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New perspectives on education technology and performance measurement: Exploring the opportunities and challenges

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Abstract

This thesis contributes to an understanding of current opportunities and challenges in both the education industry and scientific organizations. The first three studies shed light on opportunities provided by digital technologies in the education industry. In particular, the first empirical chapter investigates, based on a qualitative content analysis, whether specific business model components (i.e., sub components of customer identification, value delivery, financial aspects and value proposition) influence firm performance (i.e., financial success and web and social media success). The results show that some business model components influence both financial success and web and social media success (e.g., identification of the target customer, sub component of customer identification), whereas some business model components influence none (e.g., concentration on education technology, sub component of value delivery) or only one of the two performance indicators (e.g., sales model, sub component of financial aspects which influences web and social media success).

The second empirical chapter focuses on common patterns in value (co-)creation of the education technology provider, customer (i.e., the university) and user (i.e., the student) in the education industry. The analysis includes the role of education technology and the service offered by education technology providers. This content analysis, followed by a cluster analysis, reveals three typical patterns in value (co-)creation: (1) “low service solution” (characterized by an active role of the university and co-creation between the learner and the university, little service by the provider and little co-creation overall); (2) “technology-based student-targeting service” (characterized by an inactive role of the university, an active role of the education technology and high co-creation between the learner and the provider); and (3) “high co-creation and service solution” (characterized by extensive service from the provider, an active role of the university and value co-creation between the provider and the university).

The third empirical chapter provides an analysis of the status quo of blockchain-based education technologies. The descriptive results of the qualitative content analysis show that existing blockchain-based education technologies are diverse and offer important advantages for education (e.g., trust and equal opportunities). In sum, these technologies already offer many approaches for possibly changing education and therefore have the potential to provide substantial educational innovations.

Insight into the challenges the education industry is currently facing due to the introduction of digital technologies is given by the fourth empirical chapter. This chapter uses a questionnaire study to identify antecedents of business administration students' acceptance of education technology. The goal is to gain an understanding of ways in which students' acceptance of education technology can be increased. The results show that students' problem-solving skills and enjoyment, the compatibility of education technology with students' learning style, and peer encouragement for the use of education technology positively influence the intention to use these tools through their perceived usefulness/ perceived ease of use. Instructor encouragement does not influence the intention to use education technology.

The last chapter analyzes, based on an interview study, the consequences that tight performance measurement can have on scientists' behavior. Current performance measurement mainly has negative consequences and leads to gaming of performance measurement (i.e., achieving performance goals by reducing performance quality and focusing on the tasks that are measured), which shares the same characteristics as deviant workplace behavior (i.e., a voluntary violation of organizational norms that harms the organization). Reasons for the negative influence are discussed (e.g., differences between performance measurement criteria and organizational goals). Taken together, the results of the five studies contribute to a successful inclusion of education technology in higher education, and they provide an understanding of the challenges arising through tight performance measurement.

Kurzfassung (German abstract)

Diese Doktorarbeit trägt zum Verständnis von aktuellen Chancen und Herausforderungen in der Bildungsindustrie beziehungsweise von wissenschaftlichen Organisationen bei. Die Chancen, die durch digitale Technologien in der Bildungsindustrie geboten werden, werden im Rahmen der ersten drei empirischen Kapitel beleuchtet. Die erste Studie analysiert, basierend auf einer qualitativen Inhaltsanalyse, ob spezifische Komponenten der Geschäftsmodelle von Bildungstechnologieanbietern (d.h. Sub-Komponenten von Kundenidentifikation, Wertübertragung, finanziellen Aspekten und Leistungsversprechen) einen Einfluss auf die Unternehmensleistung haben (d.h. finanzieller Erfolg und Erfolg im Internet und in sozialen Medien). Es zeigt sich, dass manche Komponenten der Geschäftsmodelle beide Arten der Unternehmensleistung beeinflussen (z.B. Identifizierung der Zielkunden, d.h. eine Sub-Komponente der Kundenidentifikation), während andere Komponenten keinen Einfluss haben (z.B. Konzentration auf Bildungstechnologie, d.h. eine Sub-Komponente der Wertübertragung), oder nur einen Einfluss auf einen der beiden Indikatoren der Unternehmensleistung haben (z.B. Verkaufsmodell, d.h. eine Sub-Komponente der finanziellen Aspekte, beeinflusst den Erfolg im Internet und in sozialen Medien).

Die zweite Studie analysiert typische Muster in der (gemeinsamen) Wertschöpfung von Anbietern, Kunden (d.h. die Universitäten) und Nutzern (d.h. die Lerner) in der Bildungsindustrie. Die Analyse beinhaltet auch die Rolle der Bildungstechnologie und die von den Bildungsanbietern angebotenen Services. Hierzu wurde eine Inhaltsanalyse durchgeführt, auf die eine Clusteranalyse folgte. Die Analysen zeigen drei typische Muster in der Wertschöpfung: (1) “Niedrige Service Lösung” (charakterisiert durch eine aktive Rolle der Universität und gemeinsame Wertschöpfung zwischen Lernenden und Universität, wenig Service durch den Anbieter und insgesamt wenig gemeinsame Wertschöpfung); (2) „Technologiebasierter auf den Studierenden abzielender Service“ (charakterisiert durch eine

inaktive Rolle der Universität, eine aktive Rolle der Bildungstechnologie und gemeinsame Wertschöpfung zwischen Lernenden und Anbieter); (3) „Starke gemeinsame Wertschöpfung und Service-Lösung“ (charakterisiert durch starken Service durch den Anbieter, eine aktive Rolle der Universität und gemeinsame Wertschöpfung zwischen Anbieter und Universität).

Das dritte empirische Kapitel bietet eine Analyse des Status quo von blockchainbasierten Bildungstechnologien. Die deskriptiven Ergebnisse der qualitativen Inhaltsanalyse zeigen, dass die Technologien unterschiedlich sind und Vorteile für die Bildung bieten (z.B. Vertrauen und gleichberechtigte Möglichkeiten). Zusammenfassend bietet blockchainbasierte Bildungstechnologie bereits viele Ansätze, um Bildung zu verändern und hat somit das Potential substantielle Innovationen in der Bildung zu ermöglichen.

Erkenntnisse über die Herausforderungen, vor denen die Bildungsindustrie steht, werden durch das vierte empirische Kapitel gewonnen. Diese Studie beleuchtet, basierend auf einer Fragebogenstudie, die Voraussetzungen für die Akzeptanz von Bildungstechnologie durch Studierende der Wirtschaftswissenschaften. Das Ziel ist es ein Verständnis über die Möglichkeiten zu erlangen, um die Akzeptanz von Bildungstechnologie durch Studierende zu erhöhen. Die Ergebnisse zeigen, dass die Problemlösekompetenzen, die Freude an der Technologie, die Kompatibilität der Technologie mit dem Lernstil der Studierenden und die Ermutigung durch andere Studierende einen positiven Einfluss auf die wahrgenommene Nützlichkeit und den wahrgenommenen Bedienungskomfort haben. Diese Aspekte haben wiederum einen positiven Einfluss auf die Intention die Lerntechnologie zu nutzen. Die Ermutigung durch die Lehrkräfte hat keinen Einfluss auf die Intention Lerntechnologie zu nutzen.

Das letzte empirische Kapitel analysiert, basierend auf einer Interviewstudie, die Konsequenzen, die eine starre Leistungsmessung auf das Verhalten von Wissenschaftlern haben kann. Aktuelle Leistungsmessung hat vor allem negative Konsequenzen auf das

Verhalten von Wissenschaftlern und führt zu „Spielverhalten“ (d.h. das Erreichen von Leistungszielen, indem die Qualität der Leistung reduziert wird und man sich auf das Erreichen der Aufgaben konzentriert die bewertet werden), welches wiederum eine Form von deviantem Verhalten am Arbeitsplatz darstellt (d.h. das freiwillige Verletzen von organisationalen Normen, wodurch eine Schädigung für die Organisation entsteht). Gründe für diese negativen Einflüsse werden diskutiert (z.B. Unterschiede zwischen Leistungsmessungskriterien und den organisationalen Zielen).

Zusammenfassend tragen die Ergebnisse der fünf empirischen Kapitel zu einer erfolgreichen Inklusion von Lerntechnologie in die Hochschulbildung bei. Die Ergebnisse erzeugen zudem ein Verständnis von den Herausforderungen, die durch eine starre Leistungsmessung entstehen.

1 Introduction[1]

This thesis contributes to an understanding of current opportunities and challenges in both the education industry and scientific organizations at different organizational and individual levels. In particular, the analyses shed light on the opportunities and challenges arising due to the increasing introduction of technologies in education. Furthermore, the thesis enables an understanding of the challenges scientific organizations are facing due to the negative behavioral consequences of current performance measurement practices. The following chapter introduces the five research questions.

1.1 Motivation and research questions

An analysis of research questions related to the introduction of technologies in education is particularly interesting because this technology enables the blurring of boundaries between the traditional education industry and digital learning environments. Education technology describes the use of any technology to facilitate learning and to improve the performance of students in higher education (e.g., online courses adapting to the learners pace instead of face-to face lectures; Januszewski & Molenda, 2008). Education technology "has democratized innovation and almost anyone can now participate" (c.f., Yoo, Henfridsson, & Lyytinen, 2010, p.726). As a result, in addition to traditional stakeholders such as users and organizations (e.g., universities), the providers of education technologies – with their technology-based business models – have also become important education industry stakeholders.

Traditional education is currently mainly an offline service (c.f., Lusch & Nambisan, 2015), which is evolving to a more digitalized context through education technology.

[1]This introduction is partly based on Graf*, Wendler*, Stumpf-Wollersheim & Welpe (2019) [*equal contribution]; Lévy, Stumpf-Wollersheim & Welpe (2019a); Lévy, Stumpf-Wollersheim & Welpe (2019b); Lévy, Stumpf-Wollersheim & Welpe (forthcoming) and Wendler, Stumpf-Wollersheim & Welpe (2017); the full references can be found in the Appendix.

In particular, education technology enables new opportunities to transform traditional education; for example, education can now be provided independently of place and time (Barrett, Davidson, Prabhu, & Vargo, 2015): through online courses and virtual reality, learners can experience education remotely. The introduction of education technology results in new opportunities and, in particular, the introduction of education technology-based business models, value co-creation between traditional higher education industry stakeholders and education technology providers, and disruptive innovations through new digital technologies such as blockchain technology. Furthermore, the introduction of education technology creates the need for acceptance of this technology.

Previous research has established the importance of analyzing the opportunities created by digital technologies and by education technology in particular (e.g., Grech & Camilleri, 2017). However, the abovementioned areas of research emerging due to education technology have not been considered until now. The following chapter introduces each of the empirical chapters and the relevant research gaps and contributions in more depth.

The first research question focuses on success factors of education technology providers' business models (concerning the sub components of customer identification, value delivery, financial aspects and value proposition). These success factors of business models are a key research topic in the context of the digital transformation of education for the following reasons. Education technologies enable the development of new business models that challenge traditional education providers (e.g., universities). In particular, the providers of education technology specialize in offering previously unavailable opportunities to learners, such as education independent of place and time. Therefore, their value creation focuses on the learners and their needs (c.f., Johnson, Christensen, & Kagermann, 2008). Being aware of key success factors of the business models of education technology providers can better enable them to challenge traditional higher education by responding to students' needs.

The importance of business models for business success has been recognized, and research and discussion on business models are growing (e.g., Burkhart, Krumeich, Werth, & Loos, 2011; Demil & Lecocq, 2010; Schneider & Spieth, 2013; Trimi & Berbegal-Mirabent, 2012; Veit et al., 2014). However, there is little research analyzing the influence of business models on firm performance (e.g., Brea ‐ Solís, Casadesus ‐ Masanell, & Grifell ‐ Tatjé, 2015; Zott & Amit, 2007). Similarly, there is a lack of empirical research on the business models of education technology providers in particular (Kalman, 2016; Mendling, Neumann, Pinterits, & Simon, 2005; Mendling, Neumann, Pinterits, Simon, & Wild, 2005). In sum, research on how education technology providers can have successful business models is currently missing.

Given the essential role of a functioning business model in a firm's success, this research gap needs to be addressed to provide knowledge of which components education technology providers should include in their business models to be successful. This study therefore analyzes the success factors of business models of education technology providers based on a full content analysis of the firms' websites followed by an analysis of the influence of the business model components on firm performance. This chapter contributes to research on successful business models and enables education technology providers to create successful business models to be a meaningful part of value creation in the higher education industry.

Research Question 1: What makes the business models of education technology providers successful?

The second empirical chapter analyzes value creation and co-creation and therefore the interplay of the value that different stakeholders create on their own plus the value that they co-create jointly (Grönroos & Voima, 2013). The key stakeholders in value (co-)creation in higher education are the technology providers, customers (i.e., universities) and users (i.e., learners). This research further takes the role of education technology into account. Education technology is used with the goal of improving students' performance in higher education (Januszewski &

Molenda, 2008). This study is of particular importance because due to the increasing use of education technology, the boundaries between classical face-to-face higher education and technology-based higher education become blurred. The analysis of typical patterns of value (co-)creation of key stakeholders in the higher education industry is a means to understand how education technology becomes part of higher education and blurs these boundaries.

Previous research stresses the explanatory importance of value co-creation for technological transformation (Spohrer & Maglio, 2008) and developed a framework of the interface of the stakeholders in value creation and co-creation (Grönroos & Voima, 2013). Furthermore, researchers emphasize that the role of information technology should be considered in value co-creation (Spohrer & Maglio, 2008). The role of technology can range from being a resource that universities use to create value to being a total service integration that provides complete content and functionality (Nambisan, 2013).

However, the model of value (co-)creation only includes general relationships and lacks a profound explanation of the patterns of value (co-)creation. Further, until now, technology has mostly been considered a distinct element and not part of value co-creation (Breidbach & Maglio, 2015). Addressing this lack of knowledge on how value is (co-)created is of the utmost importance because of the tremendous explanatory power of value (co-)creation and the important potential of education technology to induce digitalized learning in higher education. Therefore, the goal of this study is to identify clusters in value (co-)creation that are the basis of the interpretation of common role patterns. This study contributes to research on value (co-) creation by showing how value is (co-)created in an emerging technological field. The study allows for an understanding of how value (co-)creation is typically realized and how the boundaries between classical face-to-face education and education technology become blurred.

Research question 2: What are common patterns in value (co-)creation?

The third empirical chapter analyzes the status quo of blockchain-based education technologies and the opportunities and advatages this technology provides for education. Blockchain technology is a distributed and encrypted digital database. Entries on a blockchain are permanent and accountable (Piscini, Guastella, Rozman, & Nassim, 2016) and can be retrieved throughout all entities connected to this blockchain (c.f., Swan, 2015; Underwood, 2016). As a result, blockchain technology offers the means to securely store data and has the potential to change education, for example, by allowing the elimination of intermediaries, such as educational institutions that would otherwise serve as a means to legitimate the educational data (Iansiti & Lakhani, 2017; Yli-Huumo, Ko, Choi, Park, & Smolander, 2016; Zyskind & Nathan, 2015). Blockchain technology therefore allows the democratization and decentralization of data (c.f., Kosba, Miller, Shi, Wen, & Papamanthou, 2016; Piscini et al., 2016; Zyskind & Nathan, 2015). Through these characteristics, blockchain technology can be used, for example, in the awarding of qualifications and the managing of student records (see Sharples & Domingue, 2016). As a result, blockchain-based education technology is a particularly good example of a technology that might change or even disrupt traditional education.

Although previous research has established the vast innovative potential of blockchain-based technologies, only 20% of papers have addressed blockchain in contexts other than cryptocurrencies (Friedlmaier, Tumasjan, & Welpe, 2017; Yli-Huumo et al., 2016). In particular, there is a lack of research systematically analyzing the opportunities of blockchain technology for education. Considering the immense potential of blockchain technology for education, this research gap is unfortunate. Therefore, paper three focuses on the status quo of blockchain technology in education, particularly assessing the change this technology may induce in education. The chapter is based on an analysis of the websites of firms offering blockchain-based education technology. This knowledge about blockchain-based education

technology contributes to an understanding of how blockchain technology may change education.

Research Question 3: What is the status quo of blockchain-based education technologies?

The fourth empirical chapter focuses on students as the users of education technology and analyses their technology acceptance. This analysis is highly relevant because, even though the advantages of education technology have been established (e.g., Prensky, 2001), education technology still seems to be adopted with reservations by technology users. One reason for this reluctance is that education technology induces change in teaching in higher education, which in turn leads to the need for users to adapt to the use of the technology (Martins & Kellermanns, 2004). Similar to change management in organizations, user acceptance is a prerequisite for a successful change process (Gagné, Koestner, & Zuckerman, 2000; Kotter & Schlesinger, 1979).

Although previous research has analyzed the acceptance of education technology in different contexts, what is missing thus far is knowledge of which antecedents are relevant for business administration students' acceptance of a broad range of education technology. Given the increasing awareness of the positive effects of education technology on learning and the importance of its acceptance for successful implementation of the education technology, this research gap needs to be filled. Therefore, this study analyzes potential antecedents of business administration students' acceptance of education technology. This empirical chapter contributes to the successful implementation of education technology in higher education by analyzing the antecedents of the students' acceptance of this technology. As a result, this thesis provides insights into how technology acceptance can be achieved.

Research Question 4: What are the antecedents of business administration students' acceptance of education technology?

The fifth empirical chapter explores the negative behavioral consequences of current performance measurement practices in academia. Performance measurement practices (e.g., equating research performance with the number of publications in top-tier journals) are often named as reasons for the unethical behavior of scientists (e.g., Barsky, 2008; Clor-Proell, Kaplan, & Proell, 2015; Gross, 2016; Ordónez, Schweitzer, Galinsky, & Bazerman, 2009). Furthermore, research has established the severe impact of unethical behavior, such as less-reliable scientific findings or wasted funding (Steneck, 2006). What is missing thus far is a better understanding of this unethical behavior. Given the growing awareness of the effect of performance measurement on performance, it is essential to understand why performance measurement might lead to unethical behavior.

A reason for negative influences of performance measurement on employee behavior is that performance measurement criteria are often similar across organizations but are not tailored to the organizations' goals. This mismatch becomes problematic, when employees adapt their behavior to the performance measurement criteria. This phenomenon is called 'gaming performance measurement' (i.e., achieving performance goals by reducing performance quality and focusing on the tasks that are measured). A result is that the employees' behavior is not adapted to the organizational goals.

This problem becomes prohibitive in the scientific context due to the seeming comparability of performance (e.g., journal rankings or impact factors). However, in addition to comparable and measurable goals such as research output, scientific organizations might have different organizational goals that are not included in measurements and are harder to measure (e.g., novelty of the research topic).

The fifth empirical chapter therefore explores the consequences that performance measurement can have on employee behavior based on qualitative semistructured interviews with different stakeholders of the higher education system (e.g., professors). The study takes a

stepwise approach and shows that performance measurement has positive, yet mainly negative consequences on employee behavior. It further shows that scientists engage in gaming performance measurement but also demonstrates that gaming performance measurement is a type of deviant workplace behavior, that is, a "voluntary behavior that violates significant organizational norms and in so doing threatens the well-being of an organization, its members, or both" (Robinson & Bennett, 1995, p. 565). This study contributes to theory on deviant workplace behavior and further sheds light on the negative consequences of current performance measurement in scientific organizations.

Research Question 5: What are the negative consequences of current performance measurement?

This thesis makes several important contributions to the understanding of the changes in the education industry that are fueled by education technology; it also illuminates the negative behavioral consequences of current performance measurement practices in academia. This thesis advances theory on business models, value (co-)creation, technology acceptance, gaming performance measurement and deviant workplace behavior; finally, it generates knowledge on the status quo of blockchain technology in education.

However, this thesis not only contributes to a theoretical understanding of the opportunities and challenges organizations are currently facing but also makes practical contributions to how opportunities can be successfully used and how challenges can be mastered. In particular, the thesis takes several organizational and individual levels into account and provides a detailed approach to including education technology in higher education. Therefore, one overarching contribution of this thesis is an understanding of how digital technology-induced change can be – and is already – leading to a new digital era in the education industry. Given the advantages of education technology described above, this research contributes to improving education by enhancing knowledge of the smooth integration

of education technology. This thesis further analyzes how to master the negative behavioral consequences of current performance measurement practices in academia. This analysis contributes to an understanding of how to oppose the negative consequences of a tight and outcome-based performance measurement on employee behavior.

In sum, first, the success factors of education technology-based business models are assessed and can be employed to fuel the successful introduction of education technology in higher education. Second, this thesis analyzes common patterns in value (co-)creation between technology providers, customers (i.e., universities) and users (i.e., learners) and takes the role of the technology into account. This knowledge allows for an understanding of how value (co-)creation is typically realized. Third, the status quo of blockchain-based education technology is determined and allows for an understanding of how this technology may change education. Fourth, new insights are provided into the antecedents of business administration students' acceptance of education technology. Fifth, organizational challenges are assessed by analyzing negative behavioral consequences of current performance measurement practices in academia and showing that resulting gaming of performance measurement is a type of deviant workplace behavior. This knowledge allows organizations to prevent deviant workplace behavior.

1.2 Theoretical background and core concepts

This thesis relies on several theoretical concepts to answer the abovementioned research questions. An introduction to education technology and the education industry is provided below, particularly focusing on higher education, which represents the context chapters 2, 3, 4 and 5 are based on. Subsequently, research on business models is presented, and an explanation of the model of value (co-)creation, of blockchain technology and of technology acceptance will be given. Finally, performance measurement and the theory of deviant workplace behavior are introduced.

Education technology is the use of any technology to facilitate learning and to improve the performance of students in education, e.g., online courses that adapt to the learners' pace instead of face-to face lectures (Januszewski and Molenda 2008). This type of technology enhances the digitalization of higher education and, as a result, the digital transformation of traditional education. Education technology enables the fulfillment of learners' needs (c.f., Gray & Rumpe, 2015), such as education independent of place and time. This characteristic means that education technology, for example, allows learning online instead of face-to-face; or, that face-to-face education can be supported through digital technology. Compared to traditional education, education technology enables different service exchanges between higher education stakeholders (Lusch & Vargo, 2014).

1.2.1 Provider's business model

Business models describe the way firms operate and sell their technology (Osterwalder & Pigneur, 2002; Teece, 2010) or service (Paton & McLaughlin, 2008). Business models further represent the logic a firm pursues in selling its product or service (Osterwalder & Pigneur, 2010; Osterwalder, Pigneur, & Tucci, 2005). Previous research has found evidence of the importance of business models for a firm's performance (see Chesbrough & Rosenbloom, 2002; Johnson, 2010). As a result, business models allow for an explanation of how education technology providers seize the opportunities of this technology and how they capture value from it (Teece, 2010).

Until now, there has been no generally accepted view of business models and their components (Zott, Amit, & Massa, 2011), but there are well-known examples (Osterwalder & Pigneur, 2010), and reviews have extracted important components of business models. Additionally, there is little research on business model components in education technology. Therefore, this study draws on different theoretical conceptualizations of business models and adapts them to the education technology context (Al-Debei & Avison, 2010; Amit & Zott, 2001;

Baden-Fuller & Haefliger, 2013; Desyllas & Sako, 2013; Johnson et al., 2008; Morris, Schindehutte, & Allen, 2005; Rayna & Striukova, 2014; Schief & Buxmann, 2012).

The study is based on the assumption that firm decisions regarding the following four business model components influence firm performance. The first component is value proposition, which implies "the value created for the users by an offering based on technology" (Chesbrough, 2010, p. 355). This component describes the unique selling position of the firm to the customer (Schief & Buxmann, 2012). The offer of a firm (i.e., technology type, which describes the main function of the education technology, e.g., an online course and the form of distribution, e.g., website, software and hardware) and the services offered by the firm (i.e., support, integration of the buyer in development, customization) are important components of the value proposition. Customer identification is the second major component (Baden-Fuller & Haefliger, 2013). This component describes the market segment a firm claims (Chesbrough, 2010). Therefore, the target learner and target customer are part of customer identification. Third, value delivery is an important business model component and describes the firm's key resources (Al-Debei & Avison, 2010), such as cooperation with a public institution/ private firm or concentration on higher education/ education technology. Fourth, financial aspects such as the sales model are part of the firm's business model (Casadesus-Masanell & Ricart, 2010; Casadesus-Masanell & Ricart, 2011; Casadesus‐Masanell & Zhu, 2013).

1.2.2 Value (co-)creation by key stakeholders

Grönroos and Voima's (2013) representation of value creation abstracts the roles of stakeholders in value creation. Value creation is the interplay of the value that the user creates, facilitated by other stakeholders, plus the value the user and other stakeholders co-create jointly (Grönroos & Voima, 2013). This model can be applied to the education industry and enables the understanding of patterns in value creation between stakeholders. Thereby, it allows for an understanding of how value is (co-)created.

The key stakeholders of value (co-)creation in the use of education technology are the user (i.e., the learner), the customer (i.e., the university represented by the instructor; or the learner) and the education technology provider (and the amount of service offered by the provider). Based on the roles that the stakeholders take, their contributions to value creation and co-creation can have different scopes (i.e., larger or smaller). The service offered by education technology providers can be considered as support (i.e., facilitation) for the value creation of the customer (Grönroos, 2011).

In addition to these stakeholders, education technology plays a role in value creation, which has, until now, not been sufficiently taken into consideration (Breidbach & Maglio, 2016). Education technology offers a variety of ways to digitalize education (e.g., augmented and virtual reality or collaboration tools). Due to this contribution, education technology is an important part of the transformation of value creation (Breidbach & Maglio, 2016). The technology can be an enabler of value creation (Lusch & Nambisan, 2015) or a service innovation itself, and it can therefore create an entirely different way to deliver an educational service.

An exemplary value (co-)creation pattern is an education technology provider who sells virtual reality glasses to a university as the customer. The university uses the included software to create content. The technology is an enabler of new value creation. By themselves, these glasses are only a technology, but they enable the delivery of the learning content from the university to the student. The provider offers support, and the university facilitates the learner's use of the glasses in learning. The university further co-creates value with the learner by using the glasses within a course.

1.2.3 Blockchain technology

Blockchain technology is a digital database (Swan, 2015) whose entries are permanent and accountable because they are distributed and encrypted (Piscini et al., 2016). Through a digital signature, each record in the blockchain is connected to its source. Several records are stored in a block (Crosby, Pattanayak, Verma, & Kalyanaraman, 2016; Swan, 2015), and each block is interlinked to other blocks in the chain (Underwood, 2016). There are several people connected to the blockchain database, and this database is shared with each of them (i.e., each person is a node in the network; Cachin, 2016). The blockchain is therefore a decentralized network (Kosba et al., 2016; Zyskind & Nathan, 2015).

Blockchain technology has many advantages compared to other types of digital storage. The decentralization and encryption make it hard to change the data, particularly compared to centrally stored data (e.g., a bank in case of money transferring; Friedlmaier et al., 2017; Iansiti & Lakhani, 2017; Piscini et al., 2016). Through its architecture, blockchain technology creates trust (Mainelli & Smith, 2015; Underwood, 2016) and allows the democratization of data (c.f., Kosba et al., 2016; Piscini et al., 2016; Zyskind & Nathan, 2015). By making it possible to securely store data, blockchain technology has a high potential to change education, for example, by allowing the elimination of intermediaries, such as educational institutions (Iansiti & Lakhani, 2017; Yli-Huumo et al., 2016; Zyskind & Nathan, 2015). This technology allows, for example, the storage of asset transactions of currency, to pay for education (Crosby et al., 2016; Nakamoto, 2008) and digital certificates or signatures (i.e., usually hashes referring to the certificate, e.g., educational certificates; Grech & Camilleri, 2017; Peters & Panayi, 2016). Blockchain technology further allows us to award qualifications and manage student records (see Sharples & Domingue, 2016). In sum, the key advantages of blockchain technology are self-sovereignty, trust, immutability, disintermediation (Swan, 2017; Underwood, 2016; Yli-Huumo et al., 2016), efficiency, equal opportunities and motivation. As a result, blockchain-

based education technology is a particularly good example of an education technology that might change or even disrupt traditional education.

Blockchain technology can have different roles in education: it can be used to directly support learning, for example, by using blockchain technology to motivate learners through tokens. Furthermore, blockchain technology can support administrative functions, for example, by saving certificates. Moreover, blockchain technology can be part of the education technology (e.g., it awards tokens within an online course), or it can be the education technology itself (e.g., it serves as storage for educational records). Blockchain-based education technology can have different addressees, such as learners, educators or future employers (Chen, Xu, Lu, & Chen, 2018).

1.2.4 Technology acceptance model

The Technology Acceptance Model measures the user's acceptance of education technology (see Davis, Bagozzi, & Warshaw, 1989). The main components of this model are (1) the intention to use education technology (Davis, 1989) as the criterion; (2) the technology's perceived usefulness (i.e., the user's personal impression of whether using education technology will enhance the user's performance); and (3) the perceived ease of use (i.e., using education technology will not be perceived as resulting in additional effort) as predictors (Davis, Bagozzi, & Warshaw, 1992). The model allows us to measure the intention of users to engage in the use of education technology. These general relationships of the Technology Acceptance Model have been confirmed.

Davis (1986) assumes that the perceived ease of use and the perceived usefulness of information technology are influenced by external antecedents. There are several antecedents that are assumed to influence technology acceptance for the following reasons. First, problem-solving skills, and therefore content-related skills, represent a person's general approach and ability to solve problems (Heppner, Witty, & Dixon, 2004). Business administration students

often need this skill to approach complex learning tasks while using education technology, and having this skill might create more acceptance of the technology. Second, the compatibility of the education technology with the user's learning style (Escobar-Rodriguez & Monge-Lozano, 2012), i.e., the way in which education technology supports the learning process, is also important. This compatibility is important when a learning task is complicated and the students should not be distracted by the technology itself (Chandler & Sweller, 1991; Sweller & Chandler, 1994). Third, the enjoyment of the use of the technology is highly important because it leads to the feeling that the learner does not have to put too much effort into the use of the respective technology (Venkatesh, 2000). Fourth, the social influences of instructors and peers are characterized as highly important in higher education (Astin, 1993); this antecedent refers to the extent to which instructors and peers support the use of education technology (Martins & Kellermanns, 2004).

1.2.5 Performance measurement and deviant workplace behavior

Negative behavior in science can range from questionable research practices (i.e., unethical behavior), such as processing data as much as possible to achieve significant results (Babbage, 1830; Ghysels, 2000), carelessness, or harking (i.e., hypothesizing after the results are known; Butler, Delaney, & Spoelstra, 2017), up to severe scientific misconduct, such as plagiarism. The impact of these behaviors can be severe. Negative behavior can, for example, result in unreliable findings or wasted funding (Steneck, 2006), which might lead to negative consequences for the scientific organization (Christian & Ellis, 2014; Gross, 2016; Stroebe, Postmes, & Spears, 2012).

One possible type of negative behavior by scientists is 'gaming the system' (e.g., Butler et al., 2017; Osterloh & Frey, 2015), meaning that the scientists fulfill performance measures while behaving dysfunctionally (Barsky, 2008; Jaworski, 1988; Saini & Krush, 2008). The gaming of performance measurements further implies that unethical behavior is a reaction to

current performance measurement practices in academia (e.g., Fanelli, 2009; Martinson, Anderson, & De Vries, 2005; Steneck, 2003).

Reasons for the gaming of performance measurement may be attributed to the performance measurement itself. Currently, performance measurement in academia mainly measures the outcome of scientists' work (Aguinis, Shapiro, Antonacopoulou, & Cummings, 2014; Aguinis, Suárez-González, Lannelongue, & Joo, 2012; Hood, 1991; Osterloh, 2010; Sousa, de Nijs, & Hendriks, 2010) and is supposed to be objective and time-efficient (Deem & Brehony, 2005; Melo, Sarrico, & Radnor, 2008). Examples of current performance measurement criteria are the number of publications in high-impact journals or the amount of funding received. These types of performance measurement might lead to negative behavioral consequences and gaming behavior because (1) not all important job tasks are represented by these performance goals (i.e., number of publications in top tier journals is represented, however teaching related and qualitative criteria are represented much less; Osterloh, 2010); (2) the performance goals are very high and (3) goal attainment is not directly linked to behavior but rather to the outcome (Aguinis, 2013; Barsky, 2008). As a result, scientists might adapt their behavior to the performance measurement criteria and resort to questionable research methods to achieve these goals. Researchers who behave unethically focus on the fulfillment of performance measurement criteria; however, the way these criteria are achieved recede into the background (i.e., gaming performance measurement). In addition, these negative behaviors can be classified as a type of deviant workplace behavior, which is defined as (1) voluntary and (2) a violation of significant organizational norms that threatens the well-being of the organization (Bennett & Robinson, 2000).

1.3 Research methods and data analysis

This thesis uses qualitative and quantitative methods. Chapters 2, 3, 4 and 6 rely on qualitative research methods followed by quantitative analyses. This combination was chosen to evaluate these relatively new research topics while also providing clear answers to the research questions.

Chapters 2, 3 and 4 employ a similar qualitative research method. The studies rest on independently conducted content analyses (i.e., coding theoretically-based variables using information about the firms obtained from their websites) to gain information on the business models of education technology providers (chapter 2), to analyze value (co-)creation (chapter 3) and to assess the status quo of blockchain technology in education (chapter 4). Chapter 6 uses semistructured interviews to explore behavioral consequences of current performance measurement practices in academia. Chapter 5 employs a quantitative empirical method to analyze the antecedents of technology acceptance (namely, a questionnaire study).

1.3.1 Qualitative research methods

Chapters 2, 3 and 4 are based on a qualitative content analysis of firm websites. This research method is appropriate because the theory on education technology-based business models, value (co-)creation and blockchain technology needs further development. The three studies were conducted independently and at different points in time but followed a similar methodological approach. Therefore, this approach will be generally introduced in the following. Each paper followed three steps: (1) Building the sample based on a systematic search in firm databases, (2) Developing theory-based variables in the form of a coding scheme and (3) Retrieving the information from the firms' websites with the help of several coders. In the following, these steps will be delineated in more depth. The first step of each study was to build the sample as a basis of analysis. The goal of each study was a full analysis. The studies relied on a separately conducted systematic database search to retrieve the relevant education

technology firms using the Crunchbase database and, in addition, the Thomson Reuters Eikon and Orbis databases in chapters 2 and 3.[2] Based on the current literature, an extensive set of relevant keywords was selected for each research goal in order to retrieve the firms, and the sample was successively filtered to fit our respective definitions of education technology/ blockchain-based education technology; these steps led to the final sample. Due to the newness of blockchain technology, in the case of chapter 4, a search for whitepapers was conducted to find relevant blockchain-based firms whose products were not yet on the market.

The second step of each study was the qualitative content analysis itself. For all three studies, this step was conducted separately. The chosen variables were based on the relative theories (i.e., on business models, value (co-)creation and blockchain technology). Subsequently, a coding scheme was put together for each study, representing the relative variables. The categories were developed based on the reality of the firms analyzed in the study (i.e., education technology firms in chapter 2, education technology firms conducting value (co-)creation in chapter 3 and education technology firms based on blockchain technology in chapter 4); therefore, the coding schemes were shaped based on the information found on the firms' websites. Each coding scheme was sharpened based on a set of firms until it described the reality of all firms. Depending on the need, additional categories were added, and highly similar categories were condensed. This procedure resulted in a detailed theory- and reality-based description of each variable and its categories. The third step of each study was the coding of the firms, based on the firms' websites (in case of the blockchain technologies, the white papers as well). To enable objectiveness, several coders coded the variables separately, and the answers were compared to assure interrater objectivity. The coders differed in the case of the three studies.

[2] Chapters two and three are partly based on the same sample. However, the studies were conducted entirely independently.

Subsequent to the content analyses, the data was analyzed based on different approaches that fit the relative research questions. Chapter 2 uses performance data as a dependent variable to analyze the influence of business model components on performance. The Pitchbook database was used to download information on the firms' web and social media success as well as their total funding. In addition, Crunchbase, Edgar, Orbis and Thomson Reuters Eikon were used to retrieve information that was not accessible through Pitchbook. Two types of non-parametric tests were conducted (i.e., the Kruskal-Wallis test for group variables with more than two categories and the Mann-Whitney U test for group variables with two categories only). Non-parametric tests were chosen because of the non-normally distributed nature of the dependent variables. Chapter 3 uses a cluster analysis to deduce role patterns in value (co-)creation (i.e., a hierarchical cluster analysis followed by a k-means cluster analysis). A descriptive analysis is employed to analyze the status quo of blockchain technology in higher education (chapter 4).

The study described in chapter 6 is based on semistructured interviews with stakeholders of the German higher education system. The main purpose of these interviews was to analyze the criteria that are currently used to measure performance in academia and the behavioral consequences of these criteria. The main steps were (1) semistructured interviews, (2) stepwise coding of the answers and (3) comparisons to the literature. Below, these steps are described in more depth: First, the interviews were based on a semistructured guideline. The questions assessed advantages and disadvantages of the prevalent criteria for measuring scientific performance and followed the goal of deriving suggestions for improvement and future development. The questions were formulated in an open fashion to remain objective and not guide the interviewees in any direction. The interviewees were stakeholders of the higher education system (e.g., policy makers and professors).

Second, the analysis of the answers followed a stepwise procedure. A qualitative content analysis was conducted to obtain coding frequencies. Due to the explorative nature of the study, the behavioral consequences of performance measurement were first generally analyzed, leading to a variety of positive and even more negative consequences (i.e., codes in the coding scheme). Many of the negative behavioral consequences resembled the phenomenon 'gaming performance measurement' (i.e., behavior that is harming the university but fulfills the measurement criteria; Jaworski, 1988). Therefore, subsequently, the answers were coded based on how well they fit the definitions of gaming performance measurement. Gaming performance measurement in turn had a striking similarity to deviant workplace behavior, which is why the answers were independently coded according to how well they fit the definition of deviant workplace behavior. The codes for deviant workplace behavior were deductively derived from Robinson and Bennett's (1995) concept of organizational deviance, which includes (1) voluntariness and (2) the violation of significant organizational norms that threatens the well-being of the organization. Krippendorff's Alpha (Krippendorff, 2013) was used to assess interrater reliability in all three steps. Third, the answers were compared to the literature and recommendations for future research were deduced.

Qualitative methods are particularly useful for new research topics. The four research topics described above are new and aimed to develop theory without being based on previously developed hypotheses. The first study analyzed what the success factors of business models are, and the second one analyzed patterns in value (co-)creation based on an abstracted model. The third study analyzed the status quo of blockchain-based education technologies. Finally, the last study explored the negative behavioral consequences of current performance measurement practices in academia and led to the conclusion that this finding can contribute to theory building on deviant workplace behavior. This study assumed that performance measurement has consequences for employee behavior, but the concrete consequences and their

theoretical meaning needed to be deduced from the results. All four studies started with theoretical models that generally illustrated the process and, through the methods employed, they contribute to the development of a clearer understanding of the phenomenon.

1.3.2 Quantitative research methods

Chapter 5 is based on an online survey that was accessible over a period of 3.5 months. The study included current students from German universities. The questionnaire was distributed via e-mail and social media (e.g., via group postings). Existing and validated scales were used and adapted to the context of education technology in higher education. The items were originally in English and were translated into German by two independent individuals. The influence of the hypothesized antecedents on technology acceptance was analyzed with the help of structural equation modeling (i.e., based on the analysis of covariance with the help of the maximum likelihood estimation).

An online survey was performed, because the concepts used in this study already have some empirical foundation, and the scales have been developed and validated in other contexts. The biggest advantage is that through this method, data could be gathered from a large number of students simultaneously.

1.4 Thesis structure and main results

This chapter provides an overview of the findings and contributions of the five empirical chapters. The first research question (i.e., chapter 2) set out to analyze the success factors of business models of education technology providers. In particular, this study analyzed whether specific business model components (i.e., sub components of customer identification, value delivery, financial aspects and value proposition) in the education technology industry have an influence on firms' performance (i.e., financial success and web and social media success). The findings show that some business model components influenced both financial success and web

and social media success (e.g., the identification of the target customer, sub component of customer identification), whereas some business model components influenced none (e.g., concentration on education technology, sub component of value delivery) or only one of the two performance indicators (e.g., sales model, sub component of financial aspects which influences web and social media success). This study contributes to the literature on business model components by relating them to firm performance.

Research question two (i.e., chapter 3) deepens the knowledge on value (co-)creation in the context of the higher education industry. The goal was to analyze common role patterns of the stakeholders creating and co-creating value. The cluster analysis revealed three role patterns: (1) “low service solution” (characterized by an active role of the university and co-creation between the learner and the university, little service by the provider and little co-creation overall); (2) “technology-based student-targeting service” (characterized by an inactive role of the university, an active role of the education technology and high co-creation between the learner and the provider); and (3) “high co-creation and service solution” (characterized by extensive service from the provider, an active role of the university and value co-creation between the provider and the university). The service-related variables (i.e., the input of the provider) and the role of education technology play an important role in distinguishing the clusters from one another. The theoretical contribution is a better understanding of common patterns of value (co-)creation and, as a result, an understanding of how value (co-)creation is typically realized. This study acknowledges the role of education technology in service innovation by analyzing its role in value (co-)creation and therefore relates two fields of research.

Research question three (i.e., chapter 4) analyzes the status quo of blockchain-based education technology. Blockchain-based education technologies are diverse but show the following tendencies: The technologies have many advantages for education (e.g., trust, equal

opportunities for learners). They are primarily made for the general public and job seekers, and the technologies with a learning function mainly target adult learners and higher education. Education technologies serve a wider purpose than the underlying blockchain technology itself (e.g., blockchain technology is used to offer tokens for learners, but the education technology itself is an online learning platform). In sum, blockchain-based education technologies already offer many approaches to possibly changing education and therefore have the potential to provide substantial educational innovations. Nevertheless the process of changing traditional education has only just begun. The study concludes with an agenda for future research.

The fourth empirical chapter (i.e., chapter 5) identified antecedents of business administration students' acceptance of education technology based on a questionnaire study. The results show that students' problem solving skills and enjoyment, the compatibility of education technology with students' learning style, and peer encouragement in the use of education technology positively influence the intention to use these technologies through their perceived usefulness and perceived ease of use. However, instructor encouragement has no influence on the intention to use education technology. This study contributes to research on technology acceptance and an understanding of ways in which students' acceptance of education technology can be increased.

The fifth empirical chapter (i.e., chapter 6) analyzed the consequences of current performance measurements on scientists' behavior. This study identified how scientists adapt their behavior to current performance measurement practices in academia. Qualitative interviews with different stakeholders of the higher education system revealed a high prevalence of negative behavioral consequences as a reaction to performance measurement (e.g., a decrease in research quality). Furthermore, the negative behaviors were identified as the 'gaming performance measurement' phenomenon (e.g., focusing on attaining specific performance goals while actually producing lower-quality work). This study additionally

showed that gaming performance measurement exhibits the same characteristics as deviant workplace behavior (i.e., voluntary behavior and a violation of organizational norms that causes harm to universities, cf. Robinson & Bennett, 1995). This study contributes to research on gaming performance measurement by providing detailed explanations of the reasons for this behavior. The results further contribute to frameworks and typologies of deviant workplace behavior by proposing that gaming performance measurement is a type of deviant workplace behavior.

The empirical chapters take several theoretical perspectives and methods and analyze different organizational and individual levels to provide an understanding of how to successfully take advantage of the opportunities provided by digital technologies. The thesis further provides an answer on how to navigate through the challenges created by digital technologies and the challenges created by the negative influence of performance measurement on employee behavior. Figure 1.1 summarizes the research questions and hence the opportunities and challenges approached in this thesis.

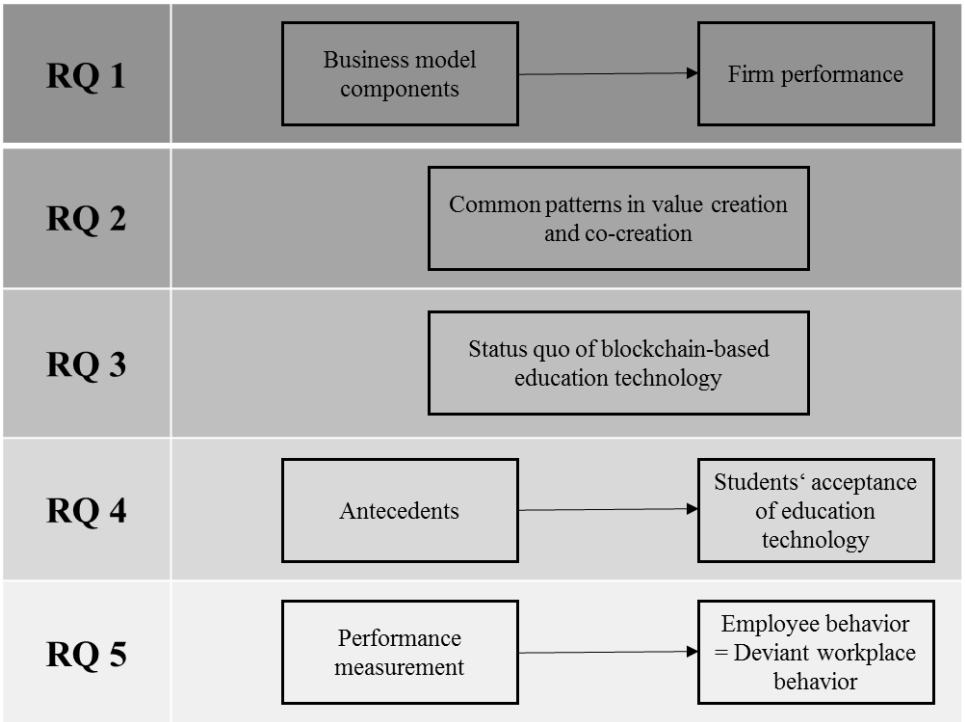

Figure 1.1. Summary of the research questions.

The main body of this dissertation is five empirical chapters (Chapters 2 to 6). Each empirical study is presented as a separate chapter. Finally, chapter 7 presents the discussion and sums up contributions to research and practice, limitations and future research.

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2 Business models in the education technology industry: What makes them successful?

Abstract

This study focuses on business models of education technology firms (i.e., technology providers that enable service innovation in higher education). The purpose of this research is to analyze which choices in business models (concerning customer identification, value delivery, financial aspects and value proposition) foster firm performance—financially and in web and social media. We conduct a complete analysis of education technology firms targeting the higher education market ($N = 407$). We use databases (e.g., Crunchbase) and firms' websites to retrieve relevant information in a standardized procedure. The empirical investigations show that most factors (e.g., support) responsible for business model success in the education technology industry are related to the firms' services. This study is the first to systematically evaluate the business models of education technology firms and among the first studies to address the influence of business models on firm performance.

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Wendler, W. S., Stumpf-Wollersheim, J., & Welpe, I. M. (2017). *Business models in the education technology industry: What makes them successful?* Paper presented at the Thirty Eighth International Conference on Information Systems, Seoul, South Korea.

3 Value (co-)creation in the education technology industry: Blurring the boundaries through digitalization

Abstract

Purpose: We focus on Grönroos and Voima's (2013) value creation model, i.e., the interplay of the value that key stakeholders of the higher education industry create on their own plus the value that they co-create and include the role of education technology. The purpose is to reveal common patterns in value creation.

Design: This study is based on a content analysis of education technology firm websites (N = 305) targeting the higher education market. We analyze the value created by each stakeholder and co-created value. Subsequently, we cluster this data to identify common patterns in value creation regarding the manifestation of stakeholder roles often occurring together (e.g., high value creation through services from providers and low value creation by learners).

Findings: This cluster analysis reveals three value creation patterns: (1) "low service solution" (characterized by an active role of the university and co-creation between the learner and the university, little service by the provider and little co-creation overall); (2) "technology-based student-targeting service" (characterized by an inactive role of the university, an active role of the education technology and high co-creation between the learner and the provider); and (3) "high co-creation and service solution" (characterized by extensive service from the provider, an active role of the university and value co-creation between the provider and the university).

Originality: We advance the model of value creation by adding different types of value creation to this model that up until now included a general functioning of value creation only. We include the role of education technology and acknowledge its increasing importance for higher education.

Practical implications: We show how value is created by and co-created with customers in the higher education industry. We build understanding of how value creation occurs and how organizational and technological boundaries of higher education could increasingly blur with offers from external education technology providers.

Current status:

Lévy, W.S., Stumpf-Wollersheim, J., & Welpe, I. M. (2019a). *Value (co-)creation in the education technology industry: Blurring the boundaries through digitalization.* Working paper.

4 Disrupting education through blockchain-based education technology?

Abstract

This study is the first to systematically analyze the use of blockchain technology in education. In particular, we analyze the status quo of blockchain-based education technologies (N = 62; i.e., a full analysis). We performed a qualitative content analysis of providers' websites to analyze the characteristics of their technologies. The analysis reveals that existing blockchain-based education technologies are diverse and offer important advantages for education (e.g., trust and equal opportunities). Employers seem to profit from these technologies (e.g., trust in applicants), but only some technologies contribute to the individualization of education. The technologies with a learning function mainly target adult learners and higher education. Current blockchain-based education technologies were primarily made for the general public or for job seekers. Education technologies serve a wider purpose than the underlying blockchain technology itself (e.g., blockchain technology is used to offer tokens for learners, but education technology is an online learning platform). We conclude that blockchain technology might disrupt education but that this process of change is only in its infancy. Given the high relevance of this topic, we conclude by developing an agenda for future research.

Current status:

Lévy, W.S., Stumpf-Wollersheim, J., & Welpe, I. M. (forthcoming). *Disrupting education through blockchain-based education technology?* Journal of Higher Education Research.

5 Investigating antecedents of business administration students' acceptance of education technology

Abstract

Education technology (i.e., digital learning tools such as online learning games and Massive Open Online Courses) is considered a promising method of instruction in business administration education. However, business administration education seems to be adopting education technology with reservations. This study aims to identify potential antecedents of business administration students' acceptance of education technology to gain an understanding of why students use education technology. For that purpose, we conducted a survey among 1,044 students. Using structural equation modeling to analyze the results, we find that students' problem-solving skills and enjoyment, the compatibility of education technology with students' learning style, and peer encouragement in the use of education technology positively influence the intention to use these tools through their perceived usefulness and perceived ease of use. However, instructor encouragement does not influence the intention to use education technology. We discuss implications for business administration education in the conclusion of the paper. Our results enable universities to enhance students' intention to use education technology in business administration education.

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Lévy, W.S., Stumpf-Wollersheim, J., & Welpe, I. M. (2019b). *Investigating antecedents of business administration students' acceptance of education technology.* Working paper.

Conference presentations (of previous versions):

Wendler, W., & Stumpf-Wollersheim, J. (2016, August). *Prerequisites of technology acceptance of innovative digital learning tools*, 2016 Academy of Management Annual Meeting, Anaheim (USA), 5-9 August 2016.

Wendler, W., Stumpf-Wollersheim, J., & Welpe, I. M. (2016, May). *Context-related prerequisites have a positive effect on technology acceptance of innovative digital learning tools in higher education*, 28th APS Annual Convention, Chicago (IL, USA), 26-29 May 2016.

Wendler, W., Stumpf-Wollersheim, J., & Welpe, I. M. (2016, April). *University 2.0: How to achieve the acceptance of digitalization in higher education?*, 11. Jahrestagung der Gesellschaft für Hochschulforschung, Munich (Germany), 7-8 April 2016.

Wendler, W., Stumpf-Wollersheim, J., & Welpe, I. M. (2016, February). *University 2.0: How to achieve the acceptance of digitalization in higher education?*, Workshop der Wissenschaftlichen Kommission Hochschulmanagement des VHB, Hamburg (Germany), 25-26 February 2016. **3rd Place of the Best Paper Awards**

Wendler, W., Wollersheim, J., & Welpe, I. M. (2015, July). *University 2.0: An empirical investigation of the role of digitalization in universities* "Governance, Performance & Leadership of Research and Public Organizations", Munich (Germany), 15-16 July 2015.

6 Wanting more, getting less: Gaming performance measurement as a form of deviant workplace behavior

Abstract

Investigating the causes of unethical behaviors in academia, such as scientific misconduct, has become a highly important research subject. The current performance measurement practices (e.g., equating research performance with the number of publications in top-tier journals) are frequently referred to as being responsible for scientists' unethical behaviors. We conducted qualitative semi-structured interviews with different stakeholders of the higher education system (e.g., professors and policy makers; N = 43) to analyze the influence of performance measurement on scientists' behavior. We followed a three-step coding procedure and found (1) that the participants described a variety of positive behavioral consequences (e.g., higher productivity) but mainly negative behavioral consequences (e.g., questionable publishing practices) of current performance measurement practices in academia; (2) that scientists' behavior can be described as gaming performance measurement (i.e., achieving performance goals by reducing performance quality and focusing on those tasks that are measured); and (3) that gaming performance measurement shares the same characteristics as deviant workplace behavior (i.e., a voluntary violation of organizational norms that harms the university). We discuss that gaming performance measurement has not been considered as a type of deviant workplace behavior in the previous literature. Furthermore, we draw from research on deviant workplace behavior and goal setting to discuss psychological processes that may underlie gaming performance measurement. Our results indicate the importance of connecting literature on deviant workplace behavior and goal setting to advance our understanding of gaming performance measurement.

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Conference presentations (of previous versions):

Wendler, W. S.*, Graf, L.*, Stumpf-Wollersheim, J., & Welpe, I. M. (2017, March). *Wanting more, getting less: Strategic task behavior as a form of deviant workplace behavior*, International Convention of Psychological Science (ICPS), Vienna (Austria), 23-25 March 2017. [*equal contribution]

Graf, L.*, Wendler, W. S.*, Stumpf-Wollersheim, J., & Welpe, I. M. (2017, January). *Intendierte und nicht-intendierte Auswirkungen von Leistungsbewertung in der Wissenschaft,* Leistungsbewertung in der Wissenschaft – Perspektiven aus Forschung, Praxis und Politik, Munich (Germany), 25-26 January 2017. [*equal contribution]

Graf, L., Wendler, W., Wollersheim, J., & Welpe, I. M. (2015, July). *Leistung und Leistungsbewertung in der Wissenschaft aus der Sichtweise verschiedener Interessensvertreter*, Symposium "Governance, Performance & Leadership of Research and Public Organizations", Munich (Germany), 15-16 July 2015.

Wendler, W., Graf, L., Wollersheim, J., & Welpe, I. M. (2015, April). *Quantität statt Qualität? Leistung und Leistungsbewertung in der Wissenschaft aus der Sichtweise verschiedener Interessensvertreter, 10. Jahrestagung der Gesellschaft für Hochschulforschung, Kassel (Germany), 9-10 April 2015.*

Graf, L., Wendler, W., Wollersheim, J., & Welpe, I. M. (2015, February). *Masse statt Klasse? Eine explorative Untersuchung von Leistung und Leistungsbewertung in der Wissenschaft, Workshop der Wissenschaftlichen Kommission Hochschulmanagement des VHB, Duisburg (Germany), 20-21 February 2015.*

7 Conclusion and discussion[3]

In conclusion, this thesis analyzes current opportunities and challenges in both the education industry and scientific organizations. The empirical chapters contribute to the overall goal of this thesis, which is to advance knowledge on how to successfully use the opportunities offered by the introduction of education technology. In particular, the studies analyze education technology providers' business models, value (co-)creation and the status quo of blockchain technology in the education industry. This thesis further contributes to knowledge on how to successfully handle the challenges the education industry is facing due to the introduction of education technology by analyzing the antecedents of the acceptance of this technology. In addition, challenges scientific organizations experience are addressed through the analysis of negative behavioral consequences of current performance measurement practices. The empirical chapters rely on different theoretical concepts to analyze this common topic.

This thesis makes practical contributions on several organizational and individual levels regarding what to consider when implementing education technology in higher education and when seeking to improve performance measurement in academia. Together, the studies allow conclusions regarding what organizations in the higher education industry need to learn as well as what can be learned from the perspective of individuals when including education technology in the education industry. Further, the last study draws conclusions regarding what academia needs to learn in terms of performance measurement. The following chapter summarizes the findings and explains the contribution of each empirical chapter to the individual research questions and different theoretical conversations.

[3] This conclusion and discussion is partly based on Graf*, Wendler*, Stumpf-Wollersheim & Welpe (2019) [*equal contribution]; Lévy, Stumpf-Wollersheim & Welpe (2019a); Lévy, Stumpf-Wollersheim & Welpe (2019b); Lévy, Stumpf-Wollersheim & Welpe (forthcoming) and Wendler, Stumpf-Wollersheim & Welpe (2017); the full references can be found in the Appendix.

7.1 Discussion of main findings and contributions

The first empirical chapter analyzes education technology providers' business models (considering sub components of customer identification, value delivery, financial aspects and value proposition). This study employs a qualitative content analysis and finds that business model components related to the firms' services are often related to firm performance (e.g., the support offered by the provider is related to the total funding). In sum, some business model components influence both financial success and web and social media success (e.g., the identification of the target customer, sub component of customer identification), whereas some business model components influence none (e.g., concentration on education technology, sub component of value delivery) or only one of the two performance indicators (e.g., sales model, sub component of financial aspects). The first empirical chapter contributes to research on business models in general and the higher education industry in particular. The main contribution in comparison to previous research is not only to analyze what business models consist of but also to analyze which of the components of business models lead to firm success.

The second empirical chapter focuses on common patterns in value (co-)creation of the education technology provider, customer (i.e., the university) and user (i.e., the learner) in the education industry. The analysis includes the role of education technology and the service offered by education technology providers. The study shows that value (co-)creation usually follows one of the following three patterns: (1) "low service solution" (characterized by an active role of the university and co-creation between the learner and the university, little service by the provider and little co-creation overall); (2) "technology-based student-targeting service" (characterized by an inactive role of the university, an active role of the education technology and high co-creation between the learner and the provider); and (3) "high co-creation and service solution" (characterized by extensive service from the provider, an active role of the university and value co-creation between the provider and the university). The results contribute

to the development of the model of value (co-)creation by adding three typical role constellations to this model that until now included only a general functioning of value (co-)creation.

The third empirical chapter assesses the status quo of blockchain technology in education. It uses a descriptive analysis to draw conclusions on the potential of blockchain technology to change education. The results show the diversity of blockchain-based education technologies and that they offer important advantages for education (e.g., trust and equal opportunities). This result contributes to an understanding of how blockchain technology may change education and allows for an understanding of the status quo of this technology. This is the first empirical study to systematically analyze the use of blockchain technology in education.

The fourth empirical chapter analyzes antecedents of business administration students' acceptance of education technology based on a questionnaire study. The results lead to the conclusion that problem-solving skills and enjoyment, the compatibility of education technology with students' learning style, and peer encouragement in the use of education technology positively influence the intention to use education technology through its perceived usefulness/ perceived ease of use. However, the instructor encouragement has no influence on the perceived ease of use and the perceived usefulness of education technology. These results contribute to an understanding of which antecedents are important for students' acceptance of education technology and thereby advance research on technology acceptance.

The fifth empirical chapter explores the consequences that performance measurement can have on employee behavior based on a semistructured interview study. This study concludes that performance measurement mainly has negative consequences on employee behavior and leads to gaming of performance measurement (e.g., focusing on attaining specific performance goals while actually producing lower-quality work), which in turn is a form of

deviant workplace behavior (i.e., a voluntary violation of organizational norms that harms the university). Therefore, this study contributes to the theory on gaming performance measurement and deviant workplace behavior by showing that gaming performance measurement is a type of deviant workplace behavior.

In sum, this thesis makes important theoretical contributions to several concepts and does so at different organizational and individual levels. The thesis enlarges literature on business models, value (co-)creation, blockchain technology, technology acceptance and gaming performance measurement as well as on deviant workplace behavior. Taken together, these diverse theoretical viewpoints provide insight into opportunities and challenges organizations in the higher education industry are currently facing. They all contribute to the successful inclusion of education technology in the education industry and the navigation of individual challenges created through this inclusion. They further contribute to the inner organizational challenges created through the influence of performance measurement on employee behavior.

7.2 Implications for practice

The successful use of opportunities created by education technology and the mastery of the challenges became a major priority on educational stakeholders' agendas. The first three empirical chapters make several important contributions to practice that will help make education technology accessible to learners. The empirical chapters make this contribution by taking different organizational and individual levels and stakeholders into account. Particularly, this thesis contributes to the successful inclusion of education technology by providing insights into how providers of education technology can be successful (chapter 2, i.e., organizational level of external providers), the inclusion of external educational technology in higher education by blurring the organizational boundaries through value (co-)creation (chapter 3; i.e., organizational and individual level) and by analyzing the status quo of blockchain technology

in education (chapter 4; i.e., organizational level). Insight into the challenges organizations are currently facing are achieved through an analysis of antecedents of education technology acceptance (chapter 5; i.e., individual level). Moreover, this thesis addresses the organizational level and individual level by analyzing the influence of performance measurement on employee behavior. The last empirical chapter contributes to successful scientific organizations by exploring the negative influence of performance measurement on employee behavior (chapter 6). Taken together, these contributions allow for a successful inclusion of education technology in higher education. Moreover, they contribute to an understanding of how to improve performance measurement in scientific organizations.

More in depth, the empirical chapters make the following practical contributions. The first empirical chapter assesses the organizational level and provides guidance to education technology providers and investors. The chapter analyzes the success factors of education technology providers' business models and further distinguishes between financial success and web and social media success. This study therefore provides insights into which business model components are particularly important for firm success. This knowledge serves investors because it contributes to a better understanding of which firms to invest in (e.g., firms offering support to their customers). The results allow education technology providers to adapt their business models to be successful and hence to provide access to the advantages of education technology.

The second empirical chapter is useful for education technology providers and higher education institutions. This study assesses patterns of value (co-)creation in higher education and takes the role of education technology into account. Through this knowledge about value (co-)creation, education technology providers can configure their service systems effectively (c.f., Maglio & Spohrer, 2013) by recognizing the type of input needed from them in a particular value (co-)creation pattern. For higher education, this knowledge is useful for the effective use

of education technology. It allows educators to be aware of their role in value (co-)creation and hence to know which input they need to provide to use the relative technology effectively. It therefore allows them to take advantage of the opportunities offered through education technology.

The third empirical chapter is useful for entrepreneurs, educational institutions and social innovators. This study assesses the status quo of blockchain-based education technologies and raises awareness about the implications of blockchain-technology to change education. Practitioners can profit from knowledge on the status quo of blockchain technology for education. Particularly, entrepreneurs can gain an understanding of the currently available technologies and opportunities to expedite digital transformation in education, and education stakeholders can include the existing technologies in their portfolio. Most importantly, blockchain technology has social implications for education. Blockchain-based education technology can provide educational opportunities for learners in impoverished or developing countries (c.f., Underwood, 2016), such as the storage of a digital identity to provide proof of education for learners in remote areas.

However, awareness of the challenges arising for organizations due to the introduction of education technology is also growing among practitioners. This knowledge also contributes to the successful inclusion of education technology in the education industry. First, users face the challenge of only carefully adopting education technology. Being aware of how to create acceptance of education technology allows an understanding of how to successfully master this challenge. Therefore, the fourth empirical chapter assesses the antecedents of the acceptance of education technology. This study enables the meaningful inclusion of these technologies and is therefore particularly helpful for educators who aim to improve their teaching success, for example, by providing them with the knowledge that they should increase the enjoyability of using an education technology to enhance its acceptance.

Similarly, due to publicly known cases of scientific misconduct, stakeholders of the scientific system have become aware of potential problems in the performance measurement system. Therefore, knowledge of the negative influences of performance measurement and the classification and understanding of negative behaviors as a reaction to performance measurement and as deviant workplace behavior (see empirical chapter 5) is highly useful to scientific organizations. This knowledge allows them to reduce the number of cases of scientific misconduct and, more importantly, increase employee performance and its alignment with organizational goals. Similarly, this knowledge is also useful to political stakeholders. Many scientific organizations are public, and, therefore, political stakeholders can participate in the regulation of performance measurement in these organizations when they are aware of the consequences of current performance measurement.

7.3 Limitations and directions for future research

When interpreting the results of this thesis, specific limitations should be considered. To some extent, these limitations lead to future research questions. Several limitations are discussed within each essay. However, there are a number of general limitations of the empirical chapters in this dissertation. First, empirical chapters 2, 3 and 4 use education technology providers' websites as the source of information. These studies therefore consider information available to potential customers when they are making a purchase decision. However, by using this source of information, the study cannot measure intangible information and therefore internal factors, such as the financial structure of a firm in case of the business models or the universities' perspective on value (co-)creation. Future studies should also assess internal factors, for example, by using different sources of data, such as questionnaire studies asking all involved parties about their perspectives.

In addition, four of the five studies use qualitative methods to analyze the relatively new research topics and generate first insights on the opportunities and challenges generated by

digital technologies and performance measurement. The fourth study is based on an online survey. These methods do not allow for the assessment of causal relationships. Hence, future research should apply methods such as experiments to test the causality of the results of the studies.

Similarly, all studies abstracted the underlying concepts to make them measurable. For example, value (co-)creation is a highly complex construct (similarly to business models, the use of blockchain technology and performance measurement); however, to draw general conclusions, these concepts were abstracted. Therefore, future research should analyze the opportunities and challenges in greater depth. For example, future research could employ case studies to draw deeper conclusions about these concepts.

All five studies used general concepts and applied them to the educational or scientific context. Therefore, in a first step, the studies allow us to draw only certain conclusions about the context of the education technology/scientific context. The results of the studies are only applicable to other contexts to some extent. To test their generalizability, the results should also be applied to other contexts of digital technologies (e.g., the use of blockchain technology within other types of organizations). The results regarding performance measurement in science should also be applied to other knowledge-intensive contexts.

7.4 References

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8 Appendix: References for the empirical chapters

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8.5 Reference for chapter 6

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