check of the data is advisable for this type of B2B commodity marketplace because incorrect entries (in terms of content or spelling) can reduce the buyer's trust.

All three types of B2B commodity marketplaces are interesting from the buyers' perspective. Depending on the buyer's role within a company, EMs might also create different added values. Here, a further distinction should be made: Firstly, purchasing and sourcing professionals who are looking for new suppliers and need (comparative) offers for specific products to optimize their procurement key performance indicators (KPIs). Secondly, user groups on the demand side who work in research and development (R&D) or related fields. These more technical-oriented professionals might use the respective marketplace to discover new products and materials that solve specific problems. If they find a suitable product, then they will pass the procurement need onto the purchasing department.

As far as the search for new suppliers, products, or materials is concerned, open and meta-search marketplaces are probably the most appropriate way to find the right business partner. Closed marketplaces well serve those who want to buy a product as quickly as possible and do not value the exact origin of the product.

2.6 Conclusion & outlook

Looking at B2B electronic marketplaces from the buyer's perspective is important as a customer or user orientation is one of the critical elements in digitalization and therefore also in e-commerce. This perspective becomes the main distinction of the proposed typology. The typology deals with operating models of B2B commodity marketplaces and makes clear that choosing one of the three models has different consequences for the platform participants and its operator. This article examines the consequences, in particular, on a functional dimension.

Most B2B commodity marketplaces allow the potential buyer to search for products and request quotes but conducting an online negotiation or even executing a transaction

on the platform is not always possible. Each function can have an effect on the behavior of the platform participants and their perception of the platform, so platform operators and practitioners should be aware that each new function can have advantages or disadvantages.

In science, B2B commodity marketplaces have not yet been treated in such detail. Relevant differentiations were made between several forms of electronic marketplaces. However, these were still very much on a meta-level, e.g., describing the intermediary role or explaining procurement platforms and e-commerce solutions in general. The proposed typology offers, therefore, new aspects for researchers in the field of B2B electronic marketplaces.

Nevertheless, this new typology can also be criticized. A limitation might be that the typology was built inductively on observations from the practice. Here, the sample and its size could be an object of criticism. Due to the focus on commodities trading, no statement can be made about other sectors as well. Two possible approaches for future research projects could be: First, test the typology presented using a deductive approach with a greater sample of commodity marketplaces. Second, it could be interesting to focus on non-commodity markets, such as service-oriented markets.

In the context of the research project, it became evident that different revenue streams are associated with each type, which is particularly important for (future) marketplace operators. Here, an analysis of the revenue and pricing models could be carried out. But it should be noted that many electronic marketplaces continue to experiment in this field and usually combine different revenue streams. In general, B2B electronic marketplaces are in an ongoing development process that poses challenges for both practitioners and scientists.

2.7 Implications for practitioners

For suppliers, every type of B2B marketplace offers potential to improve the marketing and sales of the respective product portfolio. Since the vast majority of companies active in the B2B sector pursue a multi- or omni-channel strategy, marketplaces can represent another channel. Consequently, B2B marketplaces should be part of every marketing and sales strategy.

For “marketplace newcomers”, it is sufficient to make a part of the product portfolio accessible in a first step, ideally on several marketplaces to compare the key performance

indicators (e.g., number of requests, number of qualified leads, number of closed deals). Further action steps can be derived from this after several months of testing, such as focusing on high-performing marketplaces and making the entire product portfolio accessible.

In many B2B environments, the RFQ process continues to dominate because an "open pricing" comes with a wide range of challenges. However, many marketplaces want to achieve this pricing transparency in the long term and are already experimenting with it (e.g., direct purchasing option). Indeed, there are also local or country-specific differences that need to be taken into consideration. In general, suppliers should be cautious with the "transparency aspirations" of many B2B marketplaces because they might break the respective industry's dominant logic. Nevertheless, the platforms' aspirations represent a good occasion to question the dominant logic. If a potential customer has to wait, for example, several days for an offer, this is usually due to manual processes. The aim should be to achieve a higher level of automation in the RFQ process.

Overall, suppliers in conservative industries, with a low level of pricing transparency, should ensure that sensitive price information does not end up on platforms or is communicated to potential customers via these platforms (e.g., negotiation function) as there is an ongoing collection of data taking place which might not be used in favor of the platform's supply side.

3 Essay 2 – B2B electronic marketplaces in the chemical industry: A descriptive study[3]

Abstract

E-commerce activities in business-to-business (B2B) contexts have been increasing in the last years. Electronic marketplaces are of particular importance when talking about B2B e-commerce. These digital platforms function as intermediaries or matchmakers between supply and demand, enabling the exchange of information on products and prices. Sometimes transactions take place on these marketplaces as well, for example, when a direct purchase of a product is possible. Nowadays, there are many variants of B2B electronic marketplaces. In this article, a new typology for B2B commodity marketplaces will be tested with a sample of 62 marketplaces focusing on the trade of chemical substances. In the chemical industry, mainly commodities, i.e., highly standardized products, are sold and purchased. These are, for example, different raw materials that are processed to intermediate or end products. The study confirms the new typology and, therefore, contributes to the research field of B2B e-commerce and electronic marketplaces. For practitioners, it might be interesting to see that the request for quotation (RFQ) process is still the most common B2B interaction. Nevertheless, first platforms experiment with a direct purchasing option what is very unusual for the chemical industry.

3.1 Introduction

Electronic marketplaces (EMs) received much attention during the 1990's dot-com bubble boom, both in the business-to-consumer (B2C) and business-to-business (B2B) sector. Looking at B2C EMs, both Amazon and eBay started their activities in 1995. At that time, Amazon began as an online bookstore and eBay as an auction platform. Today, these companies are still successful in the market, so that they can be seen as the big winners of the dot-com era. Many companies from this boom period that followed a marketplace business model did not survive, especially in the B2B sector (Schmitt 2019). It became quiet around B2B EMs, both in practice and in science. However, electronic

[3] This chapter is based on the working paper *B2B Electronic Marketplaces in the Chemical Industry: A Descriptive Study* co-authored by Andreas Wichmann and Alina Wolff.

marketplaces in the B2B sector are booming again (see Chapter 2). One could say that a new era has begun what can be seen in the chemical industry as well.

This study aims to test the proposed typology for B2B commodity marketplaces (see Chapter 2) and describe the status quo of electronic marketplaces in the chemical industry.

3.2 Theoretical background

The phenomenon of electronic marketplaces is a relevant topic in the fields of informatics and economics (Alt & Klein 2011). Research about this phenomenon has been conducted for more than 25 years. Thus, electronic marketplaces are often called, differently such as electronic markets (Alt and Klein 2011; Ngai et al. 2017; Wigand 2011), e-marketplaces (Movahedi et al. 2012; Petersen et al. 2007), digital marketplaces (Ordanini 2006; Täuscher & Laudien 2018) electronic intermediaries (Bailey & Bakos 1997; McIvor & Humphreys 2004), e-hubs (Kaplan & Sawhney 2000), platform-based markets (Zhu & Iansiti 2012), two-sided markets (Reimers et al. 2019), or multi-sided markets (Ardolino et al. 2016). It is also impossible to find one explicit and commonly accepted definition for this phenomenon. Consequently, many definitions for electronic marketplaces exist (Saprikis et al. 2009; Wang & Archer 2007). For example, Wang and Archer (2007, p. 91) define EMs as "places where buyers and sellers conduct transactions by electronic means". They further specify the nature of these places as "physical, virtual, or conceptual" (Wang & Archer 2007, p. 91). Table 1 provides an overview of selected definitions in prior literature.

Table 3.1: Selected definitions of electronic marketplaces (based on Grieger 2003; Lavassani 2011; Rossignoli & Ricciardi 2015)

Year	Author(s)	EM definition	Focus
1988	McCoy & Sarhan	"[…] separates the negotiating function from the physical transfer of the product or commodity in which the market trade. It can manage buyers' and sellers' offers and bids, as well as moving products directly from sellers to buyers. The system is open to all buyers and sellers, regardless of their location and can provide instant market information to all traders."	Open system, separation of negotiation function from physical transfer
1991	Bakos	"[…] is an interorganizational information system that allows the participating buyer and sellers to exchange information about prices and product offerings."	Interorganizational information system
1997	Bradley III & Peters	"[…] can be viewed as a public listing of products and their attributes from all suppliers in an industry segment, and available to all potential buyers."	Public listing

1999	Segev et al.	"Compared to many other electronic procurement solutions, EMs represent a relatively neutral position between buyer and seller, providing services to both sides of a transaction. An EM represents a virtual place where buyers and sellers meet to exchange goods and services."	Neutral e-procurement solution
2000	Kaplan & Sawhney	"[…] is a meeting-point where suppliers and buyers can interact online."	Meeting point
2003	Grieger	"The unique feature of an EM is that it brings multiple buyers and sellers together (in a "virtual" sense) in one central market space and implicitly involves trade financing organizations, logistics companies, taxation authorities and regulators."	Brings buyers and sellers together
2004	Hadaya	"[…] is an intermediary that allows buyers and sellers to meet on an electronic platform that rests on the Internet infrastructure in order to exchange information about products/services, conduct transactions online, and adhere to other value-added services offered by the intermediary."	Intermediary based on an electronic platform
2007	Petersen et al.	"[…] is a neutral, web-based location where businesses can conduct buying and selling transactions for goods or services."	Neutral, web-based location
2007	Wang & Archer	"[…] are places where buyers and seller conduct transactions by electronic means. These places can be physical, virtual, or conceptual."	Places to conduct transactions by electronic means
2009	Kwon et al.	"[…] is a virtual marketplace on the internet where the organizations can conduct economic transactions."	Virtual marketplace for economic transactions
2010	Standing et al.	"In its simplest form an e-marketplace [...] can be defined as an inter-organisational information system that allows the participating buyers and sellers in some market to exchange information about prices and product offerings. An e-marketplace should enable potential trading partners to be identified and a transaction executed."	Inter-organizational information system that allows the participating to exchange information
2012	Movahedi et al.	"[…] are effective and efficient collaborative, internet-based institutional infrastructures for inter-organizational and intra-organizational negotiation and transaction."	Collaborative, internet-based infrastructures
2018	De Reuver et al.	"[…] bring together (or match) distinct groups, whereas the value for one group increases as the number of participants from the other group increases."	Brings together (or match) distinct groups
2020	Alt	"[…] may be conceived as digital platforms that link transacting parties via a centralized information system that uses a certain infrastructure technology."	Links transacting parties via a centralized information system

According to Standing et al. (2008, p. 3), the difference to physical marketplaces is that “transactions are executed via electronic channels, usually an internet-based platform”. They further define an EM as an “inter-organizational information system that allows the participating buyers and sellers in some market to exchange information about prices and product” (Standing et al. 2008, p. 3). In more general terms, the Federation of German Industries (Bundesverband der deutschen Industrie – BDI, 2020) denotes electronic marketplaces as virtual places provided by the respective platform operator, on which companies can conduct business transactions online.

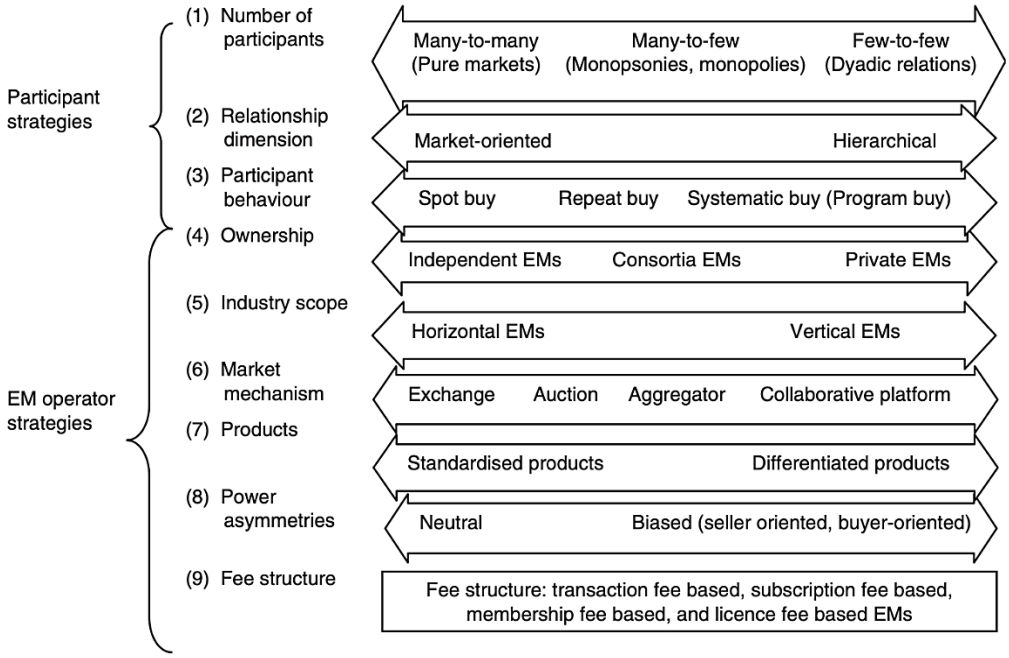
A fundamental theoretical element of EM theory is the aspect of transaction costs or coordination costs. More precisely, they refer to the necessary effort to manage all activities concerning the contract preparation process (ex-ante) as well as the monitoring and consummation process (ex-post) (Klein & Alt 2015). Collectively, they represent the effort needed to organize and conduct economic activity among market participants (Alt & Klein, 2011). Altogether, e-commerce in general and thus EMs provide value through a significant reduction of transaction costs (Murtaza et al. 2004).

Other important aspects relating to electronic marketplaces are theories on network effects and the critical mass, meaning the sufficient number of participants on both the buying and supplying side in order to make the EM work properly and unfold its full potential to build new business relationships (Petersen et al. 2007). These aspects are still relevant success factors for every electronic marketplace (Alt & Klein 2011).

There are also several classifications, models, and typologies that try to describe electronic marketplaces. Researchers elaborating an EM classification framework face the challenge of covering all relevant variants and appearances of electronic marketplaces on the one hand while simultaneously ensuring good comprehensibility at a reasonable scope of classification criteria on the other (Teuteberg 2019). This might be not easy because there are possibly too many variants to reasonably cover within one framework (Teuteberg 2019). Another aspect researchers have to pay attention to is a balanced ratio between the level of abstraction and specialization (Teuteberg 2019). This is especially important for the framework's relevance since it should ideally be applicable to a wide range of electronic marketplaces and not only to a few specific exceptional phenomena (Teuteberg 2019).

One often-cited classification for EMs comes from Wang & Archer (2007). In their article, the authors provide a reasonable selection of dimensions according to which EMs can be examined (see Figure 3.1).

Figure 3.1: Classification dimensions for electronic marketplaces (Wang & Archer 2007)



The two terms “classification” and “typology” are often denoted as synonyms in the literature. As a result, the terminology has often been applied inaccurately. For instance, classifications were referred to as typologies when in fact they were classifications. Doty and Glick (1994), for example, described a classification as “categori[zing] phenomena into mutually exclusive and exhaustive sets with a series of discrete decision rules“ (p. 232). Bailey (1994) made it slightly simpler by stating that classification schemes order “entities into groups or classes on the basis of their similarity” (p. 4). He also mentioned that classifications could be made along either one or multiple dimensions. An example of a classification scheme is the well-known periodic table of elements in the chemical context (Niknazar and Bourgault, 2017). On the other hand, typologies can be specified as “conceptually derived interrelated sets of ideal types” (Doty and Glick, 1994, p. 232). Snow and Ketchen (2014) added that typologies to be beneficial and resilient should also follow the mutually exclusive and collectively exhaustive idea (Snow and Ketchen, 2014). For instance, Porter (1980, 1985) created a typology of four generic strategies for

creating a competitive advantage, using the competitive scope and the types of competitive advantage as dimensions.

Table 3.2 shows the most cited publications dealing with classifications and typologies for electronic marketplaces. The listing is based on the number of citations taken from the literature databases Scopus and Google Scholar[4]. The entries are sorted by year of publication, starting with the earliest classification framework. Table 3.3 outlines the concepts of these articles.

Table 3.2: Most cited publications on classifications/typologies for EMs

Year	Autor(s)	Title	Number of citations	
			Scopus	Google Scholar
2000	Kaplan & Sawhney	E-hubs: The new B2B (business-to-business) Marketplaces	434	1464
2002	Dai & Kauffman	Business Models for Internet-Based B2B Electronic Markets	198	427
2003	Grieger	Electronic Marketplaces: A Literature Review and a Call for Supply Chain Management Research	238	519
2003	Skjøtt-Larsen et al.	Electronic Marketplaces and Supply Chain Relationships	107	206
2006	Standing et al.	Examining the Relationship Between Electronic Marketplace Strategy and Structure	33	62
2007	Petersen et al.	B2B E-Marketplaces: A Typology by Functionality	36	67
2007	Wang & Archer	Electronic Marketplace Definition and Classification: Literature Review and Clarifications	56	84
2007	Guo	Business-to-Business Electronic Market Place Selection	32	40
2010	Balocco et al.	B2B eMarketplaces: A Classification Framework to analyse Business Models and Critical Success Factors	33	57
2012	Movahedi et al.	E-Marketplace Emergence: Evolution, Developments and Classification	13	8
2015	Hahn et al.	A Value Proposition Oriented Typology of Electronic Marketplaces for B2B SaaS Applications	4	5
2018	Täuscher & Laudien	Understanding Platform Business Models: A Mixed Methods Study of Digital Marketplaces	105	229

Note: The lighter font color marks classifications/typologies that apply to EMs in general but are not specifically dedicated to B2B.

[4] Even though both literature databases state the respective citation counts, the numbers often differ considerably. The reason for this is that Scopus only takes journals into account whereas Google Scholar also includes sources such as dissertations and book chapters (Martín-Martín et al. 2018).

Table 3.3: Brief summaries of the selected classifications/typologies

Year	Author(s)	Concept
2000	Kaplan & Sawhney	E-hubs can be classified based on "what" and "how" companies purchase goods and services.
2002	Dai & Kauffman	The framework is based on the roles (basic market function, management needs, technology adapters) and respective functions of EMs.
2003	Grieger	The framework considers the stakeholder focus, industry scope, pricing mechanisms, purchasing process, accessibility, supported transactions, and market mechanisms of EMs.
2003	Skjøtt-Lasern et al.	The framework focuses on the industry scope, stakeholder focus, pricing mechanisms, accessibility, supported transactions, and purchasing behavior.
2006	Standing et al.	E-markets are classified based on their ownership and governance construction.
2007	Petersen et al.	EMs are typologized by their functionality throughout the purchasing process.
2007	Wang & Archer	The framework includes several dimensions, which are: number of participants, relationship dimension, participant behavior, ownership, industry scope, market mechanism, products, power asymmetries, and fee structure.
2007	Guo	EMs can be classified into three types, namely private, community, and public electronic marketplaces.
2010	Balocco et al.	The framework considers the service-provisioning model and the B2B processes supported by e-markets.
2012	Movahedi et al.	The framework is based on the types of parties involved, type of products and services offered, application of the goods and services, relationship horizon, pricing mechanism, marketplace bias, market orientation, market ownership, and accessibility.
2015	Hahn et al.	EMs can be classified according to integration into a platform ecosystem, seller/partner access, industry scope, ownership, ownership bias, value proposition focus, buyer/seller focus, and transaction phase support.
2018	Täuscher & Laudien	A business model is used to classify EMs, distinguishing between value-creating dimensions (platform type, key activity, price discovery, review system), value delivering dimensions (key-value proposition, transaction content, transaction type, industry scope, marketplace participants, geographic scope), and value capturing dimensions (key revenue stream, pricing mechanism, price discrimination, revenue source).

In Chapter 2, a new typology for B2B commodity marketplaces was introduced, consisting of three different operating models. This typology is used in the following.

- Open marketplaces: The demand side can directly see the different suppliers and their respective product portfolios. The main function of open marketplaces is to allow the potential buyer to contact the supplier and request a quote (RFQ process).
- Closed marketplaces: The demand side cannot see the suppliers, i.e., the platform usually does not support the RFQ process. Instead, the direct purchase of a product is possible, and the platform operator becomes the contractual partner here.
- Meta-search marketplaces: The demand side receives an overview about many different suppliers' product portfolios. This information is gathered from several websites, web shops, and open marketplaces. Web crawlers are usually used and programmed for this purpose, searching through the internet and copying the original content which is finally brought together and displayed in the interface of the meta-search marketplace. As with open marketplaces, the RFQ process is also possible here.

3.3 Methodology

According to Doty and Glick (1994), "typological theories must be tested with conceptual and analytical models that are consistent with the theory" (Doty & Glick. p. 264). The typology for B2B commodity marketplaces proposed in Chapter 2 is tested with the help of this descriptive study. The testing of the theory is done by assigning 62 electronic marketplaces for chemical substances according to the typology (see also Appendix 2). In addition, further statistical analyses are carried out with this data sample.

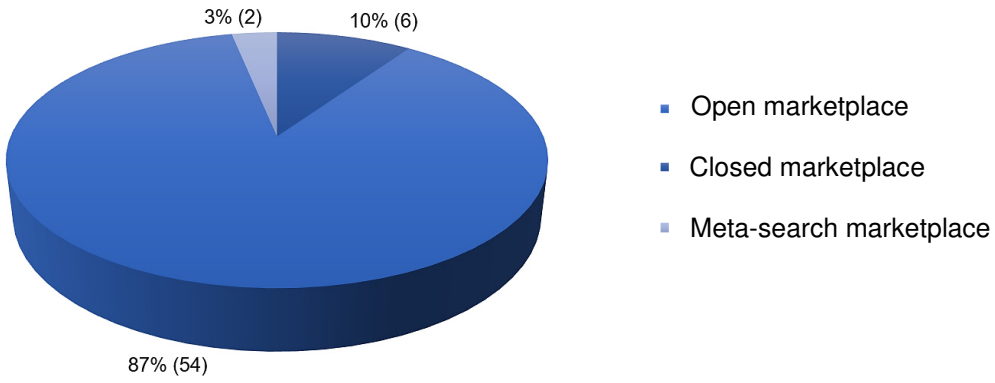
The sample comes from a survey made by the company Chembid, which operates a meta-search engine for chemical substances and their suppliers. According to Chembid, the marketplaces of their survey were selected with the following criteria: "Platforms offering chemicals like marketplaces or e-auction platforms" (Chembid 2020, p. 3). Consequently, web shops/e-shops or business directories were excluded and platforms containing only a very small number of chemical products. Furthermore, the platforms had be available in the English language. The data collection of Chembid took place

between August and November 2020. Their final report[5] was published in December 2020 and contains 61 marketplaces. Since Chembid itself is a platform for chemicals, Chembid was added to the sample so that it finally includes 62 electronic marketplaces which offer chemical products.

3.4 Results

These 62 marketplaces were assigned to the three types to test the proposed typology for B2B commodity marketplaces. The three types are the open marketplace, closed marketplace, and meta-search marketplace. The assignment shows that the majority (87%) of the marketplaces covered are operated as open marketplaces. 10% of the marketplaces function as closed marketplaces and 3% as meta-search marketplaces (see Figure 3.2).

Figure 3.2: Chemical marketplaces by operating models



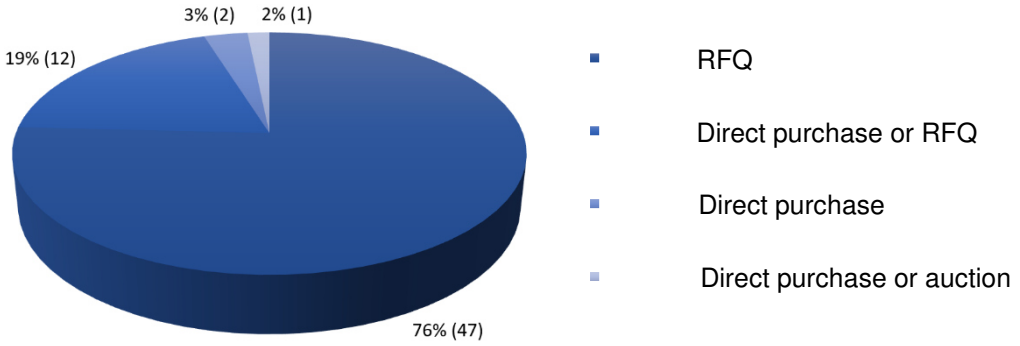
Regarding the product portfolio of these 62 marketplaces, 44% are specialized in chemicals, whereas 56% offer a wide range of different products, where chemicals are just one product category among many others.

On 76% of all marketplaces from the sample, a request must be submitted to the respective supplier via the marketplace to receive an offer in the form of the RFQ process. Consequently, price information is usually not visible at first sight. Few marketplaces (19%) follow a hybrid approach in this regard. Besides the RFQ option, these

[5] Chembid's report can be downloaded via the following link: https://www.chembid.com/en/marketplaces-report

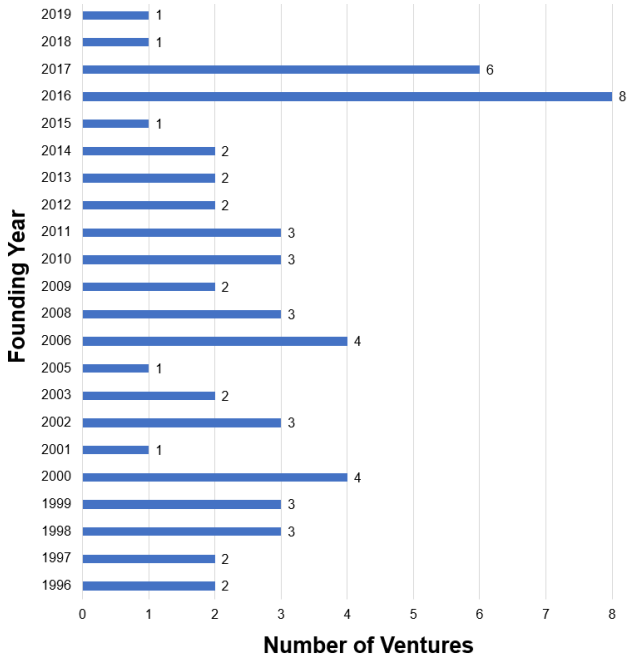
marketplaces also offer a direct purchase option for certain products. In addition, very few marketplaces offer a direct purchase as the only option (3%), or even the possibility of an auction (2%) (see Figure 3.3).

Figure 3.3: Chemical marketplaces by buying options



30 of the 62 marketplaces were founded before 2010, and 29 were founded after 2010. For three marketplaces, the founding date is not available. There were peaks in the founding activity in particular in 2016 and 2017 (see Figure 3.4). Many venture foundings took place in China (23), India (12), and the US (11). Six marketplaces of the sample were founded in German-speaking countries.

Figure 3.4: Chemical marketplaces by founding year



3.5 Discussion

In the chemical industry, the supply side consists of manufacturers, dealers, and distributors. The sale of larger quantities in the chemical industry is dedicated to the big chemical manufacturers. This market segment is generally untouched by dealers and distributors, which is also contractually defined between them and the manufacturers. For this reason, small and medium quantities remain the market segment of dealers and distributors in the chemical industry.

Being a supplying company on an electronic marketplace brings an increased perception what comes with different marketing aspects. Especially with regard to the acquisition of potential new customers, marketplaces offer interesting opportunities for suppliers. Potential new customers can request a quote or directly buy a specific product. As the analysis shows, the RFQ process is the most common way to introduce and facilitate interaction between the seller and the buyer.

The experience of "directly buying a product" via a marketplace, which is very common in B2C contexts, is very unusual in many B2B contexts, also for the chemical industry. For a direct purchase of a chemical product, it would be necessary that the respective price information is stored in the marketplace's system. This is mostly not the case what requires the RFQ process. One reason for this is that prices for chemical products are influenced by several parameters (e.g., the requested quantity, the delivery, the frequency of the order). These parameters make it difficult and complex to give a direct pricing feedback to the potential customer. Another reason is that openly visible prices would lead to increased transparency. This transparency would make it possible to compare different suppliers, what they would like to avoid. Nevertheless, few marketplaces for chemicals experiment with the direct purchase option for very few products. They aspire towards the B2C buying experience.

Even rarer are marketplaces that only allow the direct purchase of a product and do not support the RFQ process at all. Such marketplaces are often operated by dealers or distributors who have digitalized their respective product portfolio. It is consequently questionable whether these can be regarded as "real" marketplaces since such websites are actually a dealer's or distributor's web shop.

The marketplace operator makes the choice of the operating model of the electronic marketplaces. This choice comes with consequences for the platform operator as well as for the demand and supply side. If a platform follows the operating model of an open marketplace, it will be difficult or even impossible for the operator to be involved in the

transaction between the two participating parties. This is difficult because buyers and sellers come together through the marketplace, but the actual transaction usually takes place outside the marketplace environment. This is due to the RFQ process and the associated information exchange that is needed for the transaction. B2B marketplaces allow and initiate this exchange of information, which offers advantages for the supply and demand side. At the same time, it comes with a major disadvantage for the marketplace operator because open marketplaces often lack a sustainable business model. In the B2C context, monetization usually takes place during the transaction process, i.e., with a brokerage or commission fee withheld by the marketplace operator. Since the transaction happens mostly outside the platform in B2B contexts, no monetization can occur here.

Thus, there is a need for other revenue streams, which often lie in services offered to the platform participants before or after the transaction. This also applies to meta-search marketplaces. For example, Chembid decided to offer business and market analysis solutions in addition to its search function for products and suppliers. Chembid is not an exception here so that many marketplaces develop and offer additional services besides the matchmaking. Identifying suitable revenue streams for B2B marketplaces remains consequently a challenge. Marketplace operators are still experimenting what might also have effects on the platform participants. Participants should be aware of the fact that the terms and conditions of a marketplace might change over time because B2B marketplace business models are still in development.

3.6 Conclusion & implications

Assigning the chemical marketplaces to the three types for commodity marketplaces was possible, which confirms the typology. The new typology can be considered as a theoretical contribution to the research field of electronic marketplaces because it deepens the functional perspective on EMs, including the consequences of each function for the platform operator and the participants. This comes with relevant implications for practitioners what has so far not been discussed in the literature.

The application of the typology to the sample shows as well how marketplaces in the chemical industry are currently operating. It became clear that the majority of the marketplaces follow the model of an open marketplace. This model creates in particular value for the platform participants, but marketplace operators still often lack a sustainable

business model, as the established RFQ process prevents a transaction fee. Since the transaction between buyer and seller happens most of the time outside the platform, operators of B2B commodity marketplaces have to develop services that can be monetized. Otherwise, these are business models that will not exist in the long term.

In contrast, closed-marketplaces try to achieve a business model by becoming the contractual partner themselves. In other words, they want to be the transaction partner and not only the matchmaker who brings both sides together. On such marketplaces, it is usually possible to directly buy a product. A direct purchase of a product on a B2B electronic marketplaces only works when prices are stored in the respective operator's system. Suppliers would therefore need to give pricing information to the platform operator. For the vast majority of chemical suppliers this is an absolute "no-go", as pricing data is a sensitive subject (see also Chapter 4). Consequently, suppliers in the chemical industry should be careful with such information and only be present on EMs that support supply and demand matching, but not the price negotiation or the transaction. These steps should better take place apart from the platform otherwise this becomes very powerful. Besides activities on platforms, many chemical suppliers should focus on their own RFQ processes and further optimize, automate, and digitalize them.

4 Essay 3 – Challenges affecting the adoption of B2B electronic marketplaces[6]

Abstract

Almost 20 years after the bursting of the dot-com bubble, we are again experiencing a boom in B2B electronic marketplaces. These marketplaces usually connect buyers and suppliers in the digital sphere. However, the implementation of a marketplace comes with numerous challenges in the B2B sector. Marketplace operators often reach their limits, especially at the operational level. Based on expert interviews with five electronic marketplaces from the chemical industry and other data sources, we have collected these challenges and classified them into four categories: (1) Technical Level, (2) Individual & Cultural Level, (3) Corporate Level, and (4) Industry Level. The categories presented in this case study extend an existing research model that deals with the adoption of B2B electronic marketplaces. This theory development provides a deeper understanding of electronic marketplaces, which is important for researchers and practitioners. The mastering of these challenges has a major influence on the adoption of the respective marketplace as well as on its success or failure.

4.1 Introduction

During the dot-com bubble period, internet-based companies received much funding through high investments that later turned out to be extremely speculative (Day et al. 2003). The bubble was created between 1995 and 2000, shortly after it burst and went down in history as one of the most legendary stock market crashes of all time (ibid.). During the dot-com boom, numerous B2B electronic marketplaces (EMs) were created, most of which disappeared from the market during the crash or a short time later. Companies such as Chemdex, Chematch, or ChemConnect were well-known B2B EMs in the chemical industry at that time (Tedeschi 2001; Glick 2001; Kane 2002). Almost 20 years later, we are experiencing a new boom in this industry with companies such as

[6] This chapter is based on the publication *Challenges Affecting the Adoption of B2B Electronic Marketplaces* published in the *Journal of Business Chemistry (2019), 3, 154-164*. Slight changes were made compared to the publication.

CheMondis, Chemberry, GoBuyChem, KEMGO, and Asellion (CHEManager 2019). While these "new" B2B EMs share commonalities, they also exhibit differences. All companies focus on the chemical industry and pursue a marketplace model that aims to bring together buyers and suppliers of chemical substances. This makes them competitors, as well as interesting objects of investigation. A crucial success factor for every EM operator is the adoption of the marketplace in its specific community or industry, which can be defined by the regular use of the marketplace through the respective user groups, which can be grouped into buyers and suppliers (Driedonks et al. 2005).

Coming back to the chemical industry, the marketplace model represents an innovation since aspects that are still perceived as new for this very traditional industry accompany this model. For instance, EMs achieve certain transparency and comparability through their platform character (ideally many buyers and many suppliers). We are already interacting with this scenario from the B2C context when we make purchases privately on marketplaces such as Amazon, where we can compare products and prices from different manufacturers or retailers. In the B2B sector, this transparency does not yet exist in many industries. This also applies to the chemical industry, where prices for chemicals are usually negotiated between buyers and sellers.

In the course of digitalization, the importance of B2B EMs is again increasing, as many of the current activities focus on the customer or the (end-) user. From the point of view of the B2B buyer (e.g., a procurement manager), the transparency would be a desirable development. From the supplier's point of view, however, EMs represent, in most cases, a threat to the established business. B2B EMs, therefore, pose different challenges regarding their adoption than B2C EMs. The latter have been investigated intensely in research, which is probably due to the success of Amazon (Alt & Zimmermann 2019).

In this paper, we discuss the challenges of B2B EMs by applying the grounded theory approach formulated by Glaser and Strauss (1967) to the five chemical marketplaces mentioned above. With this research, a contribution is made to the field of digital business and e-commerce and, more precisely, to the field of electronic marketplaces and their adoption.

4.2 Theoretical background

Electronic Marketplaces (EMs, also "Electronic Markets," "E-Markets," "E-Hubs", "Two-sided platforms") received much attention from researchers at the time of the dot-com boom and the years that followed. Among several definitions that arose during that period, Archer & Gebauer (2002, p. 1) describe EMs as "virtual marketplaces where buyers and suppliers meet to exchange information about prices and product and service offerings, to collaborate, and to negotiate and carry out business transactions." EMs can also focus on the B2B sector by allowing business partners such as suppliers and buyers to communicate and conduct business transactions (Timmers 1998; Chow et al. 2000).

The desire to categorize EMs has remained unbroken ever since, especially when closer attention is paid to the features and functions of an EM, where one can differentiate between exchange, auction, or aggregator (Timmers 1998; Chow et al. 2000). Kaplan and Sawhney (2000) suggest categorizing B2B EMs according to their product portfolio and whether EMs perform correspondingly as horizontal or vertical markets. Others focus more on the dynamics and mechanisms inside an EM, e.g., by focusing on the aspect of competition on a platform (Kollmann 2000; Holland 2002; Belleflamme & Peitz 2019), on pricing strategies and information transparency (Yoo et al. 2002; Zhu 2004; Soh et al. 2006) or the evolution of an EM (Tomak & Xia 2002, Thuong 2005).

Day et al. (2003, p. 132) elaborate on the distinctions by regarding the functions as well: "These exchanges offer various combinations of six core services: (1) information exchange, (2) digital catalogues that help to automate the procurement process, (3) auctions that attract large numbers of suppliers to compete for contracts, (4) logistics services to facilitate the physical movement of goods, (5) collaborative planning so different members of a supply chain can view each others' inventory levels and production schedules, and (6) value-added services such as design collaboration, financing or offline brokering."

The pioneers of the research field might well be Malone et al. (1987, p. 488), who said that EMs "electronically connect many different buyers and sellers through a central database." Shortly before the bursting of the dot-com bubble, Choudhury (1997) added that EMs are "inter-organizational systems through which multiple buyers and suppliers interact to accomplish one or more of the following market-making activities: (1) identifying potential trading partners, (2) selecting a specific partner, (3) executing the transaction." Another B2B-focused definition comes from Standing et al. (2006, p. 297): "In its simplest form a B2B e-marketplaces can be defined as an inter-organizational

information system that allows the participating buyers and sellers in some market to exchange information about prices and product offerings. Indeed, e-marketplace structures are complex and vary considerably according to the market maker's business strategy."

Standing et al. (2010) categorize the literature into the following categories and subcategories (see Table 4.1). One limitation noted by the authors is the focus on scientific journals located in the area of information systems. They only included one journal outside the field of information systems, which was Management Science.

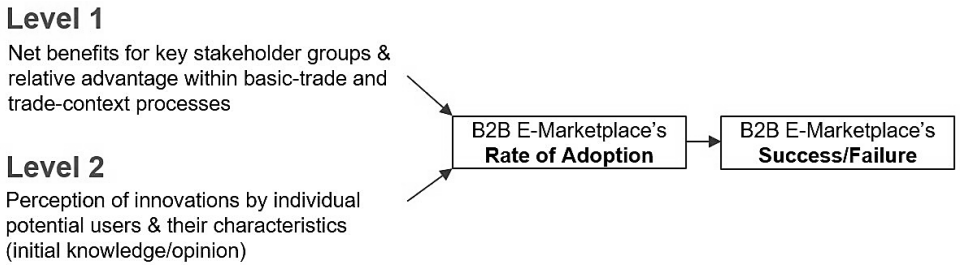
Table 4.1: Research streams in the field of electronic marketplaces (Standing et al. 2010)

Category	**Subcategory 1**	**Subcategory 2**
Electronic Markets	General discussion	
	Efficiency	
	Pricing	
	Search costs	
	Product	
	Structure	
	Operational performance	
System	General system perspective	
	Auction	General
		Auction support systems
		Pricing
		Trust
		Auction types and strategies
		Revenue
	Knowledge management systems	Procurement/supply chain
	EM models	
	Trading mechanisms	
Adoption/Implementation	General adoption issues	
	Adoption approaches	
	Adoption in procurement and supply chain	
	Barriers/motivations	
Organizational issues	General organizational issues	
	Trust and security	
	Relationships and networks	
	Strategy	

With this article, I mainly contribute to the research stream "adoption of (B2B) electronic marketplaces," where the key research question is: What affects the adoption of B2B EMs, and how can the factors influence the possible success or failure of EMs? In other words, it is about the decision of the EM user to adopt the "new way of B2B trading" (Driedonks et al. 2005, p. 50). The research stream on the adoption of EMs is based on different theories like the technology adoption theories, such as diffusion of innovation theory and technology acceptance model, as well as on other theories, such as social network theory, transaction cost theory, or resource dependence theory (Bakos 1997; Wang 2008; Luomakoski 2012). Driedonks et al. (2005) define the rate of adoption as "the relative speed with which an innovation is adopted by members of a social system, which is generally measured as the number of individuals who adopt a new idea in a specified period, such as each year." In this article, the same position is taken so that adoption can be understood "as the range of behaviors from the decision to use an innovation to full and regular use of it, and rejection means the decision not to use the innovation at all" (Driedonks et al. 2005, pp. 50). The success or failure of an EM is closely related to the rate of adoption. This was already addressed by researchers on a "high level" but not on an operational level that platform operators face in their daily business. For this reason, I focus on the operational level.

Driedonks et al. (2005) show this in a case study on the Australian beef industry, in which a marketplace emerged at the time of the study. They distinguish between two levels that influence the rate of adoption of an EM (see Figure 4.1), which will be the basis for our (extended) research model: Their Level 1 deals with the key stakeholders that should achieve a relative advantage by using the EM, always compared to existing (perhaps non-digital) transaction processes. Their Level 2 focuses on the actual user of the EM and, in particular, his or her (previous) knowledge and perception of the EM. Both levels or aspects have an influence on the adoption rate of the EM, from which it can be derived whether the EM will be a success or a failure.

Figure 4.1: Challenges influencing the adoption of EMs (Driedonks et al. 2005)



4.3 Methodology

The abductive approach describes a research process that mostly begins with "surprising facts" or "puzzles" that should be explained. These may emerge when a researcher encounters an empirical phenomenon that cannot entirely be explained by the existing range of theories (Saunders et al. 2012). Here, the empirical phenomenon is the almost simultaneous emergence of several B2B marketplaces in the chemical industry and its adoption. Following this abductive approach, I propose a model that contains the main challenges regarding the implementation of B2B EMs from the perspective of the marketplace operator. The abductive approach can be viewed as a combination of deductive and inductive approaches. Deductive approaches deal with the development of propositions from current theory, which should be tested later in the real world (Yin 2013). Inductive approaches rely on "grounded theory" (Glaser & Strauss 1967), where theory is systematically generated from data. According to Glaser and Strauss (1967), there is a continuous iteration between empirical data collection and data analysis, which allows the generation of theory. In this paper, our research follows an inductive rather than a deductive approach, as we first dealt with data collection. At the same time, I was aware of the current theory. After the data analysis, I was able to extend the model of Driedonks et al. (2005).

The main source of data are semi-structured expert interviews with company representatives (see Table 4.2). The objective of the interviews was to collect the main challenges of B2B EM operators in the chemical industry. In order to deal with a homogenous sample, only cases that follow a marketplace model in the chemical industry and are active in Europe were selected for this research. A total of eight interviews were conducted, in which ten experts from five companies were involved. These five companies represent around half of the population of chemical marketplaces that are active in the European market (Von Hoyningen-Huene 2019). The interview partners were the CEOs, managing directors, or senior managers of the respective companies. The interviews took place on the phone or on-site between January and August 2019. Each interview lasted between 30 and 60 minutes (total: ~ 5h). The interviews were transcribed and later analyzed, focusing on the challenges of the platform operators expressed by the interview partners. This resulted in four categories, which will be explained in the next section. Each challenge could be assigned to one of these categories. Secondary data was collected from company websites and newspaper articles. These sources mainly contained information about the participating companies (for the case descriptions) and

the industry in general as the context is quite relevant here. Additionally, I used newspaper articles for the introductory part (e.g., historical background). Due to the various data sources and the different companies involved, the article follows a multiple case study approach.

Table 4.2: Overview of the five cases

Company Name	**Founding Year**	**Number of Employees (09/2019)**	**Description of the company**	**Number of Interviews / Number of Interv. Partners**	**Data Sources**
Asellion B.V.[7]	2019	24	Asellion is a private, reliable and scalable digital platform allowing suppliers of chemical materials to set up their own stores and sell their products directly to industry customers. This Software-as-a Service (SaaS) model has been designed with the future aim of hosting closed direct stores where sellers and buyers can transact in a flexible, private, and secure manner. The Covestro Direct Store is the first and currently only store on the platform offering exclusive access to Covestro products and services to selected business customers. In the future, Asellion will open up the platform to third parties and create more direct stores in addition to the Covestro one. The company was fully funded by venture capital from Covestro at the time of the interview.	1 / 2	Company website, Conducted interview

[7] Asellion ceased its business activities as an independent company in 2021. Developments continue to be used within Covestro.

Chemberry (Clariant International Ltd.)	2018	10	Chemberry is an internet platform enabling chemical buyers to easily find the ingredients they need. The company aims to be the most comprehensive source of ingredients available online. Detailed, up-to-date information and cross-referencing creates an intelligent search and comparison platform for specialty chemical ingredients. The company was fully funded by venture capital from Clariant at the time of the interview.	1 / 1	Company website, Conducted interview
CheMondis GmbH	2018	30	CheMondis is an online marketplace for chemical products. The start-up, founded by specialty chemicals group LANXESS, is designed as a B2B platform for companies to buy and sell products across all manufacturers and distributors. As a buyer, it is possible to see the different suppliers on the platform, so CheMondis functions as a “matchmaker” between both sides (incl. payment options) but is not the contracting party. There are currently two ways to purchase a product through CheMondis: in the form of a direct purchase option, if the supplier allows this, or through an online negotiation.	4 / 5	Company website, Conducted interviews
GoBuyChem Ltd.	2017	4	GoBuyChem is an online marketplace for chemicals as well. Here, buyers can browse and choose products from different anonymized suppliers, so the buyers cannot see the different suppliers. Furthermore GoBuyChem is the contracting party, handling all logistics and transportation. In other words, the company pursues a “one-stop-shop”-model. GoBuyChem is backed by private investors and business angels, as well as by the distributor Noahs Ark Chemicals.	1 / 1	Company website, Conducted interview

Kemgo Inc.	2014	n.a.	Kemgo is a technology platform for different B2B e-commerce solutions. Their main focus is currently on an e-auctions marketplace for the chemical industry. This means that a supplier places an offer on the marketplace and various potential buyers can place their bids. Conversely, this is also so that different suppliers can apply for a request from a possible buyer. Kemgo was founded by two entrepreneurs.	1 / 1	Company website, Conducted interview

4.4 Findings

Four different categories emerged in the course of the interviews' analysis into which the challenges of the EMs examined can be classified. These are labeled as follows: Technical Level, Individual & Cultural Level, Corporate Level, and Industry Level. We have assigned the respective challenges to these categories (see Table 4.3).

The challenges of B2B EMs can be classified into four categories. At the technical level (1), there might be interface problems with existing and established systems that are already used internally (e.g., ERP, CRM). The manual upload of products to the EM or updating product information is also an additional effort. The basic goal of EMs to accelerate the trade and make it more efficient can already fail at this level. At the individual and cultural level (2), it might become challenging as well. Depending on the cultural area, there may be tendencies towards a higher or lower affinity with regard to the adoption of new technologies and innovations. In addition, humans seem to prefer established processes to unfamiliar and new processes. In terms of the work context, there is often a lack of incentives for an employee to take up the challenge of new digital solutions. If an employee suggests new (digital) processes, this can even be risky and, in the worst-case scenario, can lead to bad team dynamics or related problems. For this reason, a bottom-up approach appears less likely than a top-down approach. Thus, managers need to approve the new technology/innovation before the operative staff is going to work with it.

The corporate level (3) also brings various challenges: If the transaction should take place on the EM, prices must be fixed or negotiated there. Fixed prices that are open and thus visible to the user of the platform pose a problem for many suppliers in the B2B

sector. They are worried that price transparency will threaten the established business and that the potential customer will make their decision based only on price. In addition, there are various uncertainty factors. On the one hand, it is difficult for suppliers to predict how many new leads or customers can be generated through the EM. If many new requests arise, new employees might have to be hired to serve them. On the other hand, the behavior of the platform operator is difficult to predict. What exactly happens to the data generated on the EM, and is it always used to the advantage of all EM participants? Unresolved questions reduce the adoption rate, especially in the B2B area, where highly sensitive data is often involved. Furthermore, the question of liability and the appropriate business model arises. If the EM functions as a "matchmaker," the EM is openly bringing the demand and the supply side together, without necessarily being the contracting party. If the EM follows the model of a "one-stop-shop" (= "closed marketplace", see Chapter 2 and 3), the EM is the contracting party. Both the "Matchmaker Model" and the "One-Stop-Shop Model" have advantages and disadvantages for the EM operator as well as for the EM participants.

When it comes to the industry level (4), transparency about prices, products, and suppliers is particularly problematic for the supply side. This transparency is, at the same time, one of the core value propositions of an EM from the buyer's perspective. In traditionally oriented industries, such as the chemical industry, transparency-creating EMs, therefore, reach their limits. Another characteristic of B2B transactions, in general, is the pre-qualification and evaluation of suppliers. These processes are usually time-consuming and complex. EMs that focus on the transaction should therefore pay attention to industry-specific requirements. Another characteristic of the B2B sector is the general preference for strong firm-supplier-relationships. The so-called spot market for fast and unforeseen demand can therefore vary significantly in size from industry to industry. This raises the question of whether EMs always address the spot market or whether they generally try to cover an industry's entire trading. The last aspect goes hand in hand with the hypothesis that all trade will take place digitally in the future.

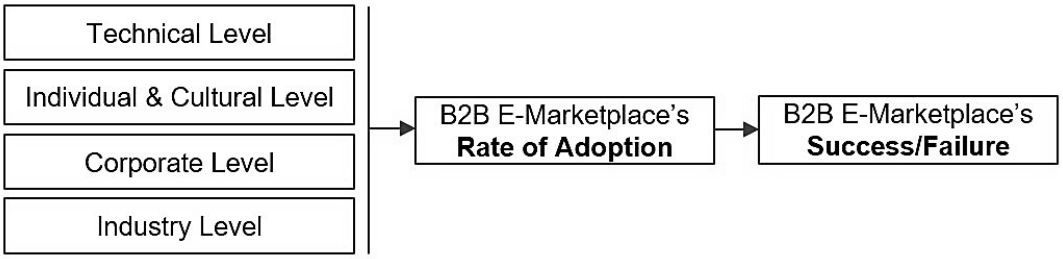
Table 4.3: Findings and categories

Technical Level	
1) Missing interfaces between EMs and corporate systems (ERP, CRM etc.)	2) Manual upload and updating of products/ product descriptions
Individual & Cultural Level	
1) Differences in cultures with a higher affinity for new technologies/innovations than others 2) General mindset of most people preferring established processes over "new way" to do something.	3) Usually there are no incentives for employees to work with new digital products 4) Sometimes it is even risky for the individual to break with the established way of "doing the job"
Corporate Level	
1) "Open" pricing becomes a major challenge for many corporates and is hardly feasible as lack of transparency is a fundamental component of B2B sales 2) Uncertainty due to unknown platform dynamics (particularly problematic for suppliers on a marketplace: Will there be more orders? Do we have to hire extra staff?) 3) Uncertainty due to operators' behavior that might not be clear or trustworthy for the platform participants, especially when it comes to data protection and sensitive information	4) Liability – Who is the liable party? The platform operator or the seller behind the platform? Such questions arise when there are different business models (see Chapter 2). 5) Selection of the "right" business model: Matchmaker (Problem: Once the platform connects buyer and supplier, they might leave the platform) or One-Stop-Shop (Problem: The platform becomes relatively powerful if the buyer does not know where the product comes from)
Industry Level	
1) Industry might fear a high degree of transparency that could damage the established business Supplier selection is usually a complex evaluation process, so it is not easy to enter a new business relationship "overnight" in most industries	2) This is related to the fact that strong customer-supplier relationships are preferred in the B2B sector, resulting in a relatively small spot market (that is targeted by the marketplaces most of the time)

4.5 Discussion & conclusion

Based on the study of Driedonks et al. (2005) and the findings, an extension of their research model can be proposed: I suggest naming their Level 1 “Corporate Level” and their Level 2 “Individual & Cultural Level”. I also suggest adding the “Technical Level” and the “Industry Level” to the model because these aspects are equally important but are yet to be treated. The proposed additions allow a broader view of the aspects that influence the adoption of a B2B EM and, consequently, also address a gap within this research stream. This represents the contribution (see Figure 3.2).

Figure 4.2: Extended model showing the challenges influencing the adoption of EMs



4.6 Limitations & outlook

There are limitations to the present study and the associated results. It might be difficult, for example, to transfer findings from the chemical industry to other industries. As far as the four categories are concerned, a clear classification of the findings was also not always possible as there are overlaps between the categories. An interesting research approach would be a process study that covers the development of B2B EMs over time, e.g., with regard to the number of participants or the possible revenue streams. Concerning the economic effect of B2B EMs, it might also be interesting to examine their impact on an industry in general (e.g., patent applications, network effects). Assuming that B2B EMs simplify and accelerate access to new materials and products, EMs could have an impact on an industry's ability to innovate.

4.7 Implications for practitioners

Managers and entrepreneurs in the process of establishing (or planning to establish) a B2B electronic marketplace face various challenges. A profound analysis needs to be carried out during (or ideally before) the implementation of such platform activities. The

levels mentioned above can serve as a guideline for this analysis. Each level should be dealt with intensively, for example, through methods such as customer and user interviews, stakeholder analysis, resource analysis, or ecosystem mapping. Based on the collected insights, a decision should then be made about whether and in what form a marketplace could be suitable for the respective industry. In most industries, there are already numerous highly specialized actors performing the key functions of the potential new marketplace (e.g., product catalogs, brokerage services, logistics services, financial services). The aim of the possible EM should be to aggregate these numerous offers and services and to provide them to the demand side from a single source.

5 Essay 4 – Website design and trust elements: A/B testing on a start-up's website[8]

Abstract

Start-ups are young companies that are hardly known by the relevant stakeholders, especially in their early stages. A start-up's website is, therefore, often the first point of contact for potential customers, investors, or partners. Such a website usually explains the new product or service and presents the founding team with its competencies. The user's perception of the website and its design can be crucial in determining whether the user is interested in getting in touch with the start-up or even considers the purchase of the respective product or service. User's trust in the website and its operator is essential for this. So-called trust elements are intended to create trust on websites, e.g., through logos, testimonials, or seals. The influence of these elements on user behavior has so far hardly been empirically proven in a real-life context. Therefore, we apply the method of A/B testing to the website of a fictive start-up. On one variant of the website, trust elements were placed (A), whereas on the other variant were none (B). The experiment shows that the duration of the user sessions does not differ between the two variants. However, more requests were made on the website variant with trust elements.

5.1 Introduction

Due to the growing importance of digitalization and the associated increase in using the internet, traditional commerce has become much more digital, what is called electronic commerce or e-commerce (Muñoz-Leiva et al. 2010). E-commerce has changed a lot particularly in the business-to-consumer sector (B2C), as new possibilities occurred to distribute goods and services directly to the customer (Walia & Zahedi 2013). Companies can use their websites as communication channels (Rahimnia & Hassanzadeh 2013) to offer products and services beyond their offices and shops (Beldad et al. 2010). With the help of these channels, companies can get in touch with existing customers as

[8] This chapter is based on the paper *Website Design and Trust Elements: A/B Testing on a Start-up's Website* published in the proceedings of the Enterprise Research Innovation Conference (ENTRENOVA, Vol. 7, No. 1, 2021), co-authored by Isabel Haupenthal and Faisal Bin Ahmed.

well as potential new ones (Rahimnia & Hassanzadeh 2013). Furthermore, e-commerce enables significant benefits for businesses and consumers, such as the reduction of costs (Rahimnia & Hassanzadeh 2013). From the perspective of potential customers, websites can be used to satisfy their needs and demands, such as obtaining a new product or service (Kim et al. 2010). Website users can interact and conduct transactions with the supplying party without any temporal or spatial constraints (Beldad et al. 2010; Lowry et al. 2014). Consequently, the purchase of a product or service might be possible under better conditions (Muñoz-Leiva et al. 2010). Hence, an increasing number of customers favor e-commerce over traditional commerce for these reasons (Li and Yeh 2010).

With focus on start-ups and young companies, e-commerce facilitates its entry into the global market and enables them to target a high-volume customer base (Rahimnia & Hassanzadeh 2013). In addition, e-commerce reduces marketing costs, promotes closer relationships with business partners as well as with customers, and can thus improve the popularity of the company (Rahimnia & Hassanzadeh 2013). Therefore, successful e-commerce businesses require websites that are visually appealing, easily navigable, informative, and secure (Cyr 2013).

As e-commerce lacks any kind of typical social presence, many concerns emerge, which cause people to be reluctant when operating online (Beldad et al. 2010). The larger the amount of money, the more concerned customers are about completing an online transaction (Muñoz-Leiva et al. 2010). As fraud also takes place online and e-commerce grows rapidly, one can assume that fraud cases continue to increase immensely (Walia & Zahedi, 2013). Therefore, the essential question is raised on how to establish trust in interactions or transactions conducted on the Internet, which is also called “e-trust” (Taddeo 2009).

Several researchers already found an answer to this question by identifying various website features and elements that influence user’s trust and consequently user behavior. These are often called “trust-inducing features” (Wang & Emurian 2005) or “trust elements” (Sivaji et al. 2011). However, their effect has hardly been empirically proven and tested in a real-life context. In contrast, laboratory experiments with control groups are much more common in the field of e-trust. We attempt to contribute to the e-trust literature through an experiment using A/B testing in a real-life context, meaning there are at least two variants of one and the same website. Differences in user behavior become, therefore, apparent in an A/B testing. In our case, the website variants differ in the presence of trust elements so that on one variant trust elements were visible (A), while

on the other these were removed (B). As far as we know, this application of a website-based A/B testing in a real-life context is unique in the field of e-trust.

According to Koning et al. (2019, p. 30), A/B testing "leads to 10% increase in [website] visits in the first few months after adoption" and "after a year of experimentation, the gains range from 30% to 100%". The numbers demonstrate the potential of this method and what importance it can have for the performance and success of a start-up.

5.2 Theoretical background

5.2.1 Trust & E-Trust

According to Rotter (1967, p. 652), trust is "the belief that one party will reliably keep its word or promise and fulfill its obligations in an exchange relationship." Gefen et al. (2003, p. 308) define trust as "the expectations that other individuals or companies with which one interacts will not take improper advantage resulting from the dependence one has on them." Coming from these offline dimensions of trust, Urban et al. (2000) transferred trust concepts to online dimensions by explaining how website trust is built. The authors also point out different contexts in which website trust might be important, e.g., online sales advisors, product presentation, advertising, or pricing (Urban et al. 2000).

Due to the increasing importance of e-commerce, the term "e-trust" was soon introduced (Merrilees & Fry 2003) as well as "online trust" (Wang & Emurian 2005; Kracher et al. 2005). Taddeo (2009, pp. 24) defines e-trust as "trust in digital contexts" and states that it "occurs in environments where direct and physical contacts do not take place, where moral and social pressures can be differently perceived, and where interactions are mediated by digital devices." E-trust is placed in a website and its content when the customer assumes that the other party is reliable and will fulfill its obligations (Muñoz-Leiva et al. 2012). We use the terms – website trust, online trust, and e-trust – as synonyms in the following. Another terminological distinction should nevertheless be made regarding the term "WebTrust". WebTrust represents guidelines for e-commerce assurance services which were developed by the American Institute of Certified Public Accountants, jointly with the Canadian Institute of Chartered Accountants (Chang et al. 2011).

Salam et al. (2003) differentiate between the trustee and the trustor. The trustee represents the party that is being trusted, so the website's operator who offers products or services. Hence, the trustor is the user who places trust into the trustee. Trust between these parties is based on the user's perception of the operator's ability, benevolence, and integrity (Mayer et al. 1995; McKnight & Chervany 2001; Pavlou 2003). Ability is here defined as the perceived competences and skills of the website operator (McKnight et al. 2002). Benevolence is described as the degree of empathy that the operator has towards the user whereas integrity refers to the aspect that the website's operator follows ethical and moral standards. Similar aspects are mentioned by Grabner-Kräuter et al. (2006), who distinguish between a soft and a hard dimension of trust. Soft characteristics of the trusted party are benevolence, honesty, integrity, and credibility, whereas hard characteristics are competence, predictability, reliability, correctness, and availability. Both dimensions affect the trustworthiness and the (perceived) functionality of the trusted party.

Further aspects for assessing the trustworthiness are the operator's reputation, the appearance and design of the website, and its performance (Beldad et al. 2010; Pengnate & Antonenko 2013). It is important to mention as well that potential customers focus heavily on reviews and other persons' feedback, even if they do not know them personally (Beldad et al. 2010). This is because people are "truth-biased", which means that they tend to believe criticism and reviews from other people (Liu & Goodhue, 2012). Tamimi & Sebastianelli (2015) emphasize that more online experience reduces perceived risks. Hence, experienced users are mainly influenced by ratings of reviews and the price of products when making their purchase decision. In contrast, less experienced users perceive the product type as the most important aspect.

Altogether many aspects play a role in the context of e-trust. The main objective from the perspective of the website's operator is to influence the user's purchase and repurchase intention. Lim (2015) states that this intention is influenced by the user's attitude as well as the perceived ease of use of the website. According to Zhang et al. (2011), the repurchase intention is closely related to the online customer loyalty which might bring a competitive advantage to the website's operator.

5.2.2 Trust elements

In our study, we focus on website design and, therefore, on trust elements that (might) influence user behavior and e-trust. For this, we use the framework of trust-inducing

interface design features from Wang & Emurian (2005). The authors developed this framework based on the existing literature. Furthermore, they categorized the identified trust elements in four dimensions: graphic design, structure design, content design, and social-cue design (see Table 5.1). Their dimensions were later confirmed by Seckler et al. (2015) through a web-based survey. When filling out the survey, the study's participants should think of an occasion where they felt "exceptionally trustful/distrustful" using a website (Seckler et al. 2015, p. 43). Consequently, their study relied on participants' memory and prior experiences with websites.

Table 5.1: Design elements influencing e-trust (Wang & Emurian 2005)

Dimension	**Explanation**	**Examples**
Graphic design	Refers to the graphical and visual design factors on the website that normally give consumers a first impression	• Use of three-dimensional dynamic • Use of moderate pastel colors • Use of well-chosen photographs
Structure design	Defines the overall organization and accessibility of displayed information on the website	• Implementation of easy-to-use navigation, i.e., simplicity and consistency • Use of accessible information, e.g., no broken links • Application of page design techniques, e.g., white spaces, grouping, visual density
Content design	Refers to the informational components that can be included on the website, either textual or graphical	• Display of brand-promoting information, e.g., company logo, slogan • Up-front disclosure of all aspects of the customer relationship, e.g., financial legal concerns • Display of seals of approval or third-party certificate • Use of comprehensive and correct product information

Social-cue design	Relates to embedding social cues, such as face-to-face interaction and social presence, into web interface via different communication media	• Inclusion of a representative photograph or video • Use of synchronous communication media, e.g., messaging and chat tools, video telephony

5.3 Methodology

Two research fields are in particular relevant in the context of this study which have not yet been brought together, although they could enrich each other in our opinion.

On the one hand, there are practitioners and researchers in the field of A/B testing who mostly present and discuss the methodology (Hynninen & Kauppinen 2014; Langmann 2018), or provide practical business examples (Kohavi et al. 2007; Crook et al. 2009; Kohavi & Longbotham 2011; Kohavi 2012; Kohavi et al. 2012; Kohavi et al. 2014; Kohavi 2015). Practitioners typically keep the results of experiments within their company scope. Software products like Google Optimize or Optimizely are usually used for A/B testing (Koning et al. 2019).

On the other hand, we have numerous theoretical models and concepts in the field of e-trust (see pp. 2-3), which were mostly derived from "offline" trust research and have not yet been tested in a real online environment. We are convinced that the method of A/B testing can be used to verify and expand existing theories.

A/B testing has so far mainly been used in practice to improve the website design and to encourage a certain user behavior, e.g., at companies like Airbnb, Amazon, Facebook, LinkedIn, or Netflix (Kohavi et al. 2020). According to Kohavi and Thomke (2017) the experimenter normally creates two experiences in an A/B testing: "A" usually represents the current website, often considered as the "champion", whereas "B" includes a modification of "A" and can, therefore, be considered as the "challenger". Modifications can be changes regarding the user interface or website layout as well as the implementation of a new website feature. The users are randomly assigned to the two variants, usually with a 50/50 ratio. The key metrics are collected, computed, and analyzed (see Table 5.2).

Table 5.2: Selection of typical metrics in an A/B testing

Metrics	Description
Pageviews	Total number of pages viewed. Repeated views of a single page are counted. (Google Optimize 2020)
Session duration	Length of a session in seconds. A session lasts as long as there is continued activity. (Google Optimize 2020)
Bounces	Total number of single-page visits. (Google Optimize 2020)
Transactions	Total number of completed purchases on the website. (Google Optimize 2020)
Revenue	The total revenue from web transactions. (Google Optimize 2020)
Click-Through Rate (CTR)	Rate that is calculated by dividing the total number of clicks on an element, e.g. buttons, by the number of people who have seen the element. (Optimizely 2020)
Conversion Rate	Rate that is calculated by dividing the total number of conversions by the total number of visitors, e.g., an e-commerce website receives 200 visitors/month and has 50 sales, the conversion rate would be 50 divided by 200, or 25%. (Optimizely 2020)

5.4 Experiment

We have chosen the start-up context as the overall setting of our experiment. The reason for this is that we believe that the website of a young company is of particular importance, as a variety of stakeholders is usually addressed, such as customers, investors, or partners. At the same time, start-ups are hardly known so that the website becomes metaphorically speaking a storefront. Consequently, we created a fictive start-up, and the corresponding website with two variants, A and B. The start-up was called SECUPROTECT.

The idea of the start-up was a “platform for security services”, which was accessible via the following URL: www.secuprotect.de. Private and commercial customers could therefore find the right security service provider more quickly with the help of SECUPROTECT. The market for security services is very fragmented this means that there are many small providers, most of whom are active locally or regionally. It is, therefore, a market where a platform business model potentially makes sense and might

bring value for the customer. The fictitious service portfolio of SECUPROTECT included the following security services: object protection (private), object protection (commercial), event protection, and personal protection (see Figure 5.1).

In our experiment, we assume that user's trust has an impact on the mentioned key metrics, especially regarding session duration. More precisely, we assume that users who trust a website stay longer on it and also show a different click behavior, i.e. users click more. Our website variants differ in the presence of trust elements, so on one variant trust elements were visible (A), while on the other these were removed (B). We have decided on three trust elements (see Figure 5.2):

- Logos of the (pretended) network of security service providers
- (Fake) Testimonial of a customer
- LinkedIn buttons (possibility to check the authenticity of the start-up founders)

Figure 5.1: Screenshot of the SECUPROTECT website

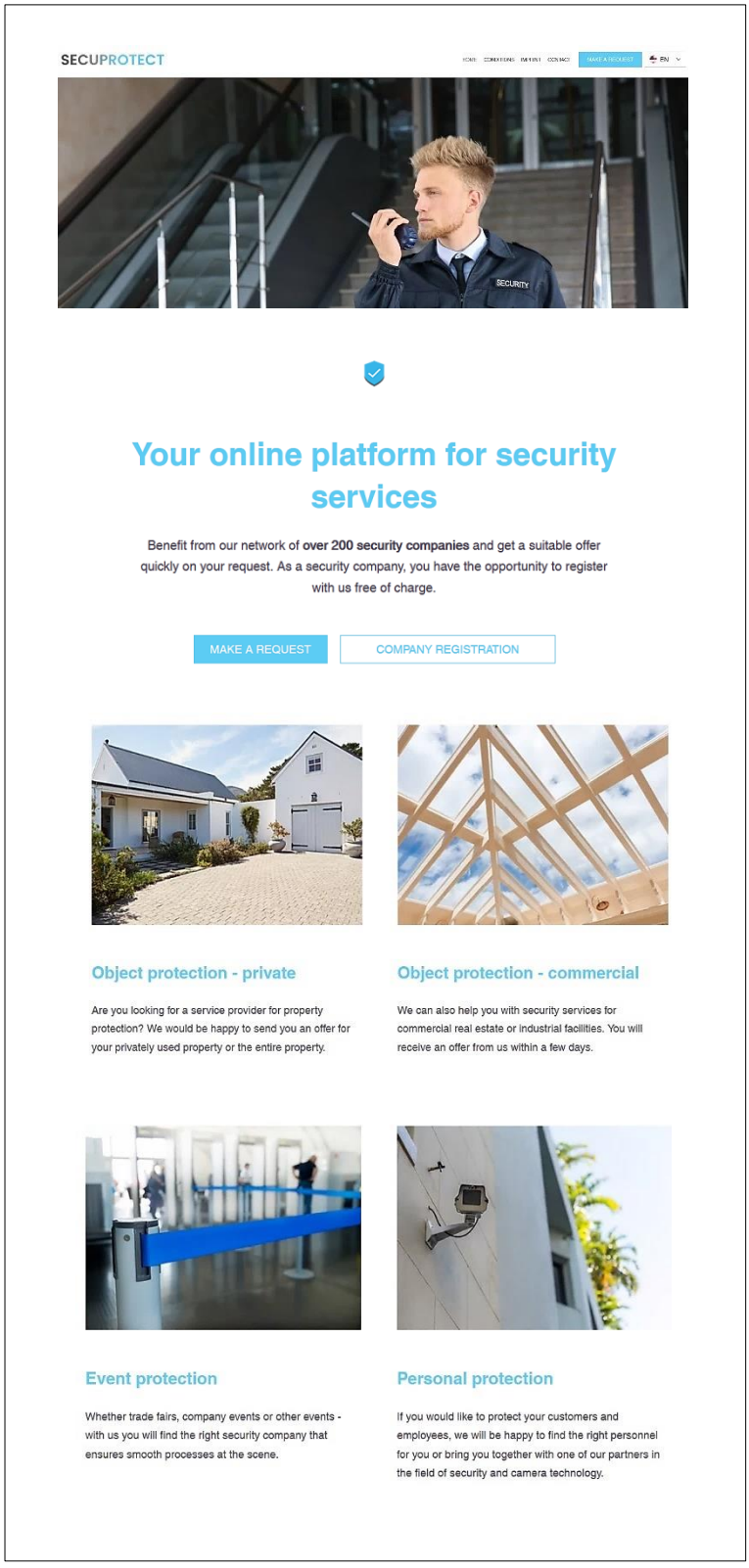
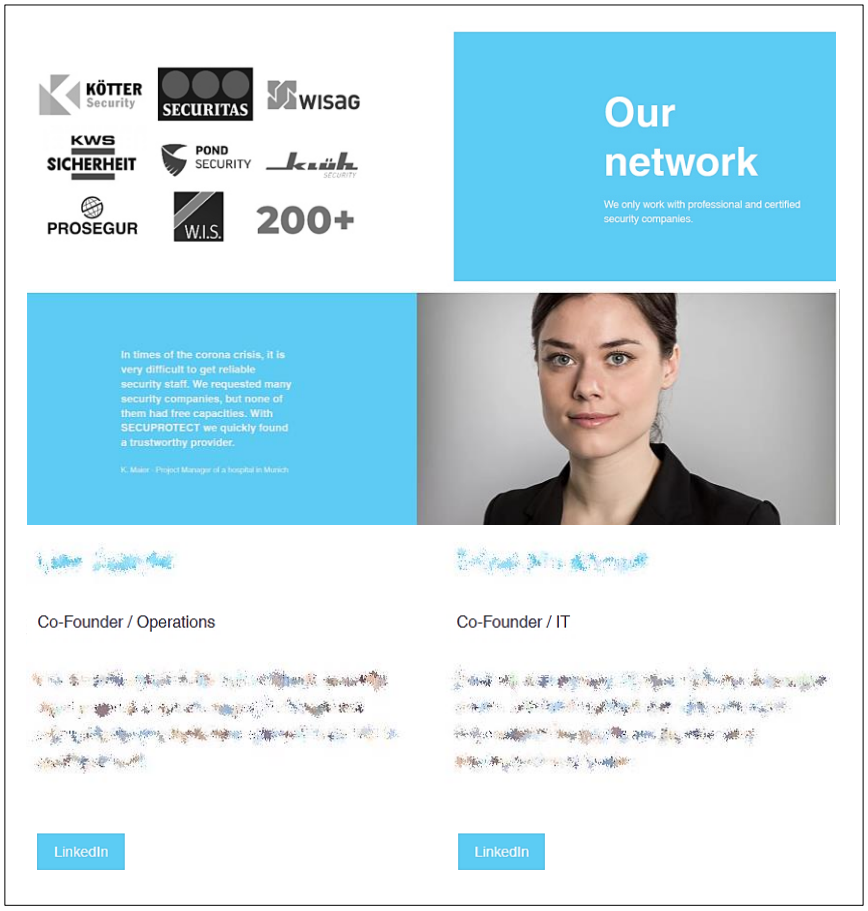
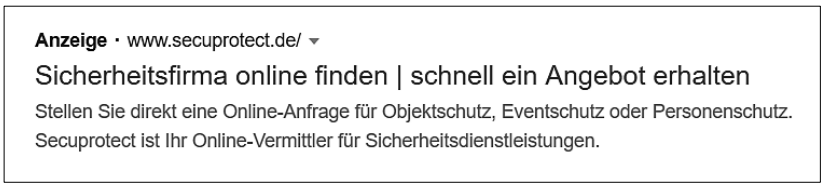


Figure 5.2: Screenshot of the trust elements on variant A (removed on variant B)



An A/B testing should be scheduled for a specific time frame. We have chosen a data collection period of 90 days (May 11, 2020 till August 9, 2020). Meanwhile, we also started the Google Ads campaign to make users aware of our website. Under the keyword "find security services" (German: *Sicherheitsdienstleistungen finden*) the website appeared mostly on page one or two in the German Google search during the campaign (see Figure 5.3).

Figure 5.3: Illustration of the Google advertisement in the German language



5.5 Technical & methodical limitations

We used the free version of Google Optimize for our experiment which comes with some limitations. In our case, the primary goal was to track the session duration as well as the number of clicks on a particular button. While Google Optimize does not support click counts on links or buttons, we decided to use a link shortener service called Cuttly as a workaround. With Cuttly, it is possible to track link or button clicks for free. We created two unique custom links for the same button, so one for each variant. We did this for the button named “Make a request.”

Much more problematic from a scientific point of view, was that Google Optimize or Google Analytics does not allow to export the raw data of the experiment. This is only possible with Google Analytics 360, which we were not aware of before and during the experiment. The use of Google Analytics 360 comes with an annual fee of EUR 135,000 which was of course outside the budget for this project. This also has consequences for the methodology of this study since without raw data no own statistical analyses can be conducted, e.g., t-test. For this reason, the following results are based entirely on Google tools. More information on the technical aspects can be found in Appendix 4.

5.6 Results

According to the statistics from Google Optimize (see also Appendix 3), there were a total of 456 sessions during the 90-day testing phase, which corresponds to the number of visits. The number of visits has to be distinguished from the number of visitors. The number of visitors was 398, meaning that some users have visited the website again. These were most likely the users who either made a request or registered as a security company. Of 456 sessions, 238 sessions are allocated to variant A and 218 to variant B. On average, users spent 36 seconds on variant A and 31 seconds on variant B (see Table 5.3). The trust elements, therefore, had no substantial influence on the length of stay of the users.

Regarding the number of clicks on the request button, there was a considerable difference between the two variants. In variant A, the request button was clicked 41 times, and we received five real requests. In variant B, in comparison, 26 clicks were made on the button, and no requests were submitted (see Table 5.4). Consequently, the trust elements on variant A led to more requests.

Table 5.3: Comparison between variant A and B regarding the session duration

	Sessions	**Total Session Duration**	**Calculated Duration per Session**
Variant A (with trust elements)	238	02:20:53 (hh:mm:ss)	00:00:36 (hh:mm:ss)
Variant B (no trust elements)	218	01:52:20 (hh:mm:ss)	00:00:31 (hh:mm:ss)

Table 5.4: Comparison between variant A and B regarding the requests

	Number of Clicks on Request Button	**Number of Requests Made**
Variant A (with trust elements)	41	5
Variant B (no trust elements)	26	0

5.7 Conclusion & outlook

With our study, we attempt to contribute to the field of e-trust by showing that an A/B testing can verify and extend given theories. The experiment has shown that in our case the presence of trust elements did not enhance the user's session duration. This was practically the same between the two variants. The experimental setting has shown as well that more requests were made on the variant with trust elements. It is therefore reasonable to conclude that trust elements have a positive influence on user behavior. This has not yet been scientifically proven in the form of an A/B testing in a real-life context, which is our contribution.

With the scientific application of the A/B testing in such a real market situation, we have entered new ground. However, we are aware that this study still leaves some potential untapped. The technical solutions we chose were not optimal in many respects. Thus, for the replication of our experiment, we would recommend using commercial

solutions that offer a higher functionality as well as more possibilities to collect and especially to export data. Heat maps are, in this context, an interesting data collection method as well, which might lead to further insights within an A/B testing. The respective raw data should always be available. Also, the duration of the experiment and thus the duration of the Google Ads campaign should ideally last longer. If the budget allows it, the mentioned points should be taken into account for similar experimental settings. In addition, ethical standards should also be considered, as we did not inform the participants of the study or ask for their permission. However, it should also be said that companies collect data about our user behavior every day, basically without us knowing the exact use of this data.

Furthermore, it would also be interesting to implement such a research project together with an established company. Thereby, the problem is often that results may not be published. This should be clarified in advance. Consequently, we would be pleased to provide both scientists and practitioners orientation and guidance through our study and its shortcomings. Furthermore, we would like to encourage the application of practice-driven methods to scientific questions in the field of human-computer interaction.

6 Essay 5 – Validating the product-market-fit of a B2B platform venture with a minimum viable product: The Coating Radar case study[9]

Abstract

Both start-ups and established companies have increasingly launched digital business models in recent years. Some of them focus on the business-to-business (B2B) sector and follow the business model of an electronic marketplace (EM). B2B electronic marketplaces are functioning as internet platforms bringing together demand and supply which is why they are often called matchmakers. According to the existing e-commerce and EM literature, the model of an EM is particularly attractive for fragmented markets, with many small and medium-sized suppliers. The argument behind this is that an electronic marketplace can significantly reduce search and transaction costs for the buyers' side due to the aggregation of numerous suppliers. There are many highly fragmented B2B markets, in which such an aggregation via a platform could add value. But less is known about the early validation of a marketplace business model. The case of a venture called Coating Radar shows this validation process based on the concept of a minimum viable product and the lean start-up approach. This represents a contribution to the still young research field of digital entrepreneurship. Furthermore, it turns out that the product-market-fit is negative for the Coating Radar. From this result, a potential generalization could be that fragmented B2B markets might be attractive for new marketplace business models. But only a systematic validation can show whether a platform business idea can become a sustainable business. This complements the literature in the field of electronic marketplaces and B2B e-commerce.

6.1 Introduction

In the course of digitalization, business-to-business (B2B) trading has changed considerably and is still subject to digital transformation. This transformation affects both

[9] This chapter is based on the publication *Validating the Product-Market-Fit of a B2B Platform Venture with a Minimum Viable Product: The Coating Radar Case Study* published in the *Journal of Business Chemistry (2021), 18(2), 49-62*.

internal company processes as well as processes for cooperation and collaboration with other companies. Procurement and sales processes are of particular interest in the context of this paper. Many activities in these areas are still largely analog or follow the patterns that existed 10 or 20 years ago, i.e. a "classic" B2B deal is often still agreed upon face-to-face or by phone. Nevertheless, there are more alternatives to these conventional processes, which can usually be seen as digital extensions or supplements to the usual procurement and sales activities. E-commerce is a central term in this context. The global B2B e-commerce gross merchandise volume (GMV) was $5,826 billions[10] in 2013 and increased to $7,661 billions. in 2017 (Statista 2017). E-commerce share of total B2B sales in the US was 9.7% in 2015 and 12% in 2019. The forecast for 2021 is 13.1% of B2B sales will be generated digitally (Forrester Research 2017). With regard to Germany, there are statistics that show that B2B e-commerce generated revenues of around €1,300 bil. in 2018. Of this, €320 billions was gained via websites, web shops and electronic marketplaces (IfH Köln 2019). Consequently, a major share of B2B trading is already taking place online and electronic marketplaces (EMs) are becoming increasingly important. EMs can be understood as marketplaces that bring together supply and demand in a digital way. These "matchmakers" are well-known from consumer shopping, e.g., Amazon, Airbnb, or Uber (Evans & Schmalensee 2016).

In the B2B sector, EMs are still perceived as new, although they were receiving a lot of attention during the dot-com bubble (Schmitt 2019). Since hardly any B2B marketplace survived from the dot-com era, interest in them declined, also from researchers. However, more recently B2B electronic marketplaces have been experiencing their "second spring" after their initial rise during the 1990's dot-com bubble boom (Schmitt 2019). In fact, the technical conditions are better than 20 years ago and habits or user experiences from the B2C context are increasingly finding their way into the B2B sector (ibi research 2019).

From a scientific point of view, the business model of an electronic marketplace is very attractive for fragmented markets, because the search and transaction costs are usually high in such markets (Bakos 1991; Bakos 1997; Kaplan & Sawhney 2000; Giaglis et al. 2002; Markus et al. 2002; Thuong 2002). Thus, EMs can reduce these costs through becoming an intermediary, platform, or matchmaker (Klein & Alt 2015). In other words,

[10] 1 bil. = 1,000,000,000 = 10^9

EMs promise that it takes less time and effort to find a new supplier from the buyer's perspective. This clear value proposition and today's appeal of digital business models have encouraged both start-ups and established companies to become active in this area. At the same time, robust and resilient supply chains require close partnerships between buyers and suppliers (Wieteska, 2016). Therefore, frequent supplier changes are usually avoided in many B2B contexts. Every business partnership also comes with dependencies (Padgett et al. 2020). Suppliers are continuously trying to decrease the likelihood of "partner switching" through increasing this dependency (Padgett et al. 2020, p. 13). At the same time, one could argue that the buyer's loyalty towards the respective supplier might play an important role as well. Both the dependencies and loyalties are relevant aspects that have an impact on the value proposition of B2B electronic marketplaces. This can also been seen in the single case study of the young venture "Coating Radar". The case study addresses the following two research questions:

a) Does the business model of an electronic marketplace create value in a highly fragmented B2B market (here: industrial coating services)?
b) How to test or validate the idea of a new B2B electronic marketplace with as few resources as possible (following the so-called Lean Start-up approach)?

6.2 Theoretical background

6.2.1 Electronic marketplaces

Strader and Shaw (2000, p. 78) once defined electronic marketplaces as an "interorganizational information system that allows the participating buyers and sellers to exchange information about prices and product offerings". In addition to the exchange of information, it is also possible for the participating parties to negotiate with each other on an electronic marketplace, or even to conduct business transactions (Archer & Gebauer 2002). The latter concretely means that one party buys a product or a service from the supplying party via the EM (Klein & Alt 2015). Such activities can take place in a business-to-consumer (B2C) context (Evans & Schmalensee 2016), but also in a business-to-business (B2B) context (Timmers 1998; Chow et al. 2000; Thuong 2002).

According to Giaglis et al. (2002) electronic marketplaces can have a major effect in markets with a high fragmentation of the supply side. Such markets "provide opportunities for intermediaries to add value" (Giaglis et al. 2002, p. 243). The main reason for this is that EMs lead mostly to an aggregation of the supply side (Kaplan and

Sawhney 2000). The aggregation achieves low search and transaction costs for the demand side. Electronic marketplaces thus can create a central value in fragmented markets, especially for potential buyers (Bakos 1991; Bakos 1997; Kaplan & Shawney 2000; Giaglis et al. 2002; Markus et al. 2002; Thuong 2002; Klein & Alt 2015). For the suppliers the promise or value proposition of an EM is that these can be found faster by potential new customers. Consequently, it should be possible for suppliers to generate new business opportunities with the help of an EM.

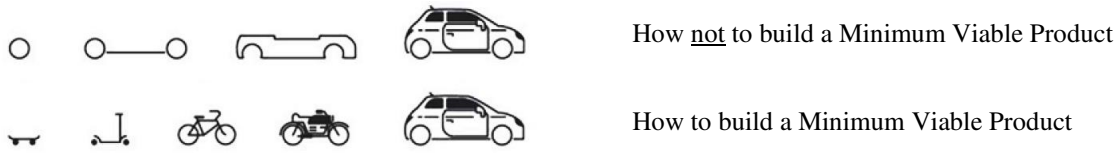
6.2.2 Minimum Viable Product & Lean Start-up

Starting a digital venture is generally considered as resource-intensive and risky because software development is expensive (Pantiuchina et al. 2017; Bohn & Kundisch 2018). A digital venture which focuses on a business model of an electronic marketplace has to deal with the challenge that it is not clear whether the respective user groups will adopt this new procurement and sales channel (Driedonks et al. 2005; Schmitt 2019). To avoid costly developments and to receive first feedback from the target and user groups, so-called minimum viable products (MVPs) are created nowadays. There are several definitions of a minimum viable product which complement each other (Lenarduzzi & Taibi 2016, p. 4):

- "A MVP is a version of a new product that allows to collect the maximum amount of validated learning about the customer with the least effort."
- "A MPV has just those features, and not more, that allow the product to be deployed."
- "A MVP is typically the first version of a product released to customers, and should contain only the absolute minimum in terms of features and design for it to become viable to the customer."
- "A MVP represents the minimum functionality or set of features within the product, allowing the firm to test the product in the market and gather customer feedback."
- "A MVP is an experimental object that allows for empirical testing of value hypotheses."

A frequently used metaphor for MVPs comes from Kniberg (2013) using various means of transportation to represent the development process of a new product (see Figure 6.1).

Figure 6.1: A minimum viable product (based on Kniberg 2013)



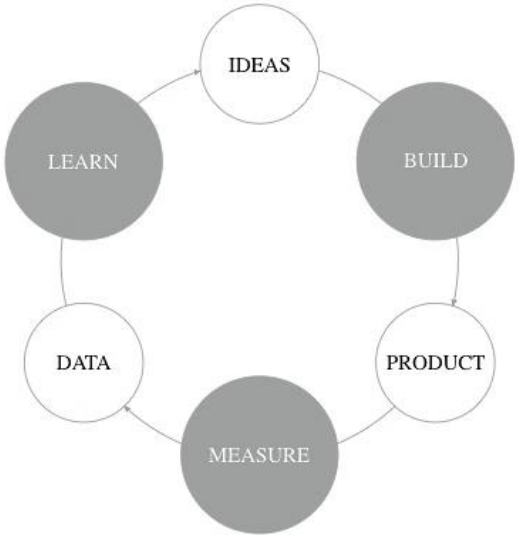
The illustration shows that MVPs focus the actual customer need, i.e., if the customer only wants to get from A to B quickly, several means of transport might solve the customer's problem. Here, a skateboard could already be a MVP to receive initial feedback from the customer. It might not be necessary to develop a car to get feedback, which would be much more costly and time-consuming.

The skateboard is actually a usable product that helps the customer get from A to B. It is not great, but a tiny bit better than nothing. So we tell the customer "don't worry, the project is not finished, this was just the first of many iterations. We're still aiming to build a car, but in the meantime please try this and give us feedback". Think big, but deliver in small functionally viable increments. (Kniberg 2016)

In the context of a digital venture, a minimum viable product can be understood as a digital prototype that shows the most important value proposition towards the user. Here, MVPs represent often so-called landing pages, i.e. websites that have a basic functionality that supports the value proposition and the underlying hypotheses (Khanna et al. 2018). The concept of an MVP can be embedded in the theoretical model of the so-called lean start-up (Blank 2013; Frederiksen & Brem 2017; Dennehy et al. 2019; Shepherd & Gruber 2020). According to Ries (2011, p. 9), "the fundamental activity of a start-up is to turn ideas into products, measure how customers respond, and then learn whether to pivot or persevere. All successful start-up processes should be geared to accelerate that

feedback loop." Furthermore, he states (Ries 2011, p. 75) that "the feedback is both qualitative and quantitative. […] The products a start-up builds are really experiments, the learning about how to build a sustainable business is the outcome of those experiments." This resulted in the "Build-Measure-Learn" feedback loop, which represents exactly these iterations (see Figure 6.2).

Figure 6.2: The Build-Measure-Learn feedback loop (Ries 2011, p. 75)



Running through iterations and experiments serves to validate the idea and should help the entrepreneur to better assess the product-market-fit (Dennehy et al. 2016). The goal of the validation is, therefore, to make a statement about the product-market-fit, based on the empirical findings of the MVP or from several MVPs (Dennehy et al. 2016).

6.3 Methodology

In the area of case study research, various approaches that can be pursued. Three approaches are particularly noteworthy. These are the Grounded Theory according to Glaser & Strauss (1967) and the case study approaches according to Yin (1981, 2013) and Eisenhardt (1989). A characteristic of the Grounded Theory approach is that a scientist investigates a certain phenomenon without taking a detailed look at the literature in the beginning. The theory development is mainly based on the data of the case. Case studies that follow Glaser & Strauss' inductive approach usually have a very short theory section, so the relevant literature is rather mentioned within the case presentation.

The procedure is different from Yin and Eisenhardt. Both Yin's and Eisenhardt's case study approaches are built on existing literature, so given theories or concepts should be tested and ideally extended. Case studies that follow Yin's deductive approach usually begin with a detailed examination of the literature. Based on this, a new model or synthesis is developed, which is then validated in the case setting.

Compared to Yin, the case selection should take place earlier in Eisenhardt's opinion. Case studies that follow Eisenhardt's abductive approach therefore start with a literature review as well and possibly give a first impression of theory development. Nevertheless, the theory is built in the process, whereas Yin completes the theory building before the case execution. For this reason, it can be said that Eisenhardt's approach lies "somewhere in-between Yin's approach and the Grounded Theory approach" (Seenhuis et al. 2006, p. 7).

The single case study about the Coating Radar is in line with Eisenhardt's hybrid form of case research, considering the process of case and theory development. This process can be described as "highly iterative and tightly linked to data" (Eisenhardt 1989, p. 532). Nevertheless, working strictly according to Eisenhardt would also include a comparison of multiple cases what was not in the scope of this research project. The arguments for and against single or multiple case studies continue to be debated among case study researchers. For this paper, the main objective was to tell a "good story" and to enrich theoretical insights, what is also in line with Dyer & Wilkins (1991).

6.4 The Coating Radar Case Study

Eisenhardt's scientific approach may sound familiar to entrepreneurs as well. Going through iterations, collecting, and analyzing data are essential components when developing a minimum viable product. In the following, the case of the Coating Radar is examined. It is important to note that the author of this study is also the main character of the case and, therefore, the founder of the start-up Coating Radar. This is the reason why the case is written in the first person. The name of the venture already reveals which industry was addressed by the idea of the Coating Radar: the coatings industry.

6.4.1 Context

The coatings industry deals with the production of paints, varnishes, and lacquers. The word "coatings" functions as an umbrella term for these products. The main actors

in this industry are the coating manufacturers, such as AkzoNobel, PPG, Sherwin-Williams or BASF (Statista 2020). The probably best-known coating processes are “wet paint” and “powder coating”. Companies in these fields are producing specific coatings, often fluid and sometimes powder-like. Private customers can find such products, mostly wet paint, for example, in do-it-yourself stores or in specialist shops. However, this case is about one specific B2B context inside the coatings industry: so-called coating services (also: “job coating”). Coating service companies (also: “job shops”) are applying special coating solutions on specific components or parts. These parts are mostly out of metal and need to be coated because of corrosion. Almost every surface that we can see our touch is usually protected by coatings. Coatings can also not only protect but also enable various functionalities, such as conductive or antibacterial coatings. The variety of functionalities, application areas, technologies, and coating processes is tremendous. The coating manufacturers supply these coating service companies with their coating material. Accordingly, coating service companies apply the material on the respective surface. This market can be seen as a classical service industry in an industrial B2B context.

6.4.2 Idea

The idea of the Coating Radar was a “platform for coating services”, so an intermediary that brings together supply and demand digitally in the field of industrial coating services (also: “industrial surface treatment”). Consequently, there should be coating service companies on the supply side of the platform that deal mainly with B2B customers. There was consequently no interest in B2C coating services, e.g., car painters or repair shops. On the demand side of the platform, there could be almost any industry since many applications for coatings exist. Important application areas are for example the automotive industry, metal industry, furniture industry, construction industry, mechanical engineering, or electrical industry.

6.4.3 Market

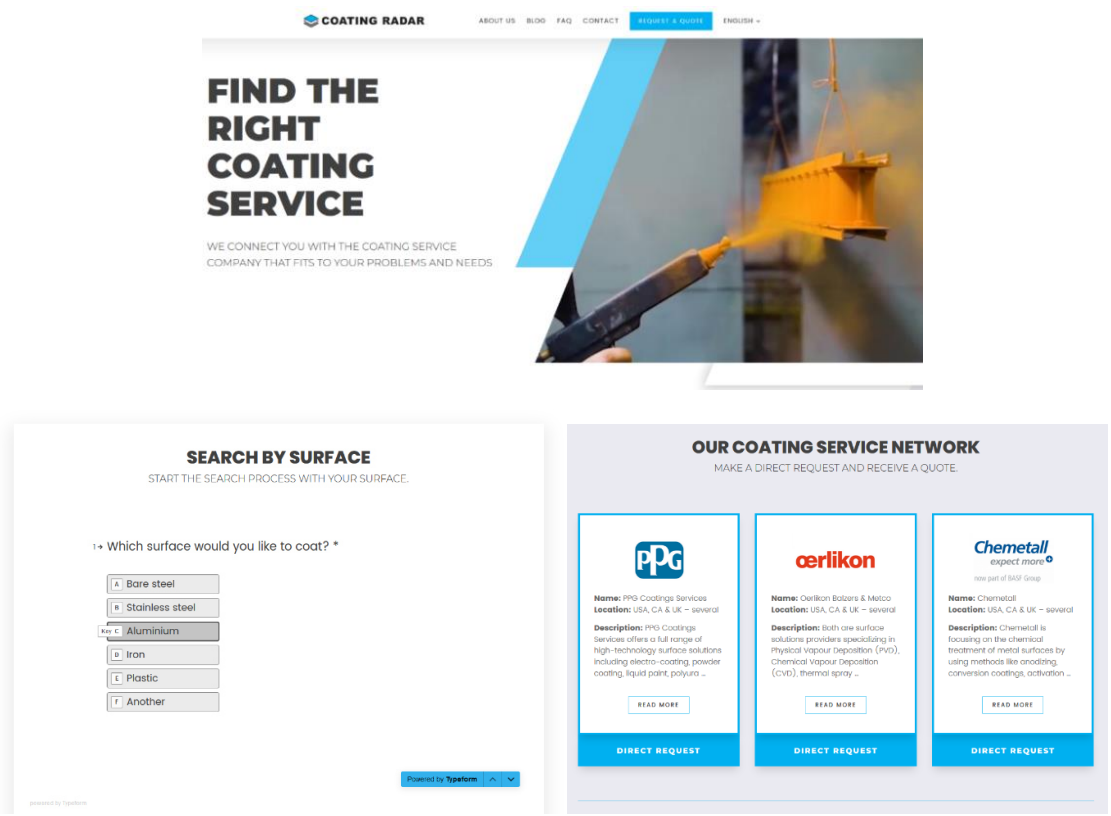
The coatings industry is an important segment of the chemical industry. Industrial coating services can be considered as a niche market within the coatings industry. The activities of the Coating Radar focused on the DACH region (Germany, Austria, Switzerland). Looking at the figures in Germany, according to the Association of the German Paint and Printing Inks Industry (Verband der deutschen Lack- und

Druckfarbenindustrie 2020), 389,000 tonnes of industrial coatings were sold in 2019, worth €2,2 bil.. Since there are hardly any reliable statistics about the coating service companies themselves, I came to an estimation of about 3,500 coating service companies in the DACH region (10,000+ worldwide) based on several industry guides and portals. The majority of the coating service companies are very small businesses with up to 20 employees (Deutscher Sparkassen- & Giroverband 2019). There are also a few big companies and corporates with several thousand employees, such as Aalberts or Oerlikon, but I was mainly interested in the small and medium-sized coating service companies with less "digital capacities" (e.g., modernity/actuality of the website, use of online marketing, etc.). These small and medium-sized enterprises (SMEs) are not necessarily known or particularly visible on the market. This should be changed by the Coating Radar.

6.4.4 Minimum Viable Product

The highly fragmented market of coating services with hundreds of rather small suppliers seemed to be ideal for a marketplace business model. The value proposition for the demand side was that the Coating Radar reduces the search costs (for finding a new supplier) through fast and digital matchmaking. For the coating service companies on the supply side, the idea of the MVP was to generate high-quality leads through a standardized request tool. Furthermore, their "digital findability" should be improved through the Coating Radar by creating online profiles for each supplier. Consequently, the MVP of the Coating Radar represented a website (or landing page) with the above-described functions. The website domain was called www.coatingradar.com, with the slogan "Find the right coating service" (see Figure 6.3). There was a German and an English version of the website, also with the respective subdomains for Germany, Austria, and Switzerland. The MVP was launched in December 2019, and the experiment lasted six months.

Figure 6.3: Impressions of the website and its functions

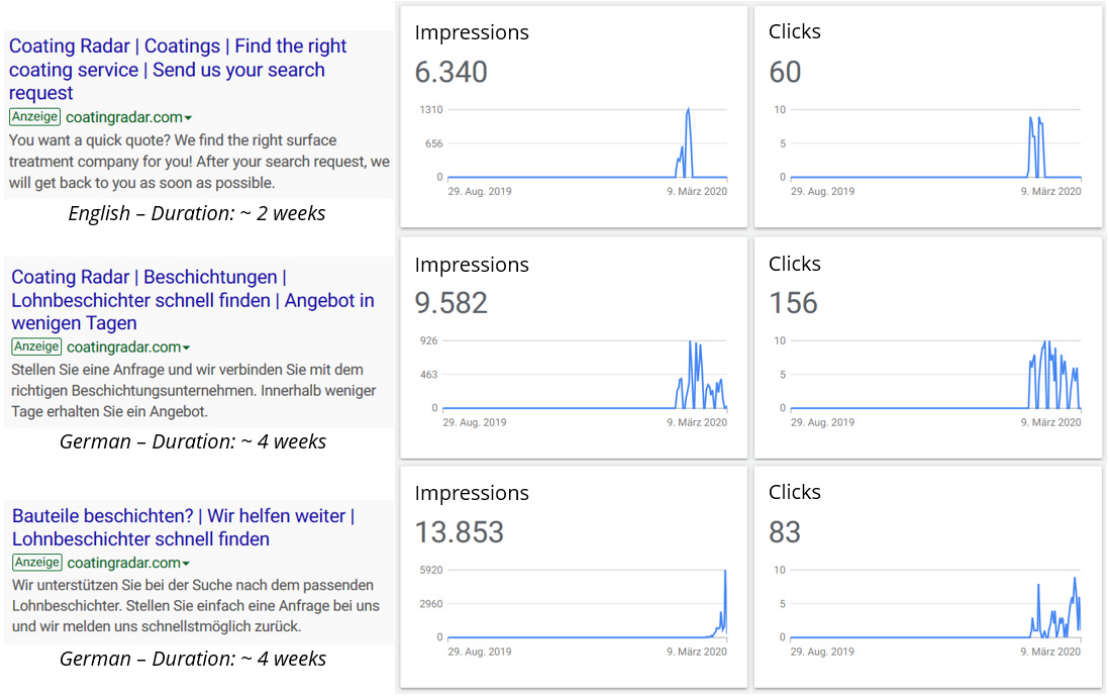


The digital matchmaking between supply and demand should become “smart” over time, so the more the Coating Radar knows about the coating service companies and their capabilities, the easier it would become to address them with suitable requests. The aim was therefore to create a database with detailed technical information for each coating plant, e.g., the maximum size or maximum weight of the component that can be coated in the respective plant. Admittedly, the matchmaking of the Coating Radar was not very intelligent at the beginning, i.e. many requests that were forwarded to the coating service companies did not fit. To resolve this, the coating service companies could register on the Coating Radar’s website, providing very detailed information about their capabilities.

A new website like www.coatingradar.com is usually not found by itself, so efforts had to be made to ensure that users visit the landing page. For this reason, a sales campaign was launched in which 250 coating companies were contacted by e-mail. In the e-mail, the Coating Radar was promoted as “the new platform for coating services”. The first e-mail was followed by a reminder e-mail after two weeks. The mailing was accompanied by Google advertising campaigns so that the Coating Radar could be found

on the first pages of Google, depending on the respective search term. Also here different variants of Google ads were tested, with different advertising texts and broadcasting periods (see Figure 6.4). The duration of the advertisement was between two and four weeks. Advertisements were published primarily in German, but occasionally also in English. For each click on the advertisement, a certain amount of money has to be paid to Google. When Google advertisements are broadcasted, impressions are generated in addition to clicks. An impression here means that the advertisement was visible to the user but was not clicked, what means that the user could see the ad when scrolling through the Google search results, for example.

Figure 6.4: Examples for the conducted Google advertisement campaigns



The question of how the Coating Radar wants to earn money was often asked during the experiment. Regarding the business model, the idea was to keep it deliberately open and to understand the industry and its dynamics first. So the matchmaking service has not been monetized. Of course, at that time there were already ideas existing to achieve revenues as a platform operator. An obvious possibility would be a brokerage fee for each match or a subscription model for the supply side. Additional services besides the matchmaking were also considered such as logistics or financial services.

6.4.5 Hypotheses & data

A minimum viable product is always based on different assumptions and hypotheses (Shepherd & Gruber, 2020; Khanna et al., 2018). In science, hypotheses are verified or falsified. In practice, it is usually about the validation of hypotheses. Since both time and monetary resources are usually limited for a young venture, hypotheses should be tested easily and at reasonable costs. Scientists usually think a lot about the formulation of the respective research hypothesis, whereas practitioners proceed much more pragmatically. From a scientific perspective, practice-driven hypotheses for MVPs, therefore, often seem rather banal. Nevertheless, the basic logic and procedures are very similar. After a successful testing of the hypotheses and a positive validation of the overall idea, more cost-intensive realization steps usually follow. Consequently, a substantial value of the new product or solution for the target or user groups should be identified during the MVP phase. The term "substantial" means here that there is a meaningful, empirical proof that the respective business idea should be pursued further. This proof is ideally expressed in numerical values. In the case of the Coating Radar, there were the following three hypotheses that should be validated in the form of the MVP experiment:

- General hypothesis: A B2B marketplace creates substantial value in the fragmented niche market of coating services, both on the demand and the supply side.
- Hypothesis addressing the supply side: The majority of the coating service companies that will be approached during the sales campaign will register via the website.
- Hypothesis addressing the demand side: The majority of the requests received via the website can be successfully matched.

The majority was specified here with 75%, i.e. at least 75% of the 250 approached coating services companies register via the website (hypothesis 2). In addition, at least 75% of the requests can be matched (hypothesis 3). If both hypotheses are validated, hypothesis 1 can also be validated. MVPs are characterized by the fact that they collect data in a variety of places. This data can be of a quantitative and qualitative nature. In the case of the Coating Radar, there were three places or contexts of data collection in particular:

1. The website, e.g.,
    - How many users will visit the website during the testing period? (see Figure 6.5)
    - Where are the users coming from?
    - For how many minutes/seconds are the users staying on the website?
    - How will Google ads increase website's traffic, also with different budgets?
    - Which Google ads will run well and what are the relevant search terms?
    - What budget will be needed in this industry niche to be on page one at Google?

2. The sales campaign, e.g.,
    - How many coating service companies will register via the website during the sales campaign?
    - Will they fill out the online registration form completely or do they stop somewhere in between?
    - How many coating service companies will answer to the mails or even call?
    - How will the coating services companies react in general about the Coating Radar and its activities (e.g., constructive, skeptical, open, positive, negative, etc.)?

3. The requests and matchings, e.g.,
    - How many requests will be generated via the website?
    - How many of these requests will come from a (potential) private or commercial customer? (The Coating Radar focused on commercial customers.)
    - How many of these requests can be matched with a suitable coating service company?
    - What will be the feedback of the coating service companies on each request?
    - What kind of requests do coating service companies prefer?

Detailed answers to these questions can be found in Appendix 5.

Figure 6.5: Website statistics of the Coating Radar (data collection: ~ 6 months)

Summary

Online Users:	1	
	Visitors	Visits
Today:	14	57
Yesterday:	49	184
Last 7 Days:	259	1,544
Last 30 Days:	1,060	5,437
Last 365 Days:	6,064	28,012
Total:	6,064	28,012

Status: 31.05.2020

Top 10 Countries

Rank	Flag	Country	Visitor Count
1		United States	1,578
2		Germany	1,357
3		Russian Federation	517
4		Netherlands	282
5		France	276
6		China	258
7		United Kingdom	223
8		Ukraine	169
9		Unknown	166
10		Canada	119

6.4.6 Results & findings

After the data collection, the evaluation of the experiment was carried out. In summary, the MVP came to the following results on a quantitative level:

- In total, 34 requests (demand side) were created and submitted via the website. 20 out of 34 requests were commercial requests made by companies. No match could be achieved for these requests. Private requests dropped out because of the B2B focus.
- Around 30 coating service companies (supply side) registered via the website, with around 60 locations in the DACH region (overall: ~ 90 European locations, ~ 20 US/UK locations)
- Around 28.000 website hits/page views were counted. Around 6.000 visitors were on the website (~ 1.600 US visitors, ~ 1.400 German visitors, ~ 500 Russian visitors). These numbers may include bots.

The number of matches already expresses that the MVP did not achieve a successful or positive result. Although some registrations of the coating service companies took place, it was not possible to match the requests with the supply side. To refer to the hypotheses (see Section 4.5), it can be stated that the majority of coating service

companies contacted did not register via the website. Furthermore, not a single match between the supply and demand side could be accomplished during the test period.

A product-market-fit is, therefore, not given since this should be the core activity of the Coating Radar. But why did the matchmaking not work out? This analysis took place mainly on a qualitative level. The following aspects were identified during the analysis, from which generalizations were derived (see Table 6.1).

Table 6.1: Qualitative findings and generalizations

Case findings	**Possible generalization derived from the case**
The Coating Radar followed an extremely universal approach which means that there are many different coating technologies and processes, and all should be reflected on the platform. Process-specific expertise is necessary to execute such an approach in a serious way. The Coating Radar would have needed experienced coating experts as team members, which was not the case.	A B2B platform operator should have domain knowledge internally.
Most requests were incomplete in the first moment of receiving the request, e.g., technical drawings of the component, data sheets or specifications were missing. In such a case, questions had to be asked to complete the documents. At the same time, the coating service companies usually had questions as well. Serving as an intermediary, I took over the very demanding moderation.	A B2B platform operator should be aware of high moderation efforts. Also here, domain knowledge brings advantages.
Hardly any match was possible because coating service companies are very selective when it comes to accepting a request. Many requests were just not attractive for them or could not be fulfilled economically, e.g., small batch sizes or special customer requests. So apparently suitable requests were rejected.	A B2B platform operator should know the respective industry very well, e.g., knowing which requests can be realized economically and what is attractive for the supply side in general.

The main reason why the Coating Radar received primarily such “bad” requests was that the market is characterized by strong relationships between customers and coating service companies. Conversely, this means that the “good” requests do not go through a new platform.	A B2B platform operator should be aware of the fact that buyers’ loyalty towards the established suppliers is high in most B2B contexts.

6.5 Discussion

Entering a B2B market as a new platform operator is very challenging because of several aspects. Besides the aspects of having domain knowledge (ideally in the founding team) and considerations regarding moderations efforts (and how to reduce them), the aspects of dependencies and loyalties have to be taken into consideration. The case of the Coating Radar shows that there is a high level of loyalty in the respective industry, what also comes with certain dependencies. Here, suppliers are only replaced, if something at the business relationship changes significantly, e.g., the product/service quality gets worse or the price increases enormously. It is assumed that this is the reality in many B2B contexts. Consequently, new B2B platforms should be aware that they cannot acquire relevant market shares immediately or within a few months. It can take years to gain significant market shares. One reason for this is that a new B2B platform usually questions present business relationships that often exist for years or even decades. This questioning is not desired, especially on the supplier side, but the demand side is mostly not interested either due to complex supplier qualification processes. Such processes usually take several months and are cost-intensive.

As far as the quality of the requests is concerned, it can also be stated that low-quality (or “bad”) requests will prevail, especially in the beginning of a new B2B electronic marketplace. High-quality (or “good”) requests have usually already been assigned for a long time or are repeatedly assigned to the same supplier. In the case of the Coating Radar, the problem of “not finding the right coating service company” may only be the situation for companies that have complicated components (e.g., complex geometry) or unusual requirements (e.g., special color). For them, a platform like the Coating Radar might be helpful. Focusing on this niche (within the niche) would have been a possible option for the Coating Radar. But dealing with requests that normally nobody in the market would like to handle does not sound attractive for an upcoming platform operator, and if it is possible to generate revenues in such a niche needs further considerations as well.

Consequently, entrepreneurs who choose the "adventure of starting a B2B platform" will deal in the beginning mainly with requests that do not meet the usual industry standards due to the existing and dominant business relationships. These unusual requests might be rare (depending on the market size) and require internal domain knowledge. Acting here as a consultant for the requesting company could be an opportunity for an entrepreneur as well. An alternative could also be to pursue a new business model with the knowledge achieved during the MVP. Such a major strategy change of a start-up is also called "pivot" (Bohn & Kundisch 2018; Khanna et al. 2018). A young venture that does not give up after a negative validation could therefore also pivot into a new business model, ideally taking advantage of the experiences collected during the first MVP phase.

6.6 Conclusion & outlook

In order to address the first research question regarding the value creation of an EM business model in a fragmented chemical services market, this case study indicates that the business model of an electronic marketplace is not necessarily attractive for fragmented B2B markets. The market for industrial coating services can be seen as such a market with a high fragmentation of the supply side. Business relationships are very strong in this industry, so there is hardly any willingness to switch the supplier from the buyers' perspective. This finding can be transferred to any B2B context in which a high buyers' loyalty exists. The central EM value proposition of reducing search and transaction costs through aggregation is therefore invalid in such a B2B context. Here, the search and transaction costs are kept low through strong business relationships. This complements the existing literature in the field of electronic marketplaces and B2B e-commerce.

The common limitation of a single case study is that replications might be necessary to be able to generalize the findings. Such a replication could be done in a future research project using a comparable venture. The start-up selected as a research object would need to follow a marketplace business model in a B2B context.

The case of the Coating Radar can also be seen as a pioneering application of the MVP concept and the lean start-up approach in the context of electronic marketplaces, which relates to the second research question. Both the quantitative and qualitative findings of the case have shown that a landing page, in connection with a sales and online marketing campaign, is a suitable instrument for gathering feedback in an early stage of

a new B2B EM venture. Very few resources were necessary for the testing or validation of the overall business model idea. In this sense, the case contributes mainly to the research field of digital entrepreneurship. Here, further research perspectives exist as well. A possibility would be to accompany a start-up through various MVP phases. If a venture went through several phases, there are usually “pivot stories” (from the founders). This is the case for many successful start-ups. Here, it would be interesting to describe the strategical changes and its operative execution in detail. How pivots work exactly is still an almost untreated field of research.

7 Essay 6 – E-Commerce start-ups: Characteristics and performance[11]

Abstract

E-commerce is attractive for many entrepreneurs. This is reflected in steadily growing online markets. The COVID19-pandemic gave e-commerce companies an additional boost and also triggered firms with formerly less digital capacities to launch their own e-commerce activities and provided opportunities for market entry of new e-commerce start-ups. From an economic perspective, we still know little about e-commerce start-ups' characteristics. This study explores data on more than 3,400 start-ups founded between 2010 and 2015 in Germany. The analysis shows that founders of e-commerce start-ups are more often "sidepreneurs" and more often active in markets for digital products or online services. They tend to be younger, and also less experienced. Furthermore, e-commerce foundations are more often opportunity-driven, and the founders' entrepreneurial orientation can be described as more risk-loving. Despite these differences in characteristics, the performance drivers are very similar to offline start-ups. This means that performance indicators like revenues, labor productivity, or profits are influenced in the same way by characteristics such as founder experience, academic education, and R&D, regardless of whether the business takes place online or offline. The probability of achieving revenues and profits also increases with the company's age what applies to all companies of the sample.

7.1 Introduction

The global crisis caused by the virus SARS-CoV-2 has helped the e-commerce sector to a new all-time high (OECD 2020). The shift from brick-and-mortar retail to e-commerce was already visible in April 2020, where the pandemic hit Europe's economy for the first time. When comparing the numbers from 2020 and 2019, it can be stated that retail sales via mail order or the internet increased by 30% in the European Union (OECD 2020). At the same time operators of brick-and-mortar stores had to close their businesses.

[11] This chapter is based on joint work with Hanna Hottenrott.

Many decided, therefore, to use digital sales channels as a complementary to their physical shop, for example by launching a web shop (OECD 2020).

Already longtime before the pandemic, numerous young companies, founders, and founding teams devoted themselves to business models that are based purely on e-commerce or business models in which e-commerce plays an important role, e.g., for selling a new product (Zacharakis et al. 2003). Today's understanding of e-commerce has its roots mainly in the time around the turn of the century and the dot-com bubble. Since then, typical internet-based sales channels are web shops or marketplaces, such as Amazon or eBay (Kotha & Basu 2011).

The research questions addressed in this article is whether e-commerce start-ups are different from other start-ups in certain aspects and to explore these differences and their effects on performance. Consequently, the objective is to find out what distinguishes e-commerce start-ups from non-e-commerce start-ups. We develop a prediction model that classifies start-ups into e-commerce firms and others based on observable information about the founders and their firms. Variables used include general details about the founder or the founding team (e.g., gender, founder age, academic background, industry experience), but also information about the founders' self-perception (e.g., the so-called entrepreneurial orientation), or their personal involvement (e.g., if the company is operated on the side or in full-time). In addition to these aspects, performance indicators are analyzed (e.g., revenues, labor productivity, profits) to identify possible differences but also similarities between e-commerce start-ups and non-e-commerce start-ups.

This study contributes to the growing body of literature that deals with the success factors of small and medium enterprises (SMEs) by focusing on firms with e-commerce business models. Researchers have so far paid a lot of attention to the characteristics of founders, especially in the context of the entrepreneurial orientation construct (e.g., Cooper et al. 1988; Chandler & Jansen 1992; Lumpkin & Dess 1996, Lumpkin & Dess 2001; Rauch et al. 2009). At the same time, there is an ongoing call for further studies which "examine the role of moderators" that influence a firm's performance and drive its success (Rauch et al. 2009, p. 781). The role of the entrepreneur as individual plays a role as well when talking about success factors. Here, Feindt et al. (2001) suggest having a closer look at the ownership structure, and owner's background and motivation. Assuming that both firm and individual characteristics act as moderators, it is interesting to find out whether e-commerce business models are more promising than others. For this

purpose, a novel data set is used, which includes both firm and individual characteristics, and also allows conclusions to be drawn about performance variables.

7.2 Theoretical background

Hamilton (2001) investigated how the funding situation of e-commerce ventures affects their corporate culture. The main sources of funding are self-funding, bank loans, money coming from friends and family, as well as venture capital (VC) from business angels, VC firms or corporate venture funds. According to Hamilton "each of these financial structures has its own set of risk and reward trade-offs" (Hamilton 2001, pp. 277). The study's findings indicate that it is challenging for privately financed ventures to achieve the necessary "culture of knowledge creation" because they are constantly struggling for resources, whereas VC-financed ventures might concentrate too much on the investors' expectations and returns (Hamilton 2001, pp. 277).

Oliva et al. (2003) argued in this context that "investors give start-ups a honeymoon period during which they value the firm using an estimate of profit based on revenue and assumed return on sales rather than actual profit" (Oliva et al. 2003, p. 96). This period ends at the latest when targets are not achieved and the "get big fast strategy" does not work. Here, Oliva et al. (2003) dealt with the limitations of such a strategy. For example, their analysis shows that service quality often suffers from such a strategy. In particular, when several companies simultaneously aim for rapid growth in the same market, this results in enormous expenditures for marketing and sales (Oliva et al. 2003).

Focusing the success factors of e-commerce SMEs in the start-up phase, Feindt et al. (2001) identified for critical factors: content (e.g., appealing presentation of the product/service offered), convenience (e.g., usability and design of the website), control (e.g., fulfillment and delivery processes), and interaction (e.g., customer support).

Finkelstein (2001) stated that internet businesses follow the same rules than non-internet businesses, which means, for example, that the customer acquisition costs are relevant for both. For internet firms these might be even the "Achilles heel" (Finkelstein 2001, p. 17). But in sum, he claimed that internet-based businesses follow the same market logics and fundamentals than other companies (Finkelstein 2001).

A study on e-commerce entrepreneurs from Thailand (n = 375) came to the conclusion that the "achievement orientation" of the founder and the founder's "locus of

control" are having am increased effect on firm's success (Sebora et al. 2009). In contrast, the "risk-taking propensity" was tested as less influential (Sebora et al. 2009).

Another research field worth mentioning in this context deals with research on "part-time entrepreneurship". Researchers in this niche deal with entrepreneurs that run their businesses besides being employed. For example, Petrova (2012) dealt with the question if part-time entrepreneurs decide for "being a part-timer" because of credit constraints. If they had enough money or the possibility to borrow enough money, they would run their businesses full-time. Petrova examined the influence of founder's initial wealth on the decision of being a full-time or part-time entrepreneur. She states in her study that wealth does not have a significant effect on this decision. What could have an effect, in her opinion, would be the individual risk affinity (Petrova 2012).

Block and Landgraf (2016) focus on the motives of part-time entrepreneurs to become full-time entrepreneurs and differentiate between financial and non-financial motives. According to Block and Landgraf (2016), part-timers are less likely to become full-timers if the entrepreneur's idea is only to supplement the wage from the permanent employment through self-employment. Instead, part-timers who see a certain degree of self-fulfillment in their business and strive for independence are more likely to make the transition to being a full-time entrepreneur (Block & Landgraf 2016).

In another study Block et al. (2019) analyze the impact of culture and society on the drivers of being a part-time or full-time entrepreneur. According to the authors, variables like societal uncertainty and institutional collectivism may reduce the motivation for being self-employed. In contrast, this motivation might be reinforced in performance- and future-oriented societies. All in all, the authors demonstrate in their study that several cultural and societal variables have an impact on entrepreneurial activities (Block et al. 2019).

7.3 E-commerce in practice

When we think of e-commerce companies, we often think of large e-commerce platforms on which several thousand suppliers offer their products. But there are also many small e-commerce firms, which usually focus on specific niche segments and consequently have a rather limited product portfolio. Three examples for such companies are described in the following for illustrative purposes. They can be seen as representatives for hundreds or thousands of small e-commerce companies that exist in Germany.

Snocks, a start-up from Mannheim, was founded in 2016 by Johannes Kliesch and Felix Bauer. The firm mainly sells different variants socks via the internet, in particular via their own web shop (www.snocks.com) and Amazon's e-commerce platform. In addition to socks, the company now also offers underwear or sweaters. According to the company's own information, around 15 employees work for Snocks who generate revenues in the single-digit million range. Both founders have an academic background in business management and informatics.[12]

Darling Little Place, a start-up from Stutensee next to Karlsruhe, was founded in 2015 by Vanessa Frank. Her company is dedicated to the production and sale of pillows for dogs and cats. She sees herself as a fulltime solo-entrepreneur. The only operative support comes from her mother, Constanze Frank, when help is needed. The goods are offered and sold through an own web shop (www.darlinglittleplace.de) and several retailers. Vanessa holds a bachelor's degree in tourism management and a master's degree in business management.[13]

Minga Oilive, a start-up from Munich, was founded in 2016 by Claudia Riemann and Felix Schachi. The company sells premium olive oil and other Cretan products, which are directly sourced from local farmers from the Greek island Crete. The products are mainly sold via their own web shop (www.mingaoilive.de). Claudia Riemann and Felix Schachi see their firm as a side business for themselves, in addition to their actual jobs. Both

[12] Information taken from an interview (https://www.deutsche-startups.de/2020/07/07/snocks-interview/).
[13] Information taken from the company website (https://www.darlinglittleplace.de/ueber-uns) and the founder herself.

completed their bachelor's and master's degrees in technical-oriented business management at the Technical University of Munich.[14]

All three companies can be considered as typical e-commerce start-ups. However, they are also very different, e.g., founded as a team or alone, with employees or without, full-time or part-time. These are important characteristics of young firms, which will now be examined in more detail, using a large data set covering 3,457 start-ups from Germany. The goal of this analysis to go beyond individual cases by investing a representative sample of newly founded firms covering start-ups in a multitude of economic sectors and including those visible to the general public as well as those that are less visible.

7.4 Data and descriptive statistics

The data had been collected as part of the IAB/ZEW start-up panel, which was established in 2008 by the Centre for European Economic Research (ZEW), KfW Bankengruppe, and Creditreform. The objective of this panel is to examine newly founded, legally independent firms in Germany. In other words, the panel contains representative information on young enterprises in Germany. It is suitable for describing and analyzing the activities and development of young companies in Germany. Both quantitative and qualitative information is collected via telephone survey, e.g., about the financial situation of the firm (financing sources, stakeholder structure, etc.), firm-specific data (number of employees, number of patents, etc.), or information on the founders (education, work experience, etc.). Due to its scope and the level of detail of information, the IAB/ZEW start-up panel is a unique data source. It has already been used in a large number of publications and projects to provide relevant information on the business situation and dynamics of young companies, also for the development of support instruments for start-ups in Germany (e.g., Hottenrott et al. 2018; Hottenrott & Richstein 2020).

The dataset for this project is the 2017-wave of the IAB/ZEW Start-up Panel with the reference year 2016. The companies included in this dataset were founded between 2010 and 2015. The wave contains initially 8,053 observations of unique companies. However, as common in survey data not all records are complete as founders may decide

[14] Information taken from the company website (https://mingaoilive.de/pages/uber-uns) and the founder himself.

not to answer all questions. The missing values are relatively random and the distribution of firms over industries does not change when omitting firms with incomplete records. After removing observations with missing values 3,457 observations (= start-ups) remained in the final sample for which full information is available.

Within the dataset, it is possible to filter for founders and their start-ups that can be considered as e-commerce start-ups by using the variable “E-Commerce”. An e-commerce start-up is here defined as a firm that is following an e-commerce business model or which uses e-commerce solutions as an integral part of its business model (e.g., for sales). 845 (24.44%) of the 3,457 firms can be assigned to the group of e-commerce start-ups, so that 2,612 (75.56%) are non-e-commerce firms within the sample. Looking at the respective industries in which e-commerce start-ups are located, it can be stated that software firms, creative service firms, and commerce firms make particularly often use of e-commerce solutions (see Table 7.1).

Table 7.1: Distribution of e-commerce start-ups across industries

Industry Classification	E-Commerce: No/Yes		
	No	Yes	Total
High-tech firms	**201**	**63**	**264**
	76.14	23.86	100.00
	7.70	7.46	7.64
Low-tech firms	**168**	**50**	**218**
	77.06	22.94	100.00
	6.43	5.92	6.31
Technology-intensive manufacturing firms	**561**	**158**	**719**
	78.03	21.97	100.00
	21.48	18.70	20.80
Software firms	**183**	**117**	**300**
	61.00	39.00	100.00
	7.01	13.85	8.68
Non-research-intensive manufacturing firms	**262**	**79**	**341**
	76.83	23.17	100.00
	10.03	9.35	9.86
Knowledge-intensive service firms	**275**	**57**	**332**
	82.83	17.17	100.00
	10.53	6.75	9.60
Other service firms	**208**	**42**	**250**
	83.20	16.80	100.00
	7.96	4.97	7.23
Creative service firms	**145**	**72**	**217**
	66.82	33.18	100.00
	5.55	8.52	6.28
Other creative service firms	**143**	**50**	**193**
	74.09	25.91	100.00
	5.47	5.92	5.58
Construction firms	**266**	**46**	**312**
	85.26	14.74	100.00
	10.18	5.44	9.03
Commerce firms	**200**	**111**	**311**
	64.31	35.69	100.00
	7.66	13.14	9.00
Total	**2612**	**845**	**3457**
	75.56	24.44	100.00
	100.00	100.00	100.00

Note: First row has *frequencies*; second row has *row percentages* and third row has *column percentages.*

Furthermore, the number of start-ups surveyed increased over the period (see Table 7.2). Looking at the federal states of Germany, slightly more than half of the companies (54.56%) were founded in three states which are Northrhine-Westphalia (25.72%), Bavaria (16.95%), and Baden-Württemberg (11.89%) (see Table 7.3).

Table 7.2: Distribution of firms in the sample by founding year

Founding Year			
	Freq.	Percent	Cum
2010	355	10.27	10.27
2011	385	11.14	21.41
2012	474	13.71	35.12
2013	683	19.76	54.87
2014	802	23.20	78.07
2015	758	21.93	100.00
Total	3457	100.00	

Table 7.3: Distribution of firms in the sample by federal states

Federal state			
	Freq.	Percent	Cum
Schleswig Holstein	85	2.46	2.46
Hamburg	96	2.78	5.24
Lower Saxony	294	8.50	13.74
Bremen	27	0.78	14.52
Northrhine-Westphalia	889	25.72	40.24
Hesse	252	7.29	47.53
Rhineland Palatinate	152	4.40	51.92
Baden-Württemberg	411	11.89	63.81
Bavaria	586	16.95	80.76
Saarland	34	0.98	81.75
Berlin	160	4.63	86.38
Brandenburg	77	2.23	88.60

Mecklenburg Western Pomerania	57	1.65	90.25
Saxony	175	5.06	95.31
Saxony-Anhalt	60	1.74	97.05
Thuringia	102	2.95	100.00
Total	3457	100.00	

7.5 A regression model to characterize e-commerce start-ups

For the following analysis, we rely on maximum likelihood estimation. In particular, we estimate probit models since the key indicator of interest is a binary indicator (e-commerce firm: yes or no) (Hanck et al. 2020, pp. 309-316). A probit model can be described as a specific type of regression model in which the dependent variable can take only two values and observations are classified according to the predictors included in the model. A predicted probability is then estimated for each observation which is based on a probit link function (Train 2009, pp. 97-133):

$$E(Y \mid X) = \mathrm{P}(\mathrm{Y} = 1 \mid \mathrm{X}) = \Phi(\beta_0 + \sum_{j=1}^{n} \beta_j)$$

With Φ being a cumulative standard normal distribution function and n referring to the number of included predictors. The probit model is from the same class of models as also logistic regression models. The advantage of these models is that they are designed for predicting discrete outcomes. Unlike in linear regression, the predicted probabilities are limited to the plausible range between zero and one. The probit model maximizes a log likelihood function such that the estimated coefficients maximize the probability that my model describes the sample data accurately. The model thus provides predicted probabilities for a firm from my data being an e-commerce start-up given the observable characteristics (predictors) of the firm. In principle, the resulting model could then be applied to a data set containing only those predictors to estimate the likelihood that a firm has an e-commerce business model. In other words, it could be used as a training data set to design a model that allows classification of firms that are not part of my sample data.

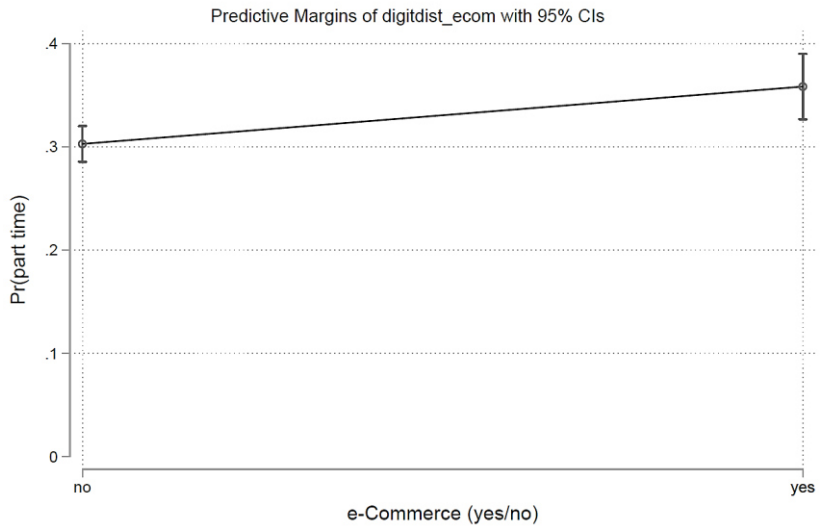
To illustrate the purpose of the model, let us focus on the independent variable "part-time" which indicates if the founder(s) are running the start-up as a part-time business. Consequently, the two values can be "yes" or "no". It is the objective to understand the time engagement of e-commerce founders. More precisely, it would be interesting to

know if part-time work is a predictor of e-commerce founders hypothesizing that they run their entrepreneurial activities more often on the side.

In general, both the founding process of a start-up and the actual operational work in a start-up are often done part-time by the founders. This may be due to the fact that the young company is developed in addition to a permanent position so that a fixed income is still secured for the founders or the founding team. Furthermore, a firm can also be designed entirely as a side business.

As a preliminary result, the data shows that founders of e-commerce start-ups are running their companies more often on the side than other founders (see Figure 7.1). The figure shows the predicted probability of observing an e-commerce start-up depending on the part-time work status information (while holding other characteristics constant; more details follow below). The predicted probability of a firm being an e-commerce start-up is significantly higher compared to other start-ups if the founder works only part-time as an entrepreneur.

Figure 7.1: Part-time engagement of e-commerce founders and non-e-commerce founders



The “part-time variable” can be seen as one key predictor in the probit model which should indicate, which firm of the sample is an e-commerce firm. In other words, the model should be able to classify the firms correctly as e-commerce firm if the predictor “part-time” takes the value of one. Several other variables are added gradually over four steps with the aim of optimizing the model(s) since “part-time” is likely not the only characteristic that differentiates e-commerce founders from others. The variables are

listed and described in the following (see Table 7.4). In total, the final model includes a set of 42 predictors.

One important aspect that should be mentioned here is a cluster of variables that deal with the so-called entrepreneurial orientation. Entrepreneurial orientation (EO) can be described as the strategic orientation of a firm and its founder(s). This orientation is captured in its strategy-making practice, managerial philosophy, and behavior, especially towards risks and competition. EO is an established research construct in the entrepreneurship literature with several different conceptualizations. Core aspects of EO are the innovativeness, proactiveness, risk-taking attitude, and the competitiveness of a firm and its founder(s). These measures are included as the personality of the founder could also predict his or her preference for certain sales channels or business models.

Table 7.4: Description of the variables

Variable name	Variable description
E-Commerce	The start-up can be considered as an e-commerce start-up.
Part-time	Part-time engagement of the founder(s).
Restarter	At least one founder has previously founded a company.
Opportunity driven	The start-up was founded to realize a business idea.
Industry experience	Years of industry experience at foundation.
Age	Age of the founders at foundation – for teams it is the average founder age.
Firm age	Age of the firm.
Team	The start-up was founded by more than one person.
Male	At least one founder is male.
Female	At least one founder is female.
Academic	At least one founder has a university degree.
Competitiveness (EO)	Value for assessing the behavior of the founder(s) towards competitors.
Innovativeness (EO)	Value for assessing the innovativeness of the founders' business idea.
Proactiveness (EO)	Value for assessing the founders' business strategy.
Risk-loving (EO)	Value for assessing the risk affinity of the founder(s).
Autonomous (EO)	Value for assessing the decision-making behavior of the founder(s).
Digital	The business model of the firm includes digital aspects.
R&Dexp	Expenditures on activities focusing research and development.
Product novelty	The start-up creates product innovations.
Diverse	Educational background of the founder(s).
Sector	The main industry the start-up operates in (out of eleven sectors).
State	Federal state the start-up was founded in.

Table 7.5 shows the differences in sample means of all predictors included in the model (two-sided t-tests). All variables except the "male" indicator have significantly different means in the group of e-commerce start-ups compared to other start-ups. For instance, in the group of e-commerce firms 38% of founders are "part-timers" while only 30% are running the firm as a part-time job in the comparison group. E-commerce firms are also founded more often by academics, but founders have – on average – less industry experience and are younger.

Table 7.5: Paired sample t-tests

Variables	Non-e-com	Mean	e-com	Mean	Mean Diff
Part-time	2612	0.300	845	0.380	-0.09***
Restarter	2612	0.410	845	0.490	-0.08***
Opportunity-driven	2612	0.820	845	0.880	-0.06***
Industry experience	2612	18.77	845	16.44	2.33***
Age	2612	46.51	845	44.81	1.70***
Team	2612	0.320	845	0.360	-0.04*
Male	2612	0.880	845	0.870	0.0100
Academic	2612	0.520	845	0.560	-0.04*
Digital	2612	0.210	845	0.380	-0.16***
R&Dexp	2612	2.670	845	3.650	-0.98***
Competitiveness (EO)	2612	2.370	845	2.640	-0.27***
Innovativeness (EO)	2612	2.350	845	2.580	-0.23***
Proactiveness (EO)	2612	3.720	845	4.010	-0.29***
Risk-loving (EO)	2612	2.530	845	2.840	-0.31***
Autonomous (EO)	2612	2.260	845	2.140	0.12***
Diverse	2612	0.610	845	0.690	-0.08***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix 6 shows detailed results for the principal component factor analysis that results in the EO variables employed in the analysis. Note that we employ five factor scores rather than three due to theoretical considerations.

Table 7.6 shows pair-wise correlation coefficients between variables. Almost all of the predictors are to some extent correlated with each other, such as industry experience and founder's age (correlation coefficient = 0.566*).

Table 7.7 shows the regression results for the different models. Model 1 includes only eight predictors and no personality traits (EO). The prediction accuracy is hence very

low (see Table 7.8). In models 2 to 4, additional predictors are added and accuracy improves (total correctly classified: 75.56% and only zeros are correctly classified, i.e. specificity = 100%, but sensitivity = 0). The Pseudo R-square value is also an indicator for goodness of model fit and one can see that it improves when more predictors are added. In model 4, 76.42% of observations are correctly classified, but sensitivity, i.e., the share of correctly specified e-commerce firms is with about 7% still low.

The estimated coefficients indicate whether the respective predictor has a positive (or negative) correlation with the predicted probability. As shown earlier, part-time work is a strong predictor of an e-commerce firms. Also, the serial entrepreneur ("Restarter") indicator has a positive coefficient indicating a higher likelihood that a firm is an e-commerce start-up. Being opportunity-driven also predict e-commerce likelihood positively. The definition of opportunity- versus necessity-driven entrepreneurs is derived from the correspondence analysis which is presented in detail in Appendix 7.

Risk affinity, competitiveness and proactiveness are personality traits that are significantly more common in e-commerce founders. Firms that sell digital products are more likely to do this via e-commerce. The location (state within Germany) is not a good predictor of e-commerce activity as there are no significant differences between states (and the reference category, which is Schleswig-Holstein). Team diversity is also not a good predictor.

Table 7.6: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Part-time	1.000															
(2) Restarter	0.198*	1.000														
(3) Opportunity-driven	0.101*	0.135*	1.000													
(4) Industry experience	-0.081*	0.092*	-0.128*	1.000												
(5) Age	0.027	0.258*	-0.112*	0.566*	1.000											
(6) Team	0.111*	0.243*	0.091*	0.039*	0.142*	1.000										
(7) Male	-0.012	0.073*	0.002	0.044*	-0.002	0.003	1.000									
(8) Academic	0.125*	0.185*	0.066*	-0.048*	0.202*	0.267*	0.019	1.000								
(9) Digital	0.059*	0.130*	0.069*	-0.073*	-0.101*	0.114*	0.113*	0.172*	1.000							
(10) R&Dexp	0.050*	0.179*	0.101*	-0.033	0.076*	0.145*	0.119*	0.268*	0.283*	1.000						
(11) Competitiveness (EO)	-0.026	0.044*	0.073*	-0.048*	-0.004	0.098*	0.065*	0.113*	0.090*	0.170*	1.000					
(12) Innovativeness (EO)	0.068*	0.193*	0.119*	-0.047*	0.036*	0.137*	0.072*	0.234*	0.259*	0.480*	0.219*	1.000				
(13) Proactiveness (EO)	0.013	0.109*	0.095*	-0.077*	-0.001	0.111*	0.026	0.130*	0.131*	0.268*	0.258*	0.358*	1.000			
(14) Risk-loving (EO)	0.058*	0.143*	0.116*	-0.098*	-0.056*	0.118*	0.076*	0.166*	0.184*	0.257*	0.319*	0.409*	0.307*	1.000		
(15) Autonomous (EO)	-0.047*	-0.013	-0.020	0.036*	0.010	-0.024	-0.020	-0.087*	-0.106*	-0.081*	-0.041*	-0.106*	-0.105*	-0.093*	1.000	
(16) Diverse	0.130*	0.204*	0.079*	-0.051*	0.191*	0.368*	0.025	0.893*	0.185*	0.285*	0.126*	0.246*	0.140*	0.179*	-0.094*	1.000

** p<0.1, ** p<0.05, *** p<0.01*

Table 7.7: Regression results

Variables	Model 1	Model 2	Model 3	Model 4
Part-time	0.153***	0.163***	0.154***	0.157***
	(0.051)	(0.052)	(0.053)	(0.053)
Restarter	0.194***	0.164***	0.130**	0.123**
	(0.052)	(0.053)	(0.054)	(0.054)
Opportunity-driven	0.159**	0.119*	0.126*	0.135*
	(0.068)	(0.069)	(0.070)	(0.070)
Industry experience	-0.009***	-0.008***	-0.007**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
Age	-0.006**	-0.006**	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Team	0.037	0.010	-0.049	-0.054
	(0.053)	(0.053)	(0.057)	(0.057)
Male	-0.072	-0.111	-0.106	-0.111
	(0.071)	(0.072)	(0.075)	(0.075)
Academic	0.035	-0.022	-0.142	-0.136
	(0.051)	(0.052)	(0.108)	(0.109)
Competitiveness (EO)		0.052***	0.044**	0.045**
		(0.019)	(0.019)	(0.020)
Innovativeness (EO)		0.003	-0.028	-0.029
		(0.021)	(0.024)	(0.024)
Proactiveness (EO)		0.087***	0.071***	0.075***
		(0.024)	(0.024)	(0.024)
Risk-loving (EO)		0.047**	0.046**	0.048**
		(0.021)	(0.022)	(0.022)
Autonomous (EO)		-0.032	-0.027	-0.028
		(0.021)	(0.021)	(0.022)
Digital			0.412***	0.399***
			(0.065)	(0.065)
R&Dexp			0.008	0.009
			(0.006)	(0.006)
Diverse			0.126	0.115
			(0.082)	(0.083)
Schleswig Holstein				--
				--
Hamburg				0.174
				(0.202)
Lower Saxony				-0.274
				(0.174)
Bremen				-0.427
				(0.336)
Northrhine-Westphalia				-0.032
				(0.157)
Hesse				-0.103
				(0.175)
Rhineland Palatinate				0.020
				(0.187)

Baden-Württemberg				-0.288*
				(0.167)
Bavaria				-0.041
				(0.160)
Saarland				-0.361
				(0.304)
Berlin				-0.077
				(0.186)
Brandenburg				-0.031
				(0.217)
Mecklenburg Western Pomerania				0.175
				(0.236)
Saxony				-0.056
				(0.184)
Saxony-Anhalt				0.041
				(0.237)
Thuringia				-0.286
				(0.213)
Constant	-0.490***	-0.946***	-1.091***	-1.045***
	(0.139)	(0.172)	(0.206)	(0.253)
Observations	3457	3457	3457	3457
Log Likelihood	-1.9e+03	-1.9e+03	-1.8e+03	-1.8e+03
Pseudo R-square	0.021	0.034	0.065	0.071

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Models 3 and 4 also contain the set of industry indicators which are not shown in the table due to space reasons.

Table 7.8: Prediction accuracy of the models

Model	Variables	Correct classification (%)
1	Restarter, Opportunity-driven, Industry Experience, Age, Team, Male, Academic	75.56
2	Model 1 + Competitiveness, Innovativeness, Proactiveness, Risk-loving, Autonomous	75.53
3	Model 2 + Digital, R&Dexp, Diverse, Sector	76.05
4	Model 3 + State	76.42

7.6 Analysis of performance indicators

In the following, an analysis of several performance indicators is conducted. The indicators are revenues, labor productivity and profits. Labor productivity is here defined as revenues per employee. The same sample is used for the probit model.

Table 7.9 shows that e-commerce start-ups do not achieve more revenues than other firms. For all companies of the sample, it becomes evident that part-time engagement of the founder(s) lowers the revenues. Other aspects that reduce the revenues according to the analysis are a high diversity (concerning the educational background of the founders), a high founder age and when one of the founders is female. What increases revenues are industry experience as well as team and academic foundations. Table 7.10 (on labor productivity) and 7.11 (on profits) show very similar patterns and consequently confirm this interpretation. The results presented in the three tables also show that the interaction terms between the e-commerce indicator and all performance drivers are mostly statistically insignificant. This suggests that there is no difference in performance divers between online and offline firms. There are some differences in terms of the role of product innovation when we consider sales or labor productivity as performance measures. When looking at profits, we find some weakly significant differences in the sense that part-time entrepreneurship is worse for e-commerce start-ups for achieving profits.

Table 7.9: Regression results for performance indicator “revenues”

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
E-Commerce	-0.104	0.028	0.020	-0.179	-0.164	-0.132	-0.059
	(0.096)	(0.064)	(0.146)	(0.201)	(0.120)	(0.084)	(0.142)
Part-time	-1.066***	-0.966***	-1.065***	-1.065***	-1.067***	-1.066***	-1.066***
	(0.087)	(0.092)	(0.087)	(0.087)	(0.088)	(0.087)	(0.087)
Diverse	-0.715***	-0.711***	-0.649**	-0.714***	-0.721***	-0.716***	-0.712***
	(0.173)	(0.174)	(0.213)	(0.171)	(0.171)	(0.172)	(0.178)
Restarter	0.125	0.128	0.123	0.125	0.124	0.124	0.125
	(0.135)	(0.132)	(0.133)	(0.134)	(0.133)	(0.132)	(0.135)
Opportunity driven	-0.161	-0.162	-0.163	-0.161	-0.158	-0.161	-0.161
	(0.113)	(0.113)	(0.114)	(0.113)	(0.114)	(0.113)	(0.113)
Industry experience	0.029***	0.029***	0.029***	0.028***	0.029***	0.029***	0.029***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Age	-0.026***	-0.027***	-0.027***	-0.026***	-0.026***	-0.026***	-0.026***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Team	0.834***	0.829***	0.833***	0.834***	0.835***	0.835***	0.833***
	(0.090)	(0.090)	(0.089)	(0.090)	(0.089)	(0.090)	(0.090)
Female	-0.452***	-0.455***	-0.451***	-0.451***	-0.453***	-0.453***	-0.452***
	(0.107)	(0.108)	(0.107)	(0.106)	(0.107)	(0.106)	(0.107)
Academic	0.920***	0.918***	0.902***	0.920***	0.927***	0.924***	0.938***
	(0.162)	(0.161)	(0.171)	(0.162)	(0.159)	(0.158)	(0.155)
Digital	-0.344**	-0.339**	-0.346**	-0.346**	-0.341**	-0.343**	-0.344**
	(0.115)	(0.113)	(0.112)	(0.117)	(0.114)	(0.116)	(0.114)
R&Dexp	0.034**	0.033*	0.033**	0.034**	0.034**	0.031*	0.033**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)	(0.015)
Competitiveness	0.143***	0.143***	0.144***	0.143***	0.143***	0.143***	0.144***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.023)	(0.024)
Innovativeness	-0.205***	-0.208***	-0.204***	-0.205***	-0.204***	-0.205***	-0.205***
	(0.059)	(0.059)	(0.058)	(0.059)	(0.059)	(0.059)	(0.059)
Proactiveness	0.068	0.071	0.068	0.068	0.069	0.069	0.068
	(0.048)	(0.050)	(0.048)	(0.048)	(0.048)	(0.047)	(0.048)
Risk-loving	-0.056	-0.052	-0.054	-0.056	-0.056	-0.056	-0.055
	(0.042)	(0.043)	(0.042)	(0.042)	(0.043)	(0.043)	(0.042)
Autonomous	-0.183***	-0.183***	-0.183***	-0.183***	-0.183***	-0.183***	-0.183***
	(0.030)	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Product novelty	0.376*	0.375*	0.379*	0.377*	0.297	0.375*	0.376*
	(0.192)	(0.197)	(0.192)	(0.192)	(0.218)	(0.191)	(0.192)
Firm age	0.217***	0.216***	0.216***	0.217***	0.217***	0.217***	0.217***
	(0.053)	(0.053)	(0.053)	(0.053)	(0.052)	(0.052)	(0.053)
Yes # Part-time=1		-0.371					
		(0.261)					
Yes # diverse			-0.187				
			(0.172)				
Yes # Industry experience				0.004			
				(0.010)			
Yes # Product novelty=1					0.235*		
					(0.129)		
Yes # R&Dexp						0.008	
						(0.021)	
Yes # Academic=1							-0.081
							(0.231)
Constant	11.790***	11.761***	11.770***	11.815***	11.788***	11.797***	11.783***
	(0.395)	(0.402)	(0.395)	(0.431)	(0.394)	(0.393)	(0.399)
Observations	3244	3244	3244	3244	3244	3244	3244
R^2	0.138	0.139	0.138	0.138	0.138	0.138	0.138

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain the set of industry indicators and state dummies which are not shown in the table due to space reasons.

Table 7.10: Regression results for performance indicator "labor productivity"

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
E-Commerce	-0.073	0.032	0.026	-0.170	-0.146	-0.138*	-0.056
	(0.089)	(0.065)	(0.130)	(0.166)	(0.112)	(0.069)	(0.116)
Part-time	-0.801***	-0.721***	-0.801***	-0.800***	-0.802***	-0.801***	-0.801***
	(0.078)	(0.077)	(0.078)	(0.078)	(0.079)	(0.078)	(0.078)
Diverse	-0.684***	-0.680***	-0.631**	-0.682***	-0.691***	-0.688***	-0.683***
	(0.174)	(0.174)	(0.203)	(0.172)	(0.171)	(0.172)	(0.177)
Restarter	0.062	0.064	0.060	0.062	0.061	0.059	0.062
	(0.124)	(0.122)	(0.123)	(0.124)	(0.122)	(0.121)	(0.124)
Opportunity driven	-0.181*	-0.182*	-0.183*	-0.182*	-0.178	-0.181*	-0.181*
	(0.100)	(0.099)	(0.100)	(0.099)	(0.100)	(0.100)	(0.100)
Industry experience	0.021***	0.021***	0.021***	0.019***	0.021***	0.021***	0.021***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Age	-0.018**	-0.018**	-0.018**	-0.018**	-0.018**	-0.018**	-0.018**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Team	0.312***	0.308***	0.312***	0.313***	0.314***	0.316***	0.312***
	(0.082)	(0.083)	(0.082)	(0.081)	(0.081)	(0.083)	(0.083)
Female	-0.425***	-0.428***	-0.424***	-0.424***	-0.427***	-0.427***	-0.425***
	(0.088)	(0.088)	(0.088)	(0.088)	(0.088)	(0.087)	(0.088)
Academic	0.873***	0.871***	0.859***	0.873***	0.881***	0.881***	0.880***
	(0.144)	(0.144)	(0.151)	(0.144)	(0.142)	(0.142)	(0.135)
Digital product	-0.248**	-0.243**	-0.249**	-0.250**	-0.244**	-0.246**	-0.248**
	(0.086)	(0.084)	(0.084)	(0.088)	(0.085)	(0.086)	(0.086)
ln(R&D)	0.005	0.005	0.004	0.005	0.005	-0.001	0.005
	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)	(0.016)	(0.013)
Competitiveness	0.061***	0.061***	0.062***	0.061***	0.061***	0.061***	0.061***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Innovativeness	-0.167***	-0.170***	-0.167***	-0.167***	-0.166***	-0.168***	-0.167***
	(0.051)	(0.052)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Proactiveness	0.021	0.024	0.021	0.021	0.022	0.022	0.021
	(0.038)	(0.040)	(0.038)	(0.038)	(0.038)	(0.037)	(0.038)
Risk tolerance	-0.086**	-0.083*	-0.085**	-0.086**	-0.086**	-0.086**	-0.086**
	(0.038)	(0.039)	(0.038)	(0.038)	(0.039)	(0.039)	(0.038)
Autonomy	-0.122***	-0.121***	-0.122***	-0.122***	-0.122***	-0.122***	-0.122***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Product novelty	0.333	0.332	0.336	0.334	0.000	0.332	0.333
	(0.187)	(0.190)	(0.186)	(0.187)	0.239	(0.186)	(0.187)
Firm age	0.153***	0.153***	0.153***	0.153***	(0.207)	0.153***	0.153***
	(0.044)	(0.045)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Yes # Part-time=1		-0.295					
		(0.258)					
Yes # diverse			-0.149				
			(0.145)				
Yes # Industry experience				0.006			
				(0.008)			
Yes # Product novelty=1					0.282*		
					(0.133)		
Yes # R&Dexp						0.018	
						(0.020)	
Yes # Academic=1							-0.031
							(0.183)
Constant	11.147***	11.124***	11.131***	11.178***	11.144***	11.163***	11.144***
	(0.357)	(0.364)	(0.358)	(0.390)	(0.357)	(0.358)	(0.362)
Observations	3237	3237	3237	3237	3237	3237	3237
R^2	0.114	0.115	0.114	0.114	0.114	0.114	0.114

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain the set of industry indicators and state dummies which are not shown in the table due to space reasons.

Table 7.11: Regression results for performance indicator “profits”

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
E-Commerce	-0.032**	-0.012	0.010	-0.040	-0.028*	-0.028*	-0.001
	(0.013)	(0.017)	(0.022)	(0.027)	(0.013)	(0.015)	(0.022)
Part-time	-0.050**	-0.036	-0.050**	-0.050**	-0.050**	-0.050**	-0.050**
	(0.019)	(0.021)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Diverse	-0.092**	-0.091**	-0.069**	-0.092**	-0.091**	-0.092**	-0.090**
	(0.036)	(0.036)	(0.031)	(0.036)	(0.036)	(0.036)	(0.035)
Restarter	-0.044**	-0.044**	-0.045**	-0.044**	-0.044**	-0.044**	-0.044**
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Opportunity driven	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
Industry experience	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Age	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Team	0.025	0.024	0.025	0.025	0.025	0.025	0.024
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Female	-0.072***	-0.072***	-0.072***	-0.072***	-0.072***	-0.072***	-0.072***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Academic	0.082**	0.082**	0.076**	0.082**	0.082**	0.082**	0.095**
	(0.034)	(0.034)	(0.033)	(0.034)	(0.034)	(0.034)	(0.037)
Digital	-0.066***	-0.065***	-0.066***	-0.066***	-0.066***	-0.066***	-0.065***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)
R&Dexp	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008**	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Competitiveness	-0.001	-0.001	-0.000	-0.001	-0.001	-0.001	-0.000
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Innovativeness	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Proactiveness	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Risk-loving	-0.024***	-0.024***	-0.024***	-0.024***	-0.024***	-0.024***	-0.024***
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)
Autonomous	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Product novelty	0.032	0.032	0.033	0.032	0.036	0.032	0.032
	(0.033)	(0.033)	(0.032)	(0.033)	(0.035)	(0.033)	(0.033)
Firm age	0.029***	0.028***	0.028***	0.029***	0.029***	0.029***	0.028***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Yes # Part-time=1		-0.055*					
		(0.029)					
Yes # diverse			-0.064**				
			(0.023)				
Yes # Industry experience				0.000			
				(0.001)			
Yes # Product novelty=1					-0.014		
					(0.043)		
Yes # R&Dexp						-0.001	
						(0.003)	
Academic=1							
Yes # Academic=1							-0.056*
							(0.031)
Constant	0.846***	0.842***	0.840***	0.849***	0.846***	0.846***	0.842***
	(0.078)	(0.080)	(0.075)	(0.076)	(0.077)	(0.077)	(0.076)
Observations	3438	3438	3438	3438	3438	3438	3438
R^2	0.110	0.111	0.112	0.110	0.110	0.110	0.111

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain the set of industry indicators and state dummies which are not shown in the table due to space reasons.

7.7 Conclusion

The goal of this article was on the one hand to build a regression-based model to classify start-ups into e-commerce and other businesses. Based on descriptive information about the firms in the sample, we could see that e-commerce founders' and firms' characteristics are quite distinct from those of other start-ups. In particular, e-commerce founders work more often part-time. Moreover, personality traits, i.e. entrepreneurial orientation scores can be predictors of e-commerce founders. Yet, the results also show that the prediction accuracy is not particularly high suggesting that important characteristics (such as product or service attributes) are unobserved. Nevertheless, the estimated coefficients of the model could now be used to predict e-commerce start-ups in data in which the e-commerce information is unknown. The model would still pretty accurately predict the zeros, i.e., firms that are not having an e-commerce business model.

On the other hand, we were interested in the similarities and differences between e-commerce start-ups and non-e-commerce start-ups. In this regard, we can state that e-commerce founders run their businesses more often part-time as "sidepreneurs" what contributes to research on part-time entrepreneurship. They are also more often active in markets for digital products or online services. E-commerce founders tend to be younger and also less experienced. Furthermore, foundations in the field of e-commerce are more often opportunity-driven, and the founders' entrepreneurial orientation can be described as more risk-loving.

Looking at the similarities, the performance drivers are very similar within the sample. This means that the performance indicators (revenues, labor productivity, and profits) are influenced in the same way, regardless of whether the business takes place online or offline. Such indicators are positively influenced, for example, if academics are in the founding team. Also, similar effects were visible for the firm age, so the probability of achieving revenues and profits increases with the age of the company. A start-up's performance is negatively influenced on the contrary by too much diversity in terms of educational backgrounds in the founding team or by part-time engagement.

All in all, Finkelstein's claim (2001) that internet-based companies follow the same market logics as every other company can be agreed upon our analysis. His claim is now backed up with empirical evidence by our study. We also contribute to a better understanding of e-commerce start-ups and its founders.

8 Summary & future research

The overall objective of this doctoral thesis was to achieve new insights in the research field of B2B electronic marketplaces. Several research questions were answered in this context by the application of different methods.

In **Chapter 1 / 1.3 Literature overview on B2B electronic marketplaces**, I presented a literature overview which summarized the main insights from the research published in the field of B2B electronic marketplaces between 2010 and 2019/20. This overview thereby updated and augmented of the so far latest literature review on electronic marketplaces from Standing et al. (2010). Considering publications on (B2B) EMs before and after 2010, it becomes evident that a holistic business model perspective on the phenomenon of B2B electronic marketplaces emerged only after 2010. This dissertation therefore takes a holistic business model perspective on the topic and presents therefore new insights that add to recent contributions on the topic presented in recent work (e.g., Chakravarty et al. 2014; Muzellec et al. 2015) that at the same time expands this perspective further. Applying such a perspective on today's status quo in the B2B e-commerce practice makes it apparent that new variants of B2B electronic marketplaces emerged over time. However, these variants have not yet found their way into the scientific discussion.

For this reason, **Chapter 2 / Essay 1 / B2B electronic marketplaces: Functions and consequences of the current operating models for commodity marketplaces** develops and presents a new typology for B2B electronic marketplaces, focusing on EMs in the field of commodity trading. The typology describes different variants and operating models of B2B commodity marketplaces, including the consequences of each business model for the platform operator and its participants. The essay can be considered a relevant contribution to the research field of B2B EMs because the developed typology provides a new depth to the scientific discussion on B2B EMs. Before, B2B EMs were still mainly seen as matchmakers or intermediaries between supply and demand. This remains true, as most B2B EMs still primarily support the request for quotation (RFQ) process (open marketplace model), but EMs also became much more diverse and sophisticated in the business-to-business reality, e.g., few EMs try to become the transaction partner (closed-marketplace model) whereas others provide offerings from

different marketplaces and web shops in one user interface (meta-search marketplace model).

Chapter 3 / Essay 2 / B2B electronic marketplaces in the chemical industry: A descriptive study tests and confirms the typology through an application to a sample of 62 EMs that deal with the trade of chemical substances. In addition to the validation of the typology, relevant implications for the e-commerce practice in the chemical industry were derived. Thus, it can be stated that most B2B electronic marketplaces in the chemical industry follow the model of an open marketplace, which usually support a request for quotation (RFQ) process between supply and demand. A direct purchase of a product, as known from B2C marketplaces, is very unusual, but there are first marketplace operators that experiment with a direct buying functionality in the chemical industry. In other words, these marketplaces go beyond "classical matchmaking" and try to become the transaction partner. The reason for this is that they see a possibility to become a stable business model by implementing a transaction fee. Without a stable business model B2B electronic marketplaces will find it difficult to sustain in the long run.

Considering the typology and the theory that goes with it as one of the main contributions of this dissertation, it should also be noted that the typology offers further research opportunities. The developed typology deals exclusively with commodity marketplaces. However, many of today's B2B marketplaces are, for example, dedicated to service offerings, and not to the trade of physical products (see also Chapter 6 in which a B2B marketplace venture for coating services is described). Consequently, one opportunity might be to develop a complementary typology for B2B electronic marketplaces focusing on services. Another possibility could be to use the developed typology as a starting point for further analysis and possible extensions of the theory.

In **Chapter 4 / Essay 3 / Challenges affecting the adoption of B2B electronic marketplaces**, five B2B commodity marketplaces from the chemical industry were the main objects of research in the context of a qualitative study. The survey's focus was on the challenges of the marketplace operators and how these challenges may influence the adoption by the respective user and target groups. As B2B electronic marketplaces continue to be perceived as "new", adoption plays a central role for these business models. The survey was conducted in the form of several expert interviews. With the findings from the interviews, it was possible to extend an existing model for the adoption of B2B electronic marketplaces. In this adoption model, the focus was primarily on two levels

dealing with individual/cultural and corporate aspects that influence the adoption rate of B2B EMs. This model could be extended by new aspects that lie on a technical and an industry level.

A possible follow-up research project could be a similar survey with the same or other companies since new challenges for EM operators certainly arise over time. At the time of the survey, most of the surveyed marketplaces were still in an early stage. Assuming that new marketplaces, like all start-ups, go through different stages of evolution, there might be specific challenges at each stage (see also Muzellec et al. 2015). Consequently, it could be a promising research approach to analyze specific B2B EMs over time.

Chapter 5 / Essay 4 / Website design and trust elements: A/B testing on a start-up's website includes an experimental study that dealt with an A/B testing on the website of a fictive start-up. This experiment contributes to the research field of human-computer interaction by showing the positive influence of trust-elements on users' behavior. The website variant with trust elements (A) generated more requests than the website variant without trust elements (B). The experiment was novel to the extent that it was conducted in a real business context. This also led to methodological and technical problems that might be of interest for researchers in the field of human-computer interaction. Thus, cost-free solutions with limited functionality (e.g., exporting raw data) led to the fact that the experimental data could not be analyzed adequately. Therefore, researchers interested in A/B testing experiments should consider in detail the software solutions to be used and their functionalities.

Chapter 6 / Essay 5 / Validating the product-market-fit of a B2B platform venture with a minimum viable product: The Coating Radar case study deals with the validation of a business idea for a B2B marketplace venture, in which the author of this doctoral thesis has tried to become an entrepreneur himself. This experience turned into a case study in which both quantitative and qualitative data were collected and evaluated. On the one hand, the essay can be seen as a contribution to the research field of digital entrepreneurship as it is the first time that the concept of a minimum viable product and the lean start-up approach are applied to a B2B marketplace business model in the form of a case study. On the other hand, the case contributes to the field of electronic marketplaces in which it was previously assumed that fragmented markets are particularly attractive for marketplace business models. This assumption remains valid, but the case

study shows that other aspects, besides the fragmentation, are even more critical in the B2B sector when starting a new marketplace business model, e.g., the consideration of established supplier relationships.

The early validation of business ideas or models is hardly explored, but from high relevance for every company trying to bring a new solution, product or service to the market. For this reason, there is an ongoing call for cases dealing with the topic of business model validation.

Chapter 7 / Essay 6 / E-Commerce start-ups: Characteristics and performance consists of a quantitative study in which a classification model was developed for the purpose of identifying e-commerce businesses in a sample of around 3,500 German start-ups. Here, it turned out that one relevant predictor might be the variable that states if a founder works part-time or full-time. The reason for this is that e-commerce founders work more often part-time. Furthermore, E-commerce founders tend to be younger and less experienced. Foundations in the field of e-commerce are more often opportunity-driven, and the founders' entrepreneurial orientation can be described as more risk-loving.

As far as performance indicators (e.g., revenues, labor productivity, and profits) are considered, it can be stated that e-commerce businesses are influenced in the same way as other businesses. These indicators are positively affected, for example, if academics are in the founding team. Also, similar effects were visible for the firm age, so the probability of achieving revenues and profits increases with the age of the company. In general, this study contributes to a better understanding of e-commerce businesses and their founders. One possibility for further research would be, for example, an in-depth analysis of why more start-ups seem to be founded and operated on the side in the e-commerce context. Are internet businesses better to run on the side than non- or little digital businesses?

The contributions made through each of the essays of this dissertation are summarized in Table 8.1. Finally, it should be noted that there are still several interesting routes of further analyses on this topic. This thesis only made a first step into the deeper economic analysis of electronic marketplaces in the B2B sector and e-commerce entrepreneurship. Recent developments in the course of the COVID19-crisis will challenge established and new businesses in this area but will also provide a whole bundle

of new opportunities. Further research will be needed to study and assess these developments and their role for the involved stakeholders.

Table 8.1: Contributions made in the context of the doctoral thesis

Essay	Research question	Objective	Contribution
1	How does a comprehensive typology for B2B electronic marketplaces look like?	Achieving a new typology for B2B electronic marketplaces that reflects the business reality	A typology for B2B commodity marketplaces was development, focusing a functional and operational perspective.
2	Is it possible to test and validate the developed typology?	Testing of the typology and deriving implications for the practice	The typology was success-fully applied to a sample of several EMs in the chemical industry.
3	What influences the adoption of current B2B electronic marketplaces?	Verifying an existing adoption model for EMs	The adoption model was verified and also enlarged by new layers.
4	Do trust elements on start-ups' websites have a positive influence on the user behavior?	Proving the effect of trust elements on a website with an A/B testing experiment	An A/B testing experiment was conducted in a real-life setting showing the effect of trust elements.
5	How to test the idea of a new B2B electronic marketplace under resource constraints?	Application of the Minimum Viable Product concept and the Lean Start-up approach in the context of a B2B electronic marketplaces venture	A case study dealing with a B2B marketplace venture was developed, showing the application of several start-up methods.
6	What characterizes e-commerce start-ups and its founders, and are they different from other start-ups?	Identifying similarities and differences between e-commerce start-ups and non-e-commerce start-ups	Characteristics of e-commerce start-ups were identified, including the development of a probit model.

References

Alt, R., Klein, S. (2011): Twenty years of electronic markets research – Looking backwards towards the future. *Electronic Markets 21*(1), 41-51.

Alt, R., Zimmermann, H.-D. (2019): Electronic markets on platform competition. *Electronic Markets, 29*, 143-149.

Alt, R. (2020). Evolution and perspectives of electronic markets. *Electronic Markets, 30*(1), 1-13.

Archer, N., Gebauer, J. (2002): B2B applications to support business transactions: Overview and management consideration. In: *Business-to-Business Electronic Commerce: Challenges and Solutions*. Idea Group Publishing.

Ardolino, M., Saccani, N., Perona, M. (2016): The analysis of multisided platforms: results from a literature review. In: *Proceedings Spring Servitization Conference*, 1-9.

Bailey, K. D. (1994): *Typologies and taxonomies: An introduction to classification techniques*. Sage Publications.

Bailey, J. P., Bakos, Y. (1997): An exploratory study of the emerging role of electronic intermediaries. *International Journal of Electronic Commerce, 1*(3), 7-20.

Bakos, Y. (1991): A strategic analysis of electronic marketplaces. *MIS Quarterly: Management Information Systems, 15*(3), 295-310.

Bakos, Y. (1997): Reducing buyer search costs: Implications for electronic marketplaces, *Management Science, 43*(12), 1676-1692.

Bakos, Y. (1998): The emerging role of electronic marketplaces on the internet. *Communications of the ACM, 41*(8), 35-42.

Balocco, R., Perego, A., Perotti, S. (2010): B2B eMarketplaces: A classification framework to analyse business models and critical success factors. *Industrial Management & Data Systems, 110*(8), 1117-1137.

BDI – Bundesverband der Deutschen Industrie e.V. (2020): *Deutsche digitale B2B-Plattformen.* Industrie-Förderung GmbH, Berlin. Accessed online (05.01.2021): https://bdi.eu/publikation/news/deutsche-digitale-b2b-plattformen/

Beldad, A., Jong, M., Steehouder, M. (2010): How shall I trust the faceless and the intangible? A literature review on the antecedents of online trust. *Computers in Human Behavior, 26*(5), 857-869.

Belleflamme, P., Peitz, M. (2019a): Managing competition on a two-sided platform. *Journal of Economics & Management Strategy, 28*(1), 5-22.

Belleflamme, P., Peitz, M. (2019b): Platform competition: Who benefits from multihoming?. *International Journal of Industrial Organization, 64*, 1-26.

Belleflamme, P., Peitz, M. (2019c): Price discolosure by two-sided platforms. *International Journal of Industrial Organization, 67*, 1-19.

Blank, S. (2013): Why the lean start-up changes everything. *Harvard Business Review, 91*(5), 63-72.

Block, J., Landgraf, A. (2016). Transition from part-time entrepreneurship to full-time entrepreneurship: The role of financial and non-financial motives. *International Entrepreneurship and Management Journal, 12*(1): 259-282.

Block, J., Landgraf, A., Semrau, T. (2019). The differential impact of societal cultural practices on part-time and full-time self-employment: A multi-level, multi-country study. *International Small Business Journal. 37*(1): 43-68.

Bradley, D. B., Peters, D., (1997): Electronic marketplaces: Collaborate if you want to compete. In: *42nd World Conference International Council for Small Business*, San Francisco.

Cambridge Dictionary (2020): *Meaning of commodity.* Accessed online (05.11.2020): https://dictionary.cambridge.org/dictionary/english/commodity

Chakravarty, A., Kumar, A., Grewal, R. (2014): Customer orientation structure for internet-based business-to-business platform firms. *Journal of Marketing, 78*(5), 1-23.

Chandler, G. N., Jansen, E. (1992): The founder's self-assessed competence and venture performance. *Journal of Business Venturing, 7*(3), 223-236.

Chang, R.-D., Fang, C.-J., Tseng, Y.-C. (2011): The effects of WebTrust assurance on consumers' web purchase decisions. *Online Information Review, 36*(2), 218-240.

Chembid (2020): *The chemical marketplace report 2021*. Accessed online (05.01.2021): https://www.chembid.com/de/marketplaces-report/

CHEManager (2019): *E-Commerce Platforms in the Chemical Industry*. CHEManager International. Accessed online (17.09.2019): https://www.chemanager-online.com/en/topics/information-technology/e-commerce-platforms-chemical-industry-0

Chen, L.-T. (2013): Dynamic supply chain coordination under consignment and vendor-managed inventory in retailer-centric B2B electronic markets. *Industrial Marketing Management, 42*(4), 518-531.

Chen, L.-T. (2014): Optimal dynamic policies for integrated production and marketing planning in business-to-business marketplaces. *International Journal of Production Economics, 153*, 46-53.

Chien, S.-H., Chen, Y.-H., Hsu, C.-Y. (2012): Exploring the impact of trust and relational embeddedness in e-marketplaces: An empirical study in Taiwan. *Industrial Marketing Management, 43*(3), 460-468.

Choudhury, V. (1997): Strategic choices in the development of interorganizational information systems. *Information Systems Research, 8*(1), 1-24.

Chow, D., Ghani, A., Miller, M., Takeda, G., Ziffru, S. (2000): B2B – Beyond the market hubs. *Kellogg Graduate School of Management.* Working Paper, Northwestern University.

Cooper, A. C., Woo, C. Y., Dunkelberg, W. C. (1988): Entrepeneurs' perceived chances for success. *Journal of Business Venturing, 3*(2), 98-108.

Crook, T., Frasca, B., Kohavi, R., Longbotham, R. (2009): Seven pitfalls to avoid when running controlled experiments on the web. In: *Proceedings of the 15th ACM SIGKDD international conference on Knowledge discovery and data mining*, 1105-1114.

Cyr, D. (2013): Website design, trust and culture: An eight country investigation. *Electronic Commerce Research and Applications, 12*(6), 373-385.

Dai, Q., Kauffman, R. J. (2001): Business models for internet-based E-procurement systems and B2B electronic markets: An exploratory assessment. In: *Proceedings of the 34th Hawaii International Conference on System Sciences*, 1-10.

Day, G., Fein, A., Ruppersberger, G. (2003): Shakeouts in digital markets: Lessons from B2B exchanges. *Californian Management Review, 45*(2), 131-150.

Dennehy, D., Kasraian, L., O'Raghallaigh, P., Conboy, K. (2016): Product market fit frameworks for lean product development. In: *Proceedings of R&D Management Conference 2016 – From Science to Society: Innovation and Value Creation*. Cambridge: Cambridge University.

Dennehy, D., Kasraian, L., O'Raghallaigh, P., Conboy, K., Sammon, D., Lynch, P. (2019): A Lean Start-up approach for developing minimum viable products in an established company. *Journal of Decision Systems, 28*(3), 224-232.

Deng, Z., Wang, Z. (2016): Early-mover advantages at cross-border business-to-business e-commerce portals. *Journal of Business Research, 69*(12), 6002-6011.

De Reuver, M., Sørensen, C., Basole, R. C. (2018): The digital platform: A research agenda. *Journal of Information Technology, 33*(2), 124-135.

Deutscher Sparkassen- und Giroverband (2019): *Branchenreport – Oberflächenveredlung und Wärmebehandlung 2019.*

Driedonks, C. F., Gregor, S., Wassenaar, A. (2005): Economic and social analysis of the adoption of B2B electronic marketplaces: A case study in the Australian beef industry. *International Journal of Electronic Commerce, 9*(3), 49-72.

Doty, D. H., Glick, W. H. (1994): Typologies as a unique form of theory building: Toward improved understanding and modeling. *The Academy of Management Review, 19*(2), 230-251.

Dyer, W. G., Wilkins, A. L. (1991): Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of Management Review, 16*(3), 613-619.

Eisenhardt, K. (1989): Building theories from case study research. *The Academy of Management Review, 14*(4), 532-550.

Evans D.-S., Schmalensee (2016): Matchmakers – The new economics of multisided platforms. *Harvard Business Review Press*. Boston.

Feindt, S., Jeffcoate, J., Chappell, C. (2002): Identifying success factors for rapid growth in SME E-Commerce. *Small Business Economics, 19*(1), 51-62.

Finkelstein, S. (2001): Internet starups: So why can't they win?. *Journal of Business Strategy,* 22(4), 16-21.

Forrester Research (2017): *Forecast B2B sales*. Accessed online (06.10.2020): https://www.statista.com/statistics/273104/us-b2b-e-commerce-share/

Gefen, D., Karahanna, E., Straub, D. W. (2003): Inexperience and experience with online stores: The importance of TAM and trust. *IEEE Transactions on Engineering Management, 50*(3), 307-321.

Giaglis, G. M., Klein, S., O'Keefe, R. M. (2002): The role of intermediaries in electronic marketplaces: developing a contingency model. *Information Systems Journal, 12*(3), 231-246.

Glaser, B., Strauss, A. (1967): *The discovery of grounded theory: Strategies of qualitative research*. London.

Glick, B. (2001): Chemdex fell through a lack of user support. *Computing*. Accessed online (17.09.2019): https://www.computing.co.uk/ctg/news/1845424/chemdex-fell-lack-user-support

Grieger, M. (2003): Electronic marketplaces: A literature review and a call for supply chain management research. *European Journal of Operational Research, 144*(2), 280-294.

Google Optimize (2020): Accessed online (08.08.2020): https://support.google.com/optimize/answer/7018998?hl=en

Grabner-Kräuter, S., Kaluscha, E. A., Fladnitzer, M. (2006): Perspectives of online trust and similar constructs – a conceptual clarification. In: *Proceedings of the 8th international conference on Electronic commerce,* 235-243.

Gunasekaran, A., McGaughey, R. E., Ngai, E. W. T., Rai, B. K. (2009): E-Procurement adoption in the Southcoast SMEs. *International Journal of Production Economics, 122*(1), 161-175.

Guo, J. (2007): Business-to-business electronic market place selection. *Enterprise Information Systems, 1*(4).

Hadaya, P. (2004): Determinants of the future level of use of electronic marketplaces among Canadian firms. In: *Proceedings of the Hawaii International Conference on System Sciences, 37*, 1-10.

Hahn, C., Zarnekow, R., Röher, D. (2015): A value proposition oriented typology of electronic marketplaces for B2B SaaS applications. In: *Proceedings of the Americas Conference on Information Systems*, 1-15.

Hamilton, R. H. (2001): E-commerce new venture performance: how funding impacts culture. *Internet Research, 11*(4), 277-285.

Hanck, C., Arnold, M., Gerber, A., Schmelzer, M. (2020): *Introduction to Econometrics with R.* Accessed online (04.02.2021): https://www.econometrics-with-r.org/index.html or https://www.econometrics-with-r.org/ITER.pdf

Hartmann, E. (2019): Ein Überblick der E-Marktplätze im B2B-Bereich. In: *Handbuch Digitale Wirtschaft*, Springer.

Hokodo (2020): *The B2B Marketplace Report: Mapping the European B2B Marketplace Landscape.* Accessed online (26.10.2020): https://www.hokodo.co/blog/mapping-the-european-b2b-marketplace-landscape

Holland, C. (2002): Competition and strategy in electronic marketplaces. In: *Proceedings of the 35th Hawaii International Conference on System Sciences.*

Hottenrott, H., Lins, E., Lutz, E. (2018): Public subsidies and new ventures' use of bank loans. *Economics of Innovation and New Technology, 27*(8), 786-808.

Hottenrott, H., Richstein, R. (2020): Start-up subsidies: Does the policy instrument matter?. *Research Policy, 49*(1), 103888.

Hudetz, K. (2016): *Leitfaden B2B-E-Commerce*. Accessed online (09.11.2020): https://handel-mittelstand.digital/wp-content/uploads/Mittelstand-4.0-Agentur-Handel_Leitfaden-B2B-E-Commerce.pdf

Hynninen, P., Kaupinnen, M. (2014): A/B Testing – A promising tool for customer value evaluation. *IEEE 1st International Workshop on Requirements Engineering and Testing.*

Ibi research (2019): Marktplätze im B2B-E-Commerce in Deutschland 2019. Accessed online (06.10.2020): https://de.statista.com/statistik/daten/studie/1040525/umfrage/kritische-faktoren-fuer-den-erfolg-von-marktplaetzen-im-b2b-e-commerce-in-deutschland/

Iyer, K. N. S., Germain, R., Claycomb, C. (2009): B2B e-commerce supply chain integration and performance: A contingency fit perspective on the role of environment. *Information and Management, 46*(6), 313-322.

Janita, M. S., Miranda, F. J. (2013): The antecedents of client loyalty in business-to-business (B2B) electronic marketplaces. *Industrial Marketing Management, 42*(5), 814-823.

Johnston, R. B. (2008): *Understanding B2B e-marketplaces*. Unpublished presentation.

Kambil, A., Heck, E. van (2002): Making markets: How firms can design and profit from online auctions and exchanges. Harvard Business Review Press, First Edition, Boston.

Kane, M. (2002): *Leap of faith – Why B2B went bust.* C-Net. Accessed online (17.09.2019): https://www.cnet.com/news/leap-of-faith-why-b2b-went-bust/

Kaplan, S., Sawhney, M. (2000): E-hubs: The new B2B marketplaces. *Harvard Business Review, 78*(3), 97-100.

Khanna, D., Nguyen-Duc, A., Wang, X. (2018): From MVPs to pivots: a hypothesis-driven journey of two software startups. In: *International Conference of Software Business 2018,* 172-186.

Kim, J. U., Kim, W. J., Park, S. C. (2010): Consumer perceptions on web advertisements and motivation factors to purchase in the online shopping. *Computers in Human Behavior, 26*(5), 1208-1222.

Klein, S., Alt, R. (2015): B2B electronic markets. In: *The International Encyclopedia of Digital Communication and Society*. John Wiley & Sons.

Kniberg, H. (2013): How Spotify builds products. Accessed online (06.10.2020): https://www.dcc.fc.up.pt/~mcoimbra/lectures/SIM_1415/SIM_1415_T2.3_HowSpotifyBuildsProducts.pdf

Kniberg, H. (2016): Making sense of MVP (Minimum Viable Product) – and why I prefer Earliest Testable/Usable/Lovable. Accessed online (06.10.2020): https://blog.crisp.se/2016/01/25/henrikkniberg/making-sense-of-mvp?ref=https://product-frameworks.com

Koch, H., Schultze, U. (2011): Stuck in the conflicted middle: A roletheoretic perspective on B2B E-marketplaces. *MIS Quarterly: Management Information Systems, 35*(1), 123-146.

Koh, T. K., Fichman, M. (2014): Multi-homing users' preferences for two-sided exchange networks. *MIS Quarterly: Management Information Systems, 38*(4), 977-996.

Kohavi, R., Henne, R.M., Sommerfield, D. (2007): Practical guide to controlled experiments on the web: listen to your customers not to the hippo. In: *Proceedings of the 13th ACM SIGKDD international conference on Knowledge discovery and data mining*, 959-967.

Kohavi, R., Longbotham, R. (2011): Unexpected results in online controlled experiments. In: *ACM SIGKDD Explorations Newsletter, 12*(2), 31-35.

Kohavi, R., Deng, A., Frasca, B., Longbotham, R., Walker, T., Xu, Y. (2012): Trustworthy online controlled experiments: five puzzling outcomes explained. In: *Proceedings of the 18th ACM SIGKDD international conference on Knowledge discovery and data mining,* 786-794.

Kohavi, R. (2015): Online Controlled Experiments: Lessons from running A/B/n Tests for 12 Years. In: *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining.*

Kohavi R. (2012): Online controlled experiments: introduction, learnings, and humbling statistics. In: *Proceedings of the sixth ACM conference on Recommender systems*, 1-2.

Kohavi, R., Deng, A., Longbotham, R., Xu, Y. (2014): Seven rules of thumb for web site experimenters. In: *Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining*, 1857-1866.

Kohavi, R., Thomke, S. (2017): The surprising power of online experiments: Getting the most out of A/B and other controlled tests. *Harvard Business Review, 95*(5), 74-82.

Kohavi, R., Tang, D., Xu, Y., Hemkens L. G., Ioannidis, J. (2020): Online randomized controlled experiments at scale: lessons and extensions to medicine. *Trials, 21*(1), 1-9.

Kollmann, T. (2000): Competitive strategies for electronic marketplaces. *Electronic Markets, 10*(2), 102-109.

Koning, R., Hasan, S., Chatterji, A. (2019): Experimentation and startup performance: Evidence from A/B testing. Available at SSRN: https://ssrn.com/abstract=3440291 (Management Science forthcoming).

Kotha, S., Basu, S. (2011): Amazon and ebay: Online retailers as market makers. In: Hamilton et al. (ed.): *The Market Makers: How Retailers Are Reshaping the Global Economy*. Oxford University Press, 155-176.

Kracher, B., Corritore, C., Wiedenbeck, S. (2005): A foundation for understanding online trust in electronic commerce. *Journal of Information, Communication and Ethics in Society, 3*(3), 131-141.

Kraus, S., Palmer, C., Kailer, N., Kallinger, F. L., Spitzer, J. (2019): Digital entrepreneurship: A research agenda on new business models for the twenty-first century. *International Journal of Entrepreneurial Behaviour & Research, 25*(2), 353-375.

Kwon, S. D., Yang, H. D., Rowley, C. (2009): The purchasing performance of organizations using e-marketplaces. *British Journal of Management, 20*(1), 106-124.

Langer, N., Forman, C., Kekre S., Sun, B. (2012): Ushering buyers into electronic channels: An empirical analysis. *Information Systems Research, 23*(4), 1212-1231.

Langmann, S. (2018): A/B testing – The importance of significance and test duration. *Applied Marketing Analytics, 4*(2), 149-156.

Lavassani, K. M., Movahedi, B. M., Kumar, V. (2011): E-Marketplaces: Taxonomy of the new collaborative information platform. In: *E-Novation for Competitive Advantage in Collaborative Globalization: Technologies for Emerging E-Business Strategies*, 16-33.

Lenarduzzi, V., Taibi, D. (2016): MVP explained: A systematic mapping study on the definitions of minimal viable product. In: *42th Euromicro Conference on Software Engineering and Advanced Applications 2016*, 112-119.

Leung, K. H., Luk, C. C., Choy, K. L., Lam, H. Y., Lee, C. K. M. (2019): A B2B flexible pricing decision support system for managing the request for quotation process under e-commerce business environment. *International Journal of Production Research, 57*(20), 6528-6551.

Li, Y.-M., Yeh, Y.-S. (2010): Increasing trust in mobile commerce through design aesthetics. *Computers in Human Behavior, 26*(4), 673-684.

Lim, W. M. (2015): Antecedents and consequences of e-shopping: an integrated model. *Internet Research, 25*(2), 184-217.

Liu, B. Q., Goodhue, D. L. (2012): Two worlds of trust for potential e-commerce users: Humans as cognitive misers. *Information Systems Research, 23*(4), 1246-1262.

Lowry, P. B., Twyman, N. W., Pickard, M., Jenkins, J. L., Bui, Q. N. (2014): Proposing the affect-trust infusion model (ATIM) to explain and predict the influence of high and low affect infusion on Web vendor trust. *Information & Management, 51*(5), 579-594.

Loux, P., Aubry, M., Tran, S., Baudoin, E. (2020): Multi-sided platforms in B2B contexts: The role of affiliation costs and interdependencies in adoption decisions. *Industrial Marketing Management, 84*, 212-223.

Lumpkin, G. T., Dess, G. G. (1996): Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review, 21*(1), 135-172.

Lumpkin, G. T., Dess, G. G. (2001): Linking two dimensions of entrepreneurial orientation to firm performance: The moderating role of environment and industry life cycle. *Journal of Business Venturing, 16*(5), 429-451.

Luomakoski, Jari (2012): *Why did electronic B2B marketplaces fail? – Case study of an agricultural commodity exchange*. Dissertation. University of Jyväskylä, Finland.

Malone, T., Yates, J., Benjamin, R. (1987): Electronic markets and electronic hierarchies. *Communications of the ACM, 30*(6), 484-497.

Markus, M. L., Banerjee, P., Ma, L. (2002): Electronic marketplaces in Hong Kong's trading industry. In: *Proceedings of the 35th Hawaii International Conference on Systems Sciences.*

Martín-Martín, A., Orduna-Malea, E., Thelwall, M., Delgado López-Cózar, E. (2018): Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of Informetrics, 12*(4), 1160-1177.

Mayer, R. C., Davis, J. H., Schoorman, F. D. (1995): An integrative model of organizational trust. *The Academy of Management Review, 20*(3), 709.

McCoy, J. H., Sarhan, M. E. (1988): *Livestock and meat marketing*. Van Nostrand Reinhold International.

McIvor, R., Humphreys, P. (2004): The implications of electronic B2B intermediaries for the buyer-supplier interface. *International Journal of Operations & Production Management, 24*(3), 241-269.

McKnight, D. H., Chervany, N. L. (2001): What trust means in e-commerce customer relationship: An interdisciplinary conceptual typology. *International Journal of Electronic Commerce, 6*(2), 35-59.

McKnight, D. H., Choudhury, V., Kacmar, C. (2002): The impact of initial consumer trust on intentions to transact with a web site: A trust building model. *Journal of Strategic Information Systems, 11*, 297-323.

Merrilees, B., Fry, M.-L. (2003): E-trust – the influence of perceived interactivity on e-retailing users. *Marketing Intelligence & Planning, 21*(2), 123-128.

Movahedi, B., Lavassani, K. M., Kumar, V. (2012): E-Marketplace emergence: Evolution, developments and classification. *Journal of Electronic Commerce in Organizations, 10*(1), 14-32.

Muñoz-Leiva, F., Hernández-Méndez, J., Sánchez-Fernández, J. (2012): Generalising user behaviour in online travel sites through the Travel 2.0 website acceptance model. *Online Information Review, 36*(6), 879-902.

Muñoz-Leiva, F., Luque-Martínez, T., Sánchez-Fernández, J. (2010): How to improve trust toward electronic banking. *Online Information Review, 34*(6), 907-934.

Murtaza, M. B., Gupta, V., Carroll, R. C. (2004): E-marketplaces and the future of supply chain management: opportunities and challenges. *Business Process Management Journal 10*(3), 325-335.

Muzellec, L., Ronteau, S., Lambkin, M. (2015): Two-sided Internet platforms: A business model lifecycle perspective. *Industrial Marketing Management, 45*(1), 139-150.

Nambisan, S. (2017): Digital Entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice, 41*(6), 1029-1055.

Niknazar, P., Bourgault, M. (2017): Theories for classification vs. classification as theory: Implications of classification and typology for the development of project management theories. *International Journal of Project Management, 35*(2), 191-203.

Ngai, E. W. T., Gunasekaran, A., Wamba, S. F., Akter, S., Dubey, R. (2017): Big data analytics in electronic markets. *Electronic Markets, 27*(3), 243-245.

OECD (2020): *E-Commerce in the time of COVID-19*. Accessed online (04.02.2021): http://www.oecd.org/coronavirus/policy-responses/e-commerce-in-the-time-of-covid-19-3a2b78e8/

Oliva, R., Sterman, J. D., Giese, M. (2003): Limits to growth in the new economy: exploring the 'get big fast' strategy in e-commerce. *System Dynamics Review, 19*(2), 83-117.

Optimizely (2020): *Glossary.* Accessed online (08.08.2020): https://www.optimizely.com/optimization-glossary/

Ordanini, A. (2006): What drives market transactions in B2B exchanges?. *Communications of the ACM, 49*(4), 89-93.

Pavlou, P. A. (2002): Institution-based trust in interorganizational exchange relationships: The role of online B2B marketplaces on trust formation. *The Journal of Strategic Information Systems, 11*(3-4), 215-243.

Pavlou, P. A. (2003): Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce, 7*(3), 101-134.

Pantiuchina J., Mondini, M., Khanna, D., Wang X., Abrahamsson, P. (2017): Are software startups applying agile practices? The state of the practice from a large survey. In: *Agile Processes in Software Engineering and Extreme Programming.* Springer.

Pengnate, S., Antonenko, P. (2013): A multimethod evaluation of online trust and its interaction with metacognitive awareness: An emotional design perspective. *International Journal of Human-Computer Interaction, 29*(9), 582-593.

Petersen, K. J., Ogden, J. A., Carter, P. L. (2007): B2B e-marketplaces: A typology by functionality. *International Journal of Physical Distribution & Logistics Management, 37*(1), 4-18.

Petrova, K. (2012): Part-time entrepreneurship and financial constraints: Evidence from the panel study of entrepreneurial dynamics. *Small Business Economics, 39*, 473-493.

Porter, M. E. (1980): *Competitive strategy: Techniques for analyzing industries and competitors*. New York, Free Press.

Porter, M. E. (1985): Technology and competitive advantage. *Journal of Business Strategy, 5*(3), 60-78.

Pressey, A. D., Ashton, J. K. (2009): The antitrust implications of electronic business-to-business marketplaces. *Industrial Marketing Management, 38*(4), 468-476.

Rahimnia, F., Hassanzadeh, J. F. (2013): The impact of website content dimension and e-trust on e-marketing effectiveness: The case of Iranian commercial saffron corporations. *Information & Management, 50*(5), 240-247.

Rauch, A., Wiklund, J., Lumpkin, G. T., Frese, M. (2009): Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future. *Entrepreneurship: Theory and Practice, 33*(3), 761-787.

Reimers, K., Guo, X., Li, M. (2019): Beyond markets, hierarchies, and hybrids: an institutional perspective on IT-enabled two-sided markets. *Electronic Markets, 29*(2), 287-305.

Ries, E. (2011): *The Lean Startup: How constant innovation creates radically successful businesses*. Penguin Radom House.

Rosenzweig, E. D., Laseter, T. M., Roth, A. V. (2011): Through the service operations strategy looking glass: Influence of industrial sector, ownership, and service offerings on B2B e-marketplaces failures. *Journal of Operations Management*, 33-48.

Rossignoli, C. Ricciardi, F. (2015): Electronic marketplaces. In: *Inter-organizational Relationships.* Springer International Publishing.

Rotter, J. B. (1967): A new scale for the measurement of interpersonal trust. *Journal of personality, 35*(4), 651-665.

Salam, A. F., Rao, H. R., Pegels, C. C. (2003): Consumer-perceived risk in ecommerce transactions. *Communications of the ACM, 46*(12), 325-331.

Sahut, J.-M., Iandoli, L, Teulon, F. (2021): The age of digital entrepreneurship. *Small Business Economics, 56*, 1159-1169.

Saprikis, V., Vlachopoulou, M., Manthou, V. (2009): A typology framework of Greek business-to-business electronic marketplaces. *International Journal of Business Innovation and Research, 3*(3), 252-267.

Saunders, M., Lewis, P. & Thornhill, A. (2012): *Research Methods for Business Students.* 6th Edition, Pearson Education Limited.

Schmitt, L. (2019): Challenges affecting the adoption of B2B electronic marketplaces. *Journal of Business Chemistry, 10*, 154-164.

Schoenherr, T., Mabert, V. A. (2011): A comparison of online and offline procurement in B2B markets: Results from a large-scale survey. *International Journal of Production Research, 49*(3), 827-846.

Sebora, T., Lee, S., Sukasame, N. (2009): Critical success factors for e-commerce entrepreneurship: an empirical study of Thailand. *Small Business Economics, 32*(3), 303-316.

Seckler, M., Heinz, S., Forde, S., Tuch, A. N., Opwis, K. (2015): Trust and distrust on the web – User experiences and website characteristics. *Computers in Human Behavior, 45*, 39-50.

Segev, A., Gebauer, J., Farber, F. (1999): Internet-based electronic markets. *Electronic Markets, 9*(3), 138-146.

Shepherd, D. A., Gruber, M. (2020): The Lean Startup framework: Closing the academic-practitioner divide. *Entrepreneurship Theory and Practice, 0*, 1-13.

Sivaji, A., Downe, A. G., Mazlan, M. F., Soo, S.-T., Abdullah, A. (2011): Importance of incorporating fundamental usability with social & trust elements for E-Commerce website. In: *Proceedings of the International Conference on Business, Engineering and Industrial Applications,* 221-226.

Skjøtt-Larsen, T., Kotzab, H., Grieger, M. (2003): Electronic marketplaces and supply chain relationships. *Industrial Marketing Management, 32*(3), 199-210.

Snow, C. C., Ketchen, D. J. (2014): Typology-driven theorizing: A response to Delbridge and Fiss. *Academy of Management Review, 39*(2), 231-233.

Soh, C., Markus, M., Goh, K. (2006): Electronic marketplaces and price transparency – Strategy, information technology, and success. *MIS Quarterly: Management Information Systems, 30*(3), 705-723.

Standing, C., Love, P., Stockdale, R., Gengatharen, D. (2006): Examining the relationship between electronic marketplace strategy and structure. *IEEE Transactions on Engineering Management, 53*(2), 297-311.

Standing, S., Standing, C., Love, P. (2008): A review of research on E-Marketplaces 1997-2007, In: *PACIS 2008 Proceedings*, 1-13.

Standing, S., Standing, C., Love, P. (2010): A review of research on e-marketplaces 1997-2008. *Decision Support Systems, 49*, 41-51.

Statista Report (2017): *B2B E-commerce.* Accessed online (06.10.2020): https://www.statista.com/statistics/705606/global-b2b-e-commerce-gmv/

Statista Report (2020): *Leading paints and coatings companies worldwide in 2019 by revenue.* Accessed online (06.10.2020): https://www.statista.com/statistics/543989/leading-paint-companies-worldwide-by-revenue/

Steenhuis, H. J., de Bruijn, E. J. (2006): Building theories from case study research: the progressive case study. In: *OM in the New World Uncertainties. Proceedings of the 17th Annual Conference of POMS*, Boston.

Strader, T. J., Shaw, M. J. (2000): Electronic markets impact and implications. In: *Handbook of electronic commerce.* Springer.

Taddeo, M. (2009): Defining trust and e-trust – From old theories to new problems. *International Journal of Technology and Human Interaction, 5*(2), 23-35.

Tamimi, N., Sebastianelli, R. (2015): The relative importance of e-tailer website attributes on the likelihood of online purchase. *Internet Research, 25*(2), 169-183.

Täuscher, K., Laudien, S. M. (2018): Understanding platform business models: A mixed methods study of marketplaces. *European Management Journal, 36*(3), 319-329.

Tedeschi, B. (2001): Business to Business – Why purchasing agents turned out to be hard to herd. The New York Times. Available online (17.09.2019): https://www.nytimes.com/2001/02/28/business/business-to-business-why-purchasing-agents-turned-out-to-be-hard-to-herd.html

Teuteberg, F. (2019): E-Marketplace-Modelle, In: Kollmann, T. (Ed.), *Handbuch Digitale Wirtschaft*. Springer Gabler: Wiesbaden, 569-601.

Timmers, P. (1998): Business models for electronic markets. *Electronic Markets, 8*(2), 3-8.

Thuong, L. T. (2002): Pathways to leadership for business-to-business electronic marketplaces. *Electronic Markets, 12*(2), 112-119.

Thuong, L. T. (2005): Business-to-business electronic marketplaces: evolving business models competitive landscape. *International Journal of Services Technology and Management, 6*(1), 40-54.

Tomak, K., Xia, M. (2002): *Evolution of B2B Marketplaces. Electronic Markets, 12*(2), 84-91.

Train, K. (2009): *Discrete choice methods with simulation*. 2nd edition. Cambridge University Press.

Urban, G. L., Sultan, F., Qualls, W. J. (2000): Placing trust at the center of your internet strategy. *MIT Sloan Management Review, 42*(1), 39-38.

Verband der deutschen Lack- und Druckfarbenindustrie (2020): *Statistiken*. Accessed online (06.10.2020): https://www.wirsindfarbe.de/statistiken

Von Hoyningen-Huene, J. (2019): *Disrupting chemical sales – The rise of online marketplaces.* CHEManager International. Accessed online (17.09.2019): https://www.chemanager-online.com/en/topics/chemicals-distribution/disrupting-chemical-sales-rise-online-marketplaces

Walia, N., Zahedi, F. M. (2013): Success strategies and web elements in online marketplaces: A moderated-mediation analysis of seller types on eBay. *IEEE Transactions on Engineering Management, 60*(4), 763-776.

Wang, S., Archer, N. P. (2007): Electronic marketplace definition and classification: Literature review and clarifications. *Enterprise Information Systems 1*(1), 89-112.

Wang, S., Zheng, S., Xu, L., Dezheng, L., Meng, H. (2008): A literature review of electronic marketplace research: Themes, theories and an integrative framework. *Information Systems Frontiers, 10*, 555-571.

Wang, S., Cavusoglu, H. (2015): Small and medium sized manufacturer performance on third party B2B electronic marketplaces: The role of enabling and IT capabilities. *Decision Support Systems, 79*, 184-194.

Wang, Y. D., Emurian, H. H. (2005): An overview of online trust: Concepts, elements and implications. *Computers in Human Behavior, 21*(1), 105-125.

Webster, J., Watson, R. T. (2002): Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly: Management Information Systems, 26*(2), xiii-xxiii.

Yin, R. (1981): The case study crisis: Some answers. *Administrative Science Quarterly, 26*, 58-65.

Yin, R. (2013): *Case study research and applications: Design and methods*. 5th Edition. Sage Publications.

Yoo, B., Choudhary, V., Mukhopadhyay, T. (2002): Pricing strategies of electronic B2B marketplaces with two-sided network externalities. In: *Proceedings of the 35th Hawaii International Conference on System Sciences.*

Yoo, B., Choudhary, V., Mukhopadhyay, T. (2011): A study of sourcing channels for electronic business transactions. *Journal of Management Information Systems, 28*(2), 145-169.

Zacharakis, A. L., Shepherd D. A., Coombs, J. E. (2003): The development of venture-capital-backed internet companies: An ecosystem perspective. *Journal of Business Venturing, 18*(2), 217-231.

Zhang, Y., Fang, Y., Wei, K.-K., Ramsey, E., McCole, P., Chen, H. (2011): Repurchase intention in B2C e-commerce – A relationship quality perspective. *Information & Management, 48*(6), 192-200.

Zhao, K., Xia, M., Shaw, M. J., Subramaniam, C. (2009): The sustainability of B2B e-marketplaces: Ownership structure, market competition, and prior buyer-seller connections. *Decision Support Systems, 47*(2), 105-114.

Zhu, F., Iansiti, M. (2012): Entry into platform-based markets. *Strategic Management Journal, 33*(1), 88-106.

Zhu, K. (2004): Information transparency of business-to-business electronic markets: A game-theoretic analyses. *Management Science, 50*(5), 670-685.

Appendix

Appendix 1: Overview of the papers, sorted by year of publication

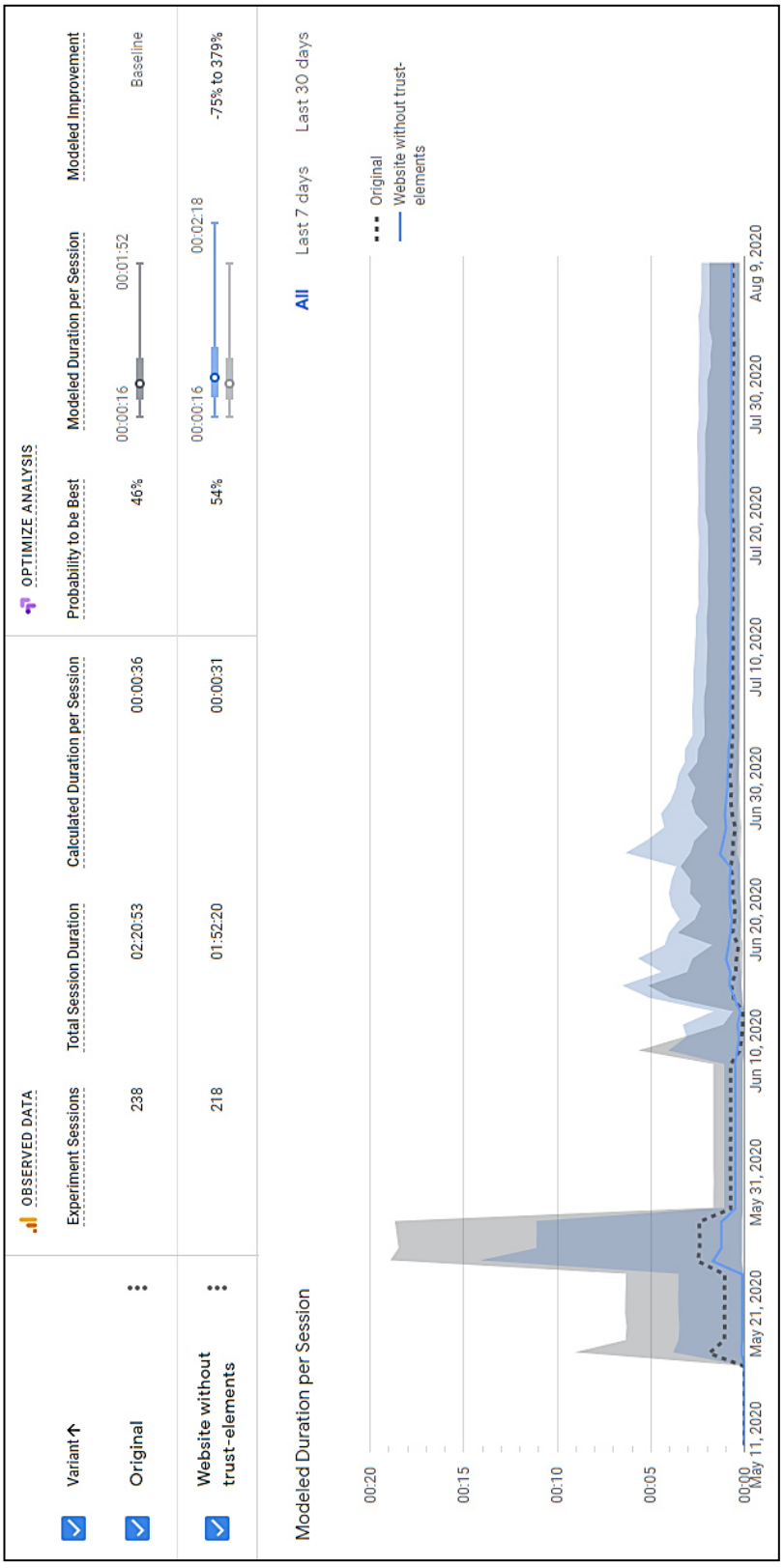
Year	Title	Research question	Author(s)	Journal
2020	Multi-sided platforms in B2B contexts: The role of affiliation costs and interdependencies in adoption decisions	How is the adoption of a project-based B2B marketplace influenced by affiliation costs and interdependencies between users?	Loux P., Aubry M., Tran S., Baudoin E.	Industrial Marketing Management
2019	A B2B flexible pricing decision support system for managing the request for quotation process under e-commerce business environment	How can artifical intelligence based methods support B2B pricing decisions?	Leung K.H., Luk C.C., Choy K.L., Lam H.Y., Lee C.K.M.	International Journal of Production Research
2016	Early-mover advantages at cross-border business-to-business e-commerce portals	How long can early entrants of an B2B marketplace take advantage of their first mover role?	Deng Z., Wang Z.	Journal of Business Research
2015	Two-sided Internet platforms: A business model lifecycle perspective	How can EMs develop stable value propositions and revenue models?	Muzellec L., Ronteau S., Lambkin M.	Industrial Marketing Management
2015	Small and medium sized manufacturer performance on third party B2B electronic marketplaces: The role of enabling and IT capabilities	How are B2B marketplaces influencing the performance of SMEs?	Wang S., Cavusoglu H.	Decision Support Systems
2014	Customer orientation structure for Internet-based business-to-business platform firms	How does the customer orientation in traditional B2B transactions differ from the customer orientation on B2B marketplaces?	Chakravarty A., Kumar A., Grewal R.	Journal of Marketing
2014	Optimal dynamic policies for integrated production and marketing planning in business-to-business marketplaces	How to integrate production and marketing planning into B2B marketplaces?	Chen L.-T.	International Journal of Production Economics
2014	Multi-Homing Users' Preferences for Two-Sided Exchange Networks	How is the participation on multiple B2B marketplaces affecting the buyers' behavior?	Koh T.K., Fichman M.	MIS Quarterly: Management Information Systems
2013	Dynamic supply chain coordination under consignment and vendor-managed inventory in retailer-centric B2B electronic markets	How does a dynamic supply chain setting affects the ventor-management inventory contracts in both traditional and electronic B2B markets?	Chen L.-T.	Industrial Marketing Management
2013	The antecedents of client loyalty in business-to-business (B2B) electronic marketplaces	How is the B2B sellers' loyalty influenced in an EM environment?	Janita M.S., Miranda F.J.	Industrial Marketing Management
2012	Exploring the impact of trust and relational embeddedness in e-marketplaces: An empirical study in Taiwan	How is the users' perceived ease of use of an B2B marketplace influencing its adoption?	Chien S.-H., Chen Y.-H., Hsu C.-Y.	Industrial Marketing Management
2012	Ushering buyers into electronic channels: An empirical analysis	Which factors influence B2B buyers' adoption of a new electronic procurement channel?	Langer N., Forman C., Kekre S., Sun B.	Information Systems Research
2011	Stuck in the conflicted middle: A roletheoretic perspective on B2B E-marketplaces	Which role conflicts can arise in a B2B marketplace environment?	Koch H., Schultze U.	MIS Quarterly: Management Information Systems
2011	Through the service operations strategy looking glass: Influence of industrial sector, ownership, and service offerings on B2B e-marketplace failures	Which strategic factors influence the failure rate of B2B marketplaces?	Rosenzweig E.D., Laseter T.M., Roth A.V.	Journal of Operations Management
2011	A comparison of online and offline procurement in B2B markets: Results from a large-scale survey	Which variables influence the use of online and offline procurement environments from the buyers' perspective?	Schoenherr T., Mabert V.A.	International Journal of Production Research
2011	A study of sourcing channels for electronic business transactions	How is uncertainty influencing firm's choice of B2B sourcing channels and do firms prefer either B2B marketplaces or web-based private channels?	Yoo B., Choudhary V., Mukhopadhyay T.	Journal of Management Information Systems
2009	E-Procurement adoption in the Southcoast SMEs	What is the current state of e-procurement on the south coast of Massachusetts and how can SMEs be encouraged to take advantage of e-procurement?	Gunasekaran A., McGaughey R.E., Ngai E.W.T., Rai B.K.	International Journal of Production Economics
2009	B2B e-commerce supply chain integration and performance: A contingency fit perspective on the role of environment	How does B2B supply chain integration affect the financial, operational and market performance?	Iyer K.N.S., Germain R., Claycomb C.	Information and Management
2009	The antitrust implications of electronic business-to-business marketplaces	How to deal with possible antitrust concerns as an EM operator and participant?	Pressey A.D., Ashton J.K.	Industrial Marketing Management
2009	The sustainability of B2B e-marketplaces: Ownership structure, market competition, and prior buyer-seller connections	Why have some electronic marketplaces failed while others survived?	Zhao K., Xia M., Shaw M.J., Subramaniam C.	Decision Support Systems

Appendix 2: Overview of the 62 chemical marketplaces, sorted by place of business

URL	Founding year	Place of business	Operating model	Product portfolio	Possible interactions
www.b2brazil.com	2010	Brazil	Open marketplace	generalist	RFQ
https://en.china.cn/	2006	China	Open marketplace	generalist	RFQ
www.21chemnet.com	2009	China	Open marketplace	specialized on chemicals	RFQ
www.alibaba.com	1999	China	Open marketplace	generalist	DIRECT PURCHASE or RFQ
www.bossgoo.com	2005	China	Open marketplace	generalist	RFQ
www.chemnet.com	2001	China	Open marketplace	specialized on chemicals	RFQ
www.diytrade.com	2006	China	Open marketplace	generalist	DIRECT PURCHASE or RFQ
www.ebiochem.com	n/a	China	Closed marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.echemi.com	2015	China	Open marketplace	specialized on chemicals	RFQ
www.ecvv.com	2006	China	Open marketplace	generalist	RFQ
www.everychina.com	2011	China	Open marketplace	generalist	RFQ
www.globalchemmade.com	2009	China	Open marketplace	specialized on chemicals	RFQ
www.guidechem.com	2011	China	Open marketplace	specialized on chemicals	RFQ
www.hisupplier.com	1998	China	Open marketplace	generalist	RFQ
www.hxchem.net	2000	China	Open marketplace	specialized on chemicals	RFQ
www.ichemical.com	2008	China	Closed marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.jumorechem.com	2016	China	Open marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.kitairu.net	2003	China	Open marketplace	generalist	RFQ
www.lookchem.com	2008	China	Open marketplace	specialized on chemicals	RFQ
www.made-in-china.com	1998	China	Open marketplace	generalist	RFQ
www.molbase.com	2013	China	Open marketplace	specialized on chemicals	RFQ
www.okchem.com	2013	China	Open marketplace	specialized on chemicals	RFQ
www.seekchem.com	2002	China	Open marketplace	specialized on chemicals	RFQ
www.tradesparq.com	2010	China	Open marketplace	generalist	RFQ
www.chem2market.com	2012	Germany	Open marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.chembid.com	2016	Germany	Meta-search marketplace	specialized on chemicals	RFQ
www.chemondis.com	2017	Germany	Open marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.pinpools.com	2016	Germany	Open marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.biomall.in	2016	India	Closed marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.carbanio.com	2017	India	Closed marketplace	specialized on chemicals	DIRECT PURCHASE
www.chemarc.com	2016	India	Open marketplace	specialized on chemicals	RFQ
www.chemicals4construction.com	2017	India	Open marketplace	specialized on chemicals	DIRECT PURCHASE

www.dial4trade.com	2011	India	Open marketplace	generalist	RFQ
www.exportersindia.com	1997	India	Open marketplace	generalist	RFQ
www.fibre2fashion.com	2000	India	Open marketplace	generalist	RFQ
www.indiamart.com	1999	India	Open marketplace	generalist	RFQ
www.jimtrade.com	n/a	India	Open marketplace	generalist	RFQ
www.kemgo.com	2014	India	Open marketplace	specialized on chemicals	DIRECT PURCHASE or AUCTION
www.tradeindia.com	1996	India	Open marketplace	generalist	RFQ
www.worldofchemicals.com	2010	India	Open marketplace	specialized on chemicals	RFQ
www.chemicals1.com	n/a	Netherlands	Open marketplace	generalist	RFQ
www.tradekey.com	2006	Saudi Arabia	Open marketplace	generalist	RFQ
www.chemtradeasia.com	2002	Singapore	Open marketplace	specialized on chemicals	RFQ
www.buykorea.org	2000	South Korea	Open marketplace	generalist	RFQ
www.ec21.com	1997	South Korea	Open marketplace	generalist	RFQ
www.ecplaza.net	1996	South Korea	Open marketplace	generalist	RFQ
www.tradekorea.com	2008	South Korea	Open marketplace	generalist	RFQ
www.chemberry.com	2018	Switzerland	Meta-search marketplace	specialized on chemicals	RFQ
www.kemiex.com	2017	Switzerland	Open marketplace	specialized on chemicals	RFQ
www.taiwantrade.com	2002	Taiwan	Open marketplace	generalist	DIRECT PURCHASE or RFQ
www.gobuychem.com	2016	UK	Closed marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.agilischemicals.com	2016	USA	Open marketplace	specialized on chemicals	RFQ
www.chemdeals.com	2000	USA	Closed marketplace	specialized on chemicals	RFQ
www.chemdirect.com	2019	USA	Open marketplace	specialized on chemicals	DIRECT PURCHASE or RFQ
www.chemequal.com	2014	USA	Open marketplace	specialized on chemicals	RFQ
www.chemicalregister.com	1998	USA	Open marketplace	specialized on chemicals	RFQ
www.chempoint.com	1999	USA	Open marketplace	specialized on chemicals	RFQ
www.echosystem.com	2017	USA	Open marketplace	specialized on chemicals	RFQ
www.eworldtrade.com	2016	USA	Open marketplace	generalist	RFQ
www.knowde.com	2017	USA	Open marketplace	specialized on chemicals	RFQ
www.tradeford.com	2012	USA	Open marketplace	generalist	RFQ
www.tradewheel.com	2003	USA	Open marketplace	generalist	RFQ

Appendix 3: Google optimize reporting of the A/B testing



Appendix 4: Further technical aspects

Selection of the Web Development Provider

The basic infrastructure of an A/B testing is a website measuring the relevant metrics. In our case, we set up a website for the fictive start-up SECUPROTECT. The website featured both German and English language versions of the contents. Depending on the user location, the respective language version was automatically loaded. Users could also change the language manually through a language switcher button.

We used a web service called Wix for the development of the website. There are a few reasons why we chose this service over other methods like developing the website with WordPress or developing the website from the ground, using raw programming technologies, namely:

- Wix provides a very user-friendly drag-and-drop method to construct and edit websites.
- Wix allows to quickly create a mobile version of the website that looks appealing on a smartphone or tablet.
- Wix makes it easy to connect a third-party domain with the respective webspace. It is also possible to get a domain directly from Wix.
- Wix directly duplicates/translates the website into another language, if needed.
- Wix supports custom scripts that we need to implement A/B testing tools.

Those who have already set up a website with WordPress or from scratch know that these points are usually very time-consuming. All in all, Wix is a cost-efficient and useful solution for simple websites. For our project, this was completely sufficient.

Selection of the A/B Testing Tool

For our case, we also decided to conduct the testing with Google Optimize. Google Optimize is a free A/B testing platform from Google. It works with most websites and supports the collection of different metrics in combination with Google Analytics. It has a user-friendly dashboard in which it is possible to set up and edit the experiment. This means that one can edit the different variants of the website directly in the Google Optimize dashboard.

Technical Preparations for the A/B Testing

First, we created a dedicated "Gmail" account for our website. This Gmail account will be used across all Google tools. After that, we went into Google Analytics to create a profile there. While creating this, Google asks you to generate a "Property." A Property is where you can combine all the data from Google Analytics. Every Property has a Property ID. Afterwards, we created an account in Google Optimize. During this step, we created a Container for SECUPROTECT. A Container is a workspace with all website-related settings. Likewise, a Container also has a unique ID.

In the Google Optimize dashboard, we go to the settings of the desired Container. There is the option to link an Analytics Property with the Container. This is where the Property ID comes into play. We had to enter our Property ID (UA-XXXXXXXXX-X) in the Container settings under "Edit Link to Property." Once this is done, the Analytics for the Optimize experiments will appear in the respective Property.

Google Optimize supports several installation methods. One is using the "global site tag" (gtag.js). This code is a custom script that loads external JavaScript code once the original page has been loaded. The JavaScript tagging framework and API allows it to send website data to Google Analytics or Google Ads. The global site tag needs to be integrated within the header file of the website; hence this is loaded with every page view. Since a new website is usually difficult to find, we created a Google Ads account and prepared an advertising campaign in parallel.

Google Optimize is not officially supported by Wix and its web development platform. Wix suggests, therefore, to use Google Tag and the Tag identification of Google Optimize to run such experiments. However, this process needs a lot of tweaking and does not allow to make variants with ease. After some trials and errors, we achieved that the Wix platform works directly with Google Optimize by using a Wix feature that allows you to insert custom JavaScript codes inside the website. Google Optimize's global site tag can also be used as a JavaScript code if wrapped inside a <script> tag. Since neither of Wix or Google mentions this solution, this can be considered as a workaround.

In our Container settings, we take the custom global site tag for our container. In the scripts there are some personal variables like Analytics Property ID, Optimize Container ID that need to be updated before use. Once injected properly in the <header>, the set up for the A/B testing should be ready. We checked if everything is connected successfully

by using Google Chrome and its Optimize extension. The extension will scan for any injected Google Optimize code and verifies the installation.

Creating and launching the A/B testing experiment

While A/B testing tools use different mechanisms behind the scene, the underlying technology is quite the same. They work by injecting their own scripts to every page of a website. When the browser loads the website initially, it automatically loads the external JavaScript code following the link in the header file. Once loaded, the script manipulates pages according to the respective configuration.

In Google Optimize you can create “Experiences” to conduct an A/B testing. This allowed us to produce variants of SECUPROTECT. The original unmodified variant is called the variant A, and the modified variant represents the variant B. While more variants can be created and loaded, for our purpose, A/B variants are sufficient.

It is possible to specify on which page the variant will be loaded. Since we made the experiment on the main page, the URL (www.secuprotect.de) was selected as “Page Targeting.” How often the variants will be loaded can also be specified. For our case, we wanted to measure each variant's performance fairly, hence we selected to load each variant in a ~50/50 ratio. The users were randomly assigned to one of the two variants when calling up the website.

As a free user, you can get metrics about maximal three “Objectives” in Google Optimize. These Objectives are primary metrics that end up in Google Analytics to measure the website performance. Our primary selected Objective was “Session Duration”, secondary Objectives were “Pageviews” and “Bounces.”

Using the editing feature of Google Optimize, we modified our B variant. Once pressed, a new window is opened with the site being loaded underneath. This window provides all necessary tools to edit any text, images, or other elements of the duplicated A variant, which becomes the B variant when modified.

Appendix 5: Detailed answers to the questions posed in Section 6.4.5

Question	Answer
How many users will visit the website during the testing period?	Around 6.000 users visited the Coating Radar website during the test period (6 months).
Where are the users coming from?	From these 6.000 users around 1.600 were US visitors, 1.400 were German visitors, 500 were Russian visitors (see Figure 5). These numbers may include bots.
For how many minutes/seconds are the users staying on the website?	The average time spend on the website was 2m 46s (during the test period, measured with Google Analytics).
How will Google ads increase website's traffic, also with different budgets?	Google ads increases the clicks enormously. Websites that are new and consequently difficult to find are therefore dependent on Google ads. Here, three campaigns were made, see question below.
Which Google ads will run well and what are the relevant search terms?	The 1st campaign addressed the USA, Canada and the UK: Coating Radar | Coatings | Find the right coating service | Send us your... You want a quick quote? We find the right surface treatment company for you! After your search request, we will get back to... *(Keywords used: powder coating service, powder coating, aluminum coating, coating service, coating service shop)* The 2nd campaign addressed Germany: Coating Radar | Beschichtungen | Lohnbeschichter schnell finden |... Stellen Sie eine Anfrage und wir verbinden Sie mit dem richtigen Beschichtungsunternehmen. Innerhalb... *(Keywords used: Oberflächentechnik, Oberflächen-beschichtung, Oberflächenbeschichtung Metall, Oberflächenbeschichtung Aluminium, Stahl beschichten, Oberflächenveredelung)* The 3rd campaign addressed Germany as well: Bauteile beschichten? | Wir helfen weiter | Lohnbeschichter schnell... Wir unterstützen Sie bei der Suche nach dem passenden Lohnbeschichter. Stellen Sie einfach eine Anfrage bei uns und wir... *(Keywords used: Lohnbeschichtung, Bauteile beschichten, Metall beschichten, Werkzeug beschichten, Stahlträger beschichten, Beschichter Deutschland)*

	1st campaign: 6.340 impressions / 60 clicks 2nd campaign: 9.600 impressions / 156 clicks 3rd campaign: 14.100 impressions / 86 clicks
What budget will be needed in this industry niche to be on page one at Google?	1st campaign: ~ 8 €/day (total: 72 €) 2nd campaign: ~ 11€/day (total: 267 €) 3rd campaign: ~ 14€/day (total: 173 €)
How many coating service companies will register via the website during the sales campaign?	Around 30 registrations were made from coating service companies (supply side), with around 60 DACH locations (90 European locations, 20 US/UK locations)
Will they fill out the online registration form completely or do they stop somewhere in between?	There was an online registration form on the website. The average time to complete the detailed registration was ~ 10m. The completion rate was ~ 23%.
How many coating service companies will answer to the mails or even call?	We addressed around 250 coating service companies with our email sales campaign, parallel to the Google campaigns. Here, unfortunately, we did not make a clean collection.
How will the coating services companies react in general about the Coating Radar and its activities (e.g., constructive, skeptical, open, positive, negative, etc.)?	Many coating service companies were interested in our activities and we were surprised about the positive feedback. However, there was a lot of skepticism, and of course there were also people that did not answer or did not show any interest.
How many requests will be generated via the website?	In total, 34 requests (demand side) were created and submitted via the website.
How many of these requests will come from a (potential) private or commercial customer? (The Coating Radar focused on commercial customers.)	20 out of 34 requests were commercial requests made by companies. The requests came from very different industries, e.g., a hotel, a craftsman shop, an architect, or an interior designer.
How many of these requests can be matched with a suitable coating service company?	No match could be achieved for these requests. Private requests dropped out because of the B2B focus.
What will be the feedback of the coating service companies on each request?	In general, the coating service companies were interested and concerned, so there was multiple correspondence, with each request we forwarded. Nevertheless, the result was always that the request itself was not interesting (often because of the low number of components, and/or because of complicated/unclear requirements).
What kind of requests do coating service companies prefer?	Industrial coating service companies prefer requests with a very high number of components to be coated. Also the requirements should be clear from the beginning. Special requests, such as special colors, are usually not welcome.

Appendix 6: Principal component factor analysis

The questionnaire of the IAB/ZEW start-up panel aimed at capturing the concept of the Entrepreneurial Orientation (EO) using at set of 10 questions in total with always two items related to one sub-concept of EO (see Table A6.1). Thus, the questionnaire contains two items for each aspect. For this reason, the number of components equals number of items (see Table A6.2).

Table A6.1: Entrepreneurial Orientation survey questions

Risk tolerance		
Item 1: In order to achieve corporate goals even in uncertain situations, my company proceeds…	a) ...rather cautiously, in a wait and see approach, in order to avoid wrong decisions.	b) ...rather bravely and aggressively so as not to miss any business opportunities.
Item 2: My company has a strong inclination for projects with...	a) ...low risk and thus normal but secure returns.	b) ...high risk and thus opportunities for very high returns.
Proactiveness		
Item 3: In dealing with the competition, my company pursues the strategy…	a) …of reacting to the actions of competitors.	b) …of taking the initiative itself, to which competitors must then react.
Item 4: When introducing new products or services, business processes or technologies, in my market environment…	a) …I do not necessarily want to be one of the first with my company.	b) …I want to be one of the first with my company.
Autonomy		
Item 5: I generally believe that the best results come about when…	a) …employees have a say in which business ideas and projects are pursued.	b) …as Managing Director, I alone decide which business ideas and projects are pursued.
Item 6: In my company…	a) …employees make decisions on their own without constantly checking back with me.	b) …employees must always check with me when making decisions.

Innovativeness		
Item 7: My strategy is to make changes to my products or services…	a) …in a small and incremental way.	b) …that are as far-reaching and fundamental.
Item 8: My company focuses on…	a) …marketing proven products or services.	b) …innovation, technology leadership and research and development.
Competitiveness		
Item 9: My company…	a) …does not make any specific efforts to win sales from competitors.	b) …is very aggressive and competitive.
Item 10: My company…	a) …avoids conflicts with competitors whenever possible and follows the motto "live and let live".	b) …does not shy away from conflict in order to challenge competitors' market positions.

Note: Original questions presented in German. Likert scale from 1 to 5 [1: completely a), 2: rather a), 3: undecided, 4: rather b), 5: completely b)].

Table A6.2: Components (Number of observations: 11,607)

Component	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	2.51215	1.27385	0.2512	0.2512
Factor 2	1.23830	0.14297	0.1238	0.3750
Factor 3	1.09533	0.14395	0.1095	0.4846
Factor 4	0.95138	0.08870	0.0951	0.5797
Factor 5	0.86268	0.06939	0.0863	0.6660
Factor 6	0.79330	0.05385	0.0793	0.7453
Factor 7	0.73945	0.06232	0.0739	0.8193
Factor 8	0.67713	0.10788	0.0677	0.8870
Factor 9	0.56925	0.00823	0.0569	0.9439
Factor 10	0.56102	.	0.0561	1.0000

Each observed variable contributes one unit of variance to the total variance. If the eigenvalue is greater than 1, then each principal component explains at least as much variance as 1 observed variable. Thus, if we apply the Kaiser criterion, we can conclude that there are three components with an Eigenvalue > 1 and hence three underlying factors. Figure A6.1 illustrates this. The scree plot suggests that we should retain three factors.

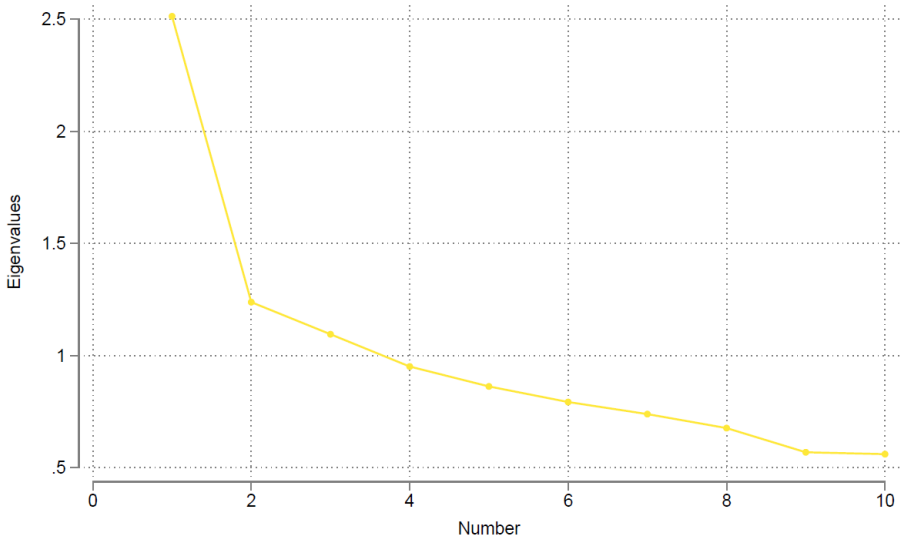


Figure A6.1: Scree plot

If we apply factor rotation with the orthogonal varimax method, we obtain the results as shown in Table A6.3.

Table A6.3: Factors

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	2.03971	0.46125	0.2040	0.2040
Factor 2	1.57846	0.35085	0.1578	0.3618
Factor 3	1.22761	.	0.1228	0.4846

The sum of the three eigenvalues (4.846) is the overall variability. In other words, these three factors explain 48.8% of the variance. This is not very high and indicates that other factors may play a role. The results in A6.2 indeed show that also Factors 4 and 5 have Eigenvalues close to one.

Table A6.4 shows the rotated factor loadings and unique variances (blanks represent values <.3). The numbers show the correlation of each component with the three identified factors. Here, we see that the components:

- Risktol2, Proact1, Proact2, Inno1 and Inno2 correlate highest with Factor 1;
- Auto1, Auto2 and Inno1 correlate highest with Factor 2;
- Comp1 and Comp2 correlate highest with Factor 3.

Table A6.4: Factor loadings and uniqueness

Component	**Factor1**	**Factor2**	**Factor3**	**Uniqueness**
Risktol1	0.2710			0.7807
Risktol2	0.5325			0.6594
Proact1	0.7166			0.4733
Proact2	0.6677			0.5473
Auto1		0.8301		0.3056
Auto2		0.7950		0.3594
Inno1	0.5019	0.3250		0.6405
Inno2	0.6702			0.5215
Comp1			0.7755	0.3975
Comp2			0.7224	0.4690

The factor analysis hence showed that when applying the Kaiser criterion, there are fewer factors than initially expected, i.e., three rather than five. The concepts of innovativeness, pro-activeness and risk tolerance turn out to be measuring the same construct in our data. Competitiveness appears to be distinct from this first factor. Autonomy is indeed very distinct from the other EO-dimensions.

Table A6.5 presents the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for each item. It is often used as an indicator for how suited data is for factor analysis. The test statistic measures sampling adequacy for each item in the model and the complete model, in particular, it measures the proportion of variance among items that might be common variance. The KMO-value is higher if this proportion is lower. According to Kaiser a KMO > 0.8 is ideal while values between 0.6 and 0.7 are also still acceptable. Values of less than 0.5 would be unacceptable which is never the case in this example.

Table A6.5: Kaiser-Meyer-Olkin Measures

Variable	**KMO**
Risktol1	0.7696
Risktol2	0.7531
Proact1	0.8178
Proact2	0.7946
Auto1	0.5516
Auto2	0.6342
Inno1	0.7481
Inno2	0.8062
Comp1	0.6784
Comp2	0.6868
Overall	0.7429

Appendix 7: Correspondence analysis (CA)

The IAB/ZEW start-up panel also contains information about the reasons to found a start-up. There were seven possible answering options (see Table A7.1). In general, it might be interesting to differentiate between "opportunity-driven entrepreneurship" and "necessity-driven entrepreneurship" in this context. A CA might help to group categories and visualize the relative "location" of responses. This can be illustrated with the help of the graph. We conduct a multiple/joint correspondence analysis on the basis of 82,258 firm-year observations using the Burt method with adjusted inertias.

Table A7.1: Survey questions on founding motive

Reason for start-up founding	**Freq.**	**Percent**	**Cum.**
Motive 1: Self-determined work	35,143	42.72	42.72
Motive 2: Realization of a concrete business idea	29,035	35.30	78.02
Motive 3: Lack of prospects in current job	4,767	5.80	83.82
Motive 4: Way out of unemployment	4,927	5.99	89.81
Motive 5: Forcing of the former employer	615	0.75	90.55
Motive 6: Tax incentives	217	0.26	90.82
Motive 7: Better earning opportunities	7,554	9.18	100.00
Total	82,258	100.00	

The results are presented in Table A7.2 and A7.3 as well as in Figure A7.1 visualizes the results. It can be seen in the results that the two items "self-determined work" and "realization of a concrete business idea" are clearly distinct from "better earning opportunities", "tax incentives", "forcing of the former employer" and "way out of employment".

Especially the first item "self-determined work" appears to lie in a different quadrant indicating that this motive might be very distinct from others (score negative on both dimensions). See Table A7.3 for the detailed values underlying Figure A7.1. Motive 2 "realization of a concrete business idea" is also quite distinct but score negative in

dimension 2 and positive on dimension 1. The remaining five motives seem to capture a more consistent construct as they are all located in the same quadrant and relatively close together. These items may hence correspond to "necessity-driven entrepreneurship" while the other correspond to "opportunity-driven entrepreneurship". To conclude, the CA provides some plausible results, but might be more valuable in other contexts where the distance between categories is more meaningful than in this example (e.g., product or brand perceptions).

Table A7.2: CA results

Dimension	**Principal inertia**	**Percent**	**Cumul. percent**
Dim 1	.0114199	32.79	32.79
Dim 2	.0011304	3.25	36.04
Dim 3	.000187	0.54	36.58
Dim 4	.0001087	0.31	36.89
Dim 5	2.44e-06	0.01	36.90
Dim 6	2.67e-07	0.00	36.90

Table A7.3: Statistics for column categories in principal normalization

Categories	**Overall**			**Dimension 1**			**Dimension 2**		
	Mass	Quality	%inert	Coord	Sqcorr	Contrib	Coord	Sqcorr	Contrib
Motive 1: Self-determined work									
0	0.082	0.444	0.170	0.178	0.436	0.226	0.025	0.009	0.045
1	0.061	0.444	0.228	-0.238	0.436	0.303	-0.033	0.009	0.060
Motive 2: Realization of a concrete business idea									
0	0.092	0.433	0.129	-0.142	0.416	0.164	0.029	0.017	0.068
1	0.050	0.433	0.237	0.261	0.416	0.300	-0.053	0.017	0.125

Motive 3: Lack of prospects in current job

0	0.135	0.077	0.004		-0.003	0.008	0.000		-0.008	0.069	0.008
1	0.008	0.077	0.058		0.043	0.008	0.001		0.130	0.069	0.124

Motive 4: Way out of unemployment

0	0.134	0.079	0.004		-0.003	0.008	0.000		-0.008	0.071	0.008
1	0.009	0.079	0.060		0.043	0.008	0.001		0.132	0.071	0.132

Motive 5: Forcing of the former employer

0	0.142	0.041	0.000		-0.000	0.006	0.000		-0.001	0.035	0.000
1	0.001	0.041	0.008		0.039	0.006	0.000		0.094	0.035	0.008

Motive 6: Tax incentives

0	0.142	0.039	0.000		-0.000	0.006	0.000		-0.000	0.033	0.000
1	0.000	0.039	0.003		0.039	0.006	0.000		0.091	0.033	0.003

Motive 7: Better earning opportunities

0	0.130	0.147	0.009		-0.005	0.009	0.000		-0.018	0.138	0.038
1	0.013	0.147	0.090		0.046	0.009	0.002		0.181	0.138	0.380

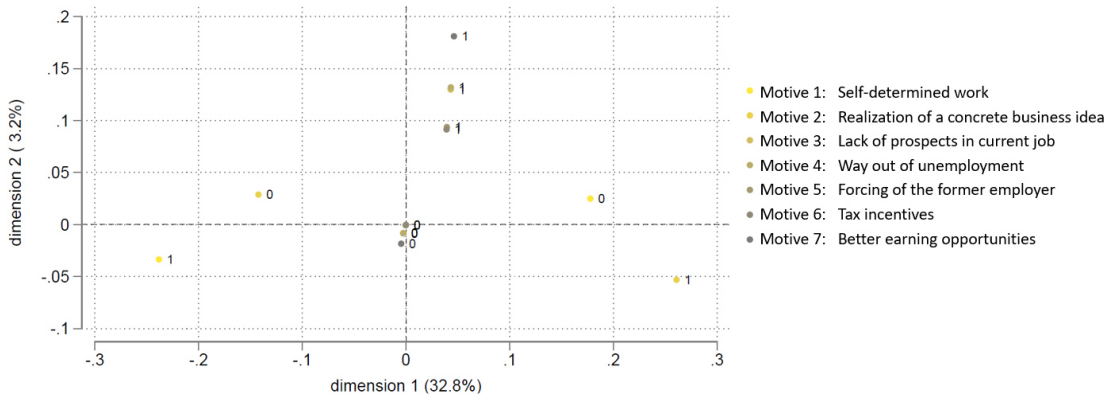


Figure A7.1: CA results