Novel approaches for managing platform-based ecosystems

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ABSTRACT

Digitalization challenges existing organizations and industries. The associated advancement changes the way organizations and their customers interact. This has increasingly fostered the emergence of platforms to facilitate such interaction. Online platforms are software or hardware infrastructures that serve as a foundation and facilitate the interaction between multiple parties (e.g., between organizations and users). Organizations create platforms as part of a larger ecosystem. One major challenge concerns the design of platform-based ecosystems so all participants benefit from their participation. The management of associated relationships with other ecosystem participants is consequently a key challenge and demands according foresight.

Platform-based ecosystems are subject to research in the field of information systems. Thus, scientific literature addresses many corresponding research questions and provides valuable insights for both research and practice. However, organizations face numerous challenges when engaging in ecosystems. Such challenges are, e.g., to develop new ecosystems, to incentivize participants to participate in the ecosystem, to cooperate with other participants, and to monitor the ecosystem. In this respect, this doctoral thesis provides a brief overview of platform-based ecosystems and the respective participants therein. Further, the thesis addresses four key challenges in the context of platform-based ecosystems, and proposes novel approaches in order to overcome the challenges.

The basis for the novel approaches stems from five research papers. The first and second research paper address the challenge of determining design options when developing new ecosystems via blockchain-enabled initial coin offerings. The papers feature a taxonomy and derive predominant archetypes by drawing on real-world cases. The third research paper addresses the challenge of incentivizing users to participate in platform-based ecosystems. The paper proposes an approach to model financial incentives concerning platform adoption. The fourth research paper proposes an approach to analyze organizational cooperation patterns for the purpose of innovation integration. The developed approach incorporates taxonomy development and enables organizations to determine cooperation characteristics to align the cooperation decision with the cooperation objectives. The fifth research paper addresses the challenge of monitoring customer sentiment on online platforms. The proposed design science research artefact includes a detector of negative sentiment such that organizations are able to identify when a negative sentiment develops, and intervene before users spread the sentiment, e.g., through comments.

Each research paper answers a stand-alone research question in the realm of platform-based ecosystems and derives a theoretically founded and separately evaluated research artefact. The artefacts draw on underlying, well-established research methods that allow answering the respective problem statements. Since the problem statements are motived in a practical context, this thesis bridges the gap between a practically oriented problem and a theoretically founded solution. As a result, the derived insights contain a contribution for both, research in the field of Information Systems and practice audience, and encourage the engagement of both domains.

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1. INTRODUCTION

1.1. MOTIVATION

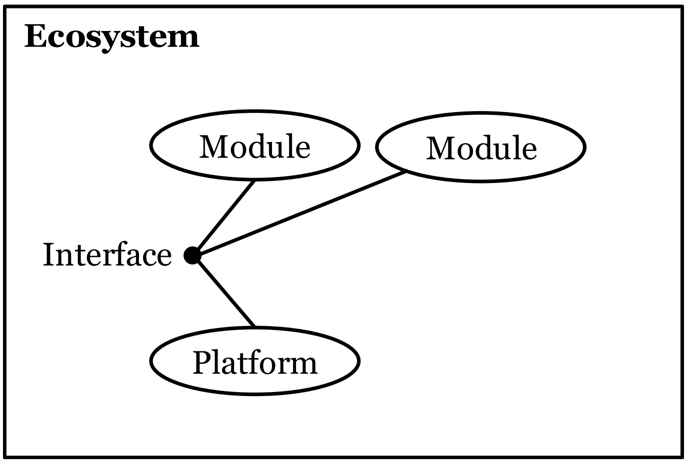
Digitalization fundamentally changes society as we know it and requires innovation in close to all industries (Gimpel et al. 2018; Karimi and Walter 2015; Legner et al. 2017; Veit et al. 2014). It covers sociotechnical challenges and how to adopt them in the individual, organizational, and societal context (Legner et al. 2017). Digitalization enables dynamic capabilities, novel forms of (digital) relationships, and tangles products or services with the underlying IT infrastructure. These characteristics are the underlying fuel for today's interaction between organizations and users, which increasingly move to various kinds of platform types. Unsurprisingly, such platforms are the centerpiece of many of today's digital giants like Amazon, Google, Facebook, or Apple (Gawer 2014), and became ubiquitous in the modern world (Parker et al. 2016; Tiwana 2014).

Platforms are usually part of larger ecosystems where organizations bring together various applications, add-on software, and hardware components (Baldwin 2000; Sanchez and Mahoney 1996). These platforms distinguish a special form of ecosystems, called platform-based ecosystems, where the centerpiece of the ecosystem is an online platform. The platform in this context can be a software platform (Firefox, Apple's operation system iOS), a social media platform (Facebook), a web service (Amazon, Google), or a marketplace ("eBay") (Tiwana et al. 2010). Organizations maintain platform-based ecosystems as an online presence through which they can interact with (potential) customers, and, therefore, form an online presence. Within these platform-based ecosystems, organizations work together as partners, or compete for customers (Hannah and Eisenhardt 2018).

In the business context, the term "ecosystem" was initially introduced by James Moore as an ecosystem that is made up of customers, agents, channels, and suppliers (Moore 1993; 2016). Whenever organizations develop such ecosystems, they ideally can form and shape it according to their needs and wishes. This doctoral thesis follows the definition of Adner (2017) and defines ecosystems as "the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize" (Adner 2017, p. 40).

Platform-based ecosystems consist of various components, such as platforms, modules, interfaces, and the overall architecture (Cusumano and Gawer 2002; Tiwana et al. 2010). Figure 1 visualizes these ecosystem components.

Figure 1. Visualization of ecosystem components (own representation based on Tiwana et al. 2010)



Platform refers to the extensible codebase of the ecosystem that provides core functionality shared by the modules that interoperate with it and the interfaces through which the modules interoperate (Baldwin and Woodard 2009; Eisenmann et al. 2006; Tiwana et al. 2010). Such platforms serve as places where at least two participants come together for interaction (e.g., organizations and users on a marketplace). Around these platforms, organizations build modules which are add-on software subsystems connected to the platform to provide additional functionality (Baldwin 2000; Sanchez and Mahoney 1996). The interfaces are specifications and design rules that provide a description of the interaction and information exchange between the platform and the modules (Katz and Shapiro 1994; Tiwana et al. 2010). The architecture provides the design rules for the ecosystem and describes how the relatively stable platform and the complementary modules partition the ecosystem (Baldwin and Woodard 2009; Katz and Shapiro 1994; Sanchez and Mahoney 1996; Tiwana et al. 2010; Ulrich 1995).

In a platform-based ecosystem, numerous organizations and customers interact with each other. Between organizations, cooperation and competition is possible. Organizations cooperate in cases in which one organization provides an additional module to a platform of another organization. In contrary, organizations compete when at least two organizations propose the same functionality and, therefore, compete for users in the ecosystem. Thus, ecosystems, platforms, and modules can create cooperation opportunities, but can also serve as entry-barriers for competitors or their ecosystems (Tiwana et al. 2010). Examples for platform-based ecosystems are the smartphone operating systems of Apple and Google: Every user who buys a smart phone with an Apple or Google operating system automatically joins one of the two ecosystems. The central platform of the ecosystem is the respective software store[1], the AppStore (Apple) or the PlayStore (Google). Both companies build various modules around their platform, such as mailing-applications, word-processing applications, or cloud storage. Other organizations that aim on offering additional modules to the ecosystems' users need to access the ecosystem via the AppStore or the PlayStore. Consequently, they permanently rely on the permission of Apple or Google to provide their product or service. In the following, this doctoral thesis refers to a "platform-based ecosystem" as "ecosystem".

[1] Please note that both organizations Apple and Google have also built other platforms within their ecosystem, e.g., Apple's application "Health", Google's online browser "Chrome".

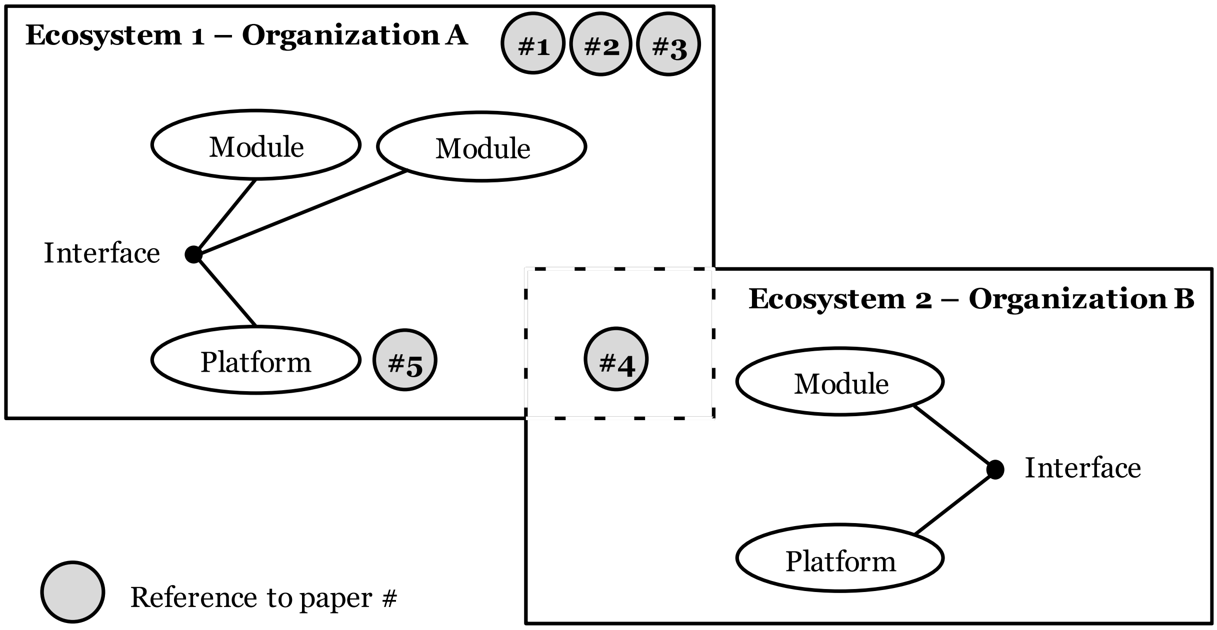
Ecosystems come along with unique characteristics: First, ecosystems are organized around a certain product or service (Hannah and Eisenhardt 2018). This results in the complementarity of components in the ecosystems, such that they depend on each other. Therefore, complex interdependencies among participants exist. Second, ecosystems have bottlenecks (Hannah and Eisenhardt 2018). These bottlenecks restrict the growth and/or performance of an ecosystem (e.g., poor quality, weak performance, scarcity), and restrains the overall ecosystem from performing at its best (Adner and Kapoor 2010; Baldwin 2015). Third, organizations need to find a sensitive balance between cooperation and competition within the ecosystem (Hannah and Eisenhardt 2018).

Ecosystems enable organizations to become dominant actors compared to their partners and competitors. However, ecosystems also pose great challenges diverse challenges due to their complex structure and inherent dependencies. Consequently, value creation by means of an ecosystem confronts organization with a magnitude of complex decisions. These decisions include developing new ecosystems, incentivizing participants to participate in the ecosystem, cooperating with other participants in the ecosystem, or monitoring the ecosystem, and will further be addressed by this doctoral thesis. For organizations, these challenges can imply tremendous business success or even failure. Information systems (IS) research deals with aspects of these challenges of building ecosystems, managing ecosystems, and creating value with competitors, complementors, or customers. For organizations that need to make decisions regarding ecosystems, methodological approaches are necessary to support and enable the management and decision making process. As a result, the objective of this doctoral thesis is to provide insights on the utilization of research-based methodology to support the relevant decision. More precisely, the objective is to propose theoretically founded research artefacts to answer practically motivated problems in the realm of platform-based ecosystems, and thereby advancing knowledge in theory and practice.

1.2. STRUCTURE OF THE THESIS AND EMBEDDING OF THE RESEARCH PAPERS

The following Section summarizes the structure of this doctoral thesis, briefly describes the underlying five research papers, and outlines their interconnection. Section 1 introduces the motivation and sets the outline for the remaining Sections. Section 2 provides an overview of the core concepts for this thesis. Therefore, it summarizes related literature on platform-based ecosystems and the relevant participants. The remaining Sections 3-6 address key challenges for the management of platform-based ecosystems. Consequently, Sections 3-6 capture the core concepts of the underlying research papers. For this purpose, Figure 2 provides a visualization on the focus of the papers. Section 7 concludes the key findings of this doctoral thesis, addresses limitations, and provides directions for further research.

Figure 2. Visualization of embedded underlying research papers (own representation based on Tiwana et al. 2010)



As described above, platform-based ecosystems can be a key success factor for organizations in the digital age. When developing such ecosystems, organizations need to consider various aspects to receive positive responses by other participants, such as users and potential partners in the ecosystem. Section 3 briefly reflects the scarce literature on developing new ecosystems and introduces blockchain-based initial coin offerings (ICO) as a novel form for building ecosystems. To date, the understanding of ICOs from a practitioner's and from a researcher's perspective is low. As a result, research paper #1 and #2 propose a structuring approach and develop a taxonomy to provide a better understanding of related design parameters. Further, the research papers propose a clustering approach, deduct ICO archetypes to obtain predominant patterns, and perform a secondary market analysis to acquire an outlook on short-, medium-, and long-term development of the ICOs.

For successful ecosystem development, customer incentives play an important role. Especially at the beginning, participants expect value generation from ecosystem participation to be low, and lack the incentive to join the platform. Section 4 discusses different aspects of user incentives to join an ecosystem. In the context of ICOs, this effect is supposed to be different, since tokens can provide a financial benefit. Therefore, research paper #3 proposes a two-step approach to analyze the incentive, and to find whether ICOs influence the participation incentive.

When organizations interact in their native ecosystems, in competitors' ecosystems, or in complementors' ecosystems, they need to decide how to co-create value with these alien organizations. This is especially important in ecosystems, where technological change rapidly shakes up market, influence, and relationships. Section 5 provides an overview of cooperation in ecosystems. In financial service industry ecosystems, a recent case is the entry of agile start-ups (e.g., Fintechs), where existing incumbents have to deal with new organization. In this respect, the challenge for incumbents is to decide on the appropriate response, and to find potential pathways for cooperation. Research paper #4 proposes a methodology to analyze this cooperation design pattern and develops a taxonomy that enables organizations to dismantle bank-fintech cooperation into single design parameters. As a result, organizations are able to apply this methodology and determine the cooperation characteristics before making a decision.

In platform-based ecosystems, organizations aim to interact with other participants. For this purpose, social media platforms often serve as the ecosystem's centerpiece for customer-customer and customer-organization interaction. Section 6 provides an overview of the characteristics of such platforms. Within these platforms, the customer experience is preferably positive, and facilitates the spread of this positive experience. However, also negative experiences toward an organization can spread throughout the platform, and consequently bears great risk. As a result, organizations need to be able to quickly identify the emergence of such negative sentiment, and react accordingly. Research paper #5 proposes a design science research artefact to detect such negative sentiment, ideally even before the negative sentiment reaches the tipping point.

Finally, Section 7 concludes by summarizing the key findings of this doctoral thesis, identifying connection points for future research, limitations, and acknowledges previous work. Appendix A includes the declaration of co-authorship and individual contribution. Appendix B includes an overview and the abstracts of the underlying research papers.

2. PLATFORM-BASED ECOSYSTEMS AND ONLINE PLATFORMS

This Section provides an overview of the most important concepts of this doctoral thesis. First, this Section describes the emergence of platform-based ecosystems. Second, it provides a simplistic scheme on the actors in the context of platform-based ecosystems. Third, it discusses objectives for participation in platform-based ecosystems.

2.1. THE EMERGENCE OF PLATFORM-BASED ECOSYSTEMS FROM DIGITALIZATION

Digitalization fundamentally changes everyday life. The term encompasses the "manifold sociotechnical phenomena and processes of adopting and using these [digital] technologies in broader individual, organizational, and societal contexts" (Legner et al. 2017, p. 301). At the forefront of this development are organizations that effectively manage the utilization of this trend: Amazon, Google and Facebook still make the most of their money selling information about their customers, claim to have transformed themselves, but never entirely left their original business (Cortada 2019). Besides the well-known giants of the digital world, there are further organizations that successfully embrace digitalization and transform themselves (Haverans 2019): Subway completely plans to remodel their self-service kiosk of the future, and works with over 150 technology professionals to improve the company's mobile app. Capital One was the first bank to integrate Amazon's Alexa into their financial transaction system, and its mobile banking app was among the first to support Apple's TouchID. Wal-Mart launched an application to enable their programmers to switch between different cloud providers. Domino's Pizza integrated a variety of ways to place orders, such as Twitter or text. These examples give an idea about the impact of digital transformation endeavors that many organizations undertake to adapt digital technology, and therefore digitalize.

Digital transformation is a business-centric perspective on strategies that focuses on the transformation of products, processes, and organizational aspects owing to new technologies (Matt et al. 2015). It consists of the elements use of technologies, changes in value creation, structural changes, and financial aspects (Matt et al. 2015). The central aspects requiring digital transformation are digital technologies. In the last couple of years novel information technologies raise with the expectation to revolutionize our societal system as we know it. “Artificial Intelligence” is expected to replace human jobs (Leetaru 2016), “Blockchain” is supposed to eliminate inefficient intermediaries (Peters and Panayi 2016; Schlatt et al. 2016), and the “Internet-of-things” is anticipated to generate interoperability across geographically distributed users to create value for customers (McKinsey & Company 2016). Unsurprisingly, in the current era of digitalization and transformation, the focus for organizations is on the exploitation of such technologies with the aim to enable new functionalities and to open promising business opportunities (Tilson et al. 2010). As a result, adapting these technologies can become a key differentiator against competitors, and a critical factor for financial sustainability (Chandy and Tellis 2000; Fagerberg 2005; Teece 2010).

In hand with digitalization and digital transformation, the last decade facilitated massive “improvements in information, communication, and connectivity technologies, which resulted in new functionalities” – a process which also changed the perception of Information Technology (IT) (Bharadwaj et al. 2013, p. 472). Thus, the way organizations utilize their IT fundamentally changed: IT is no longer a business process that enables organizations to carry out work across boundaries (e.g., Banker et al. 2006; Bharadwaj et al. 2013; Ettlie and Pavlou 2006; Kohli and Grover 2008; Rai et al. 2012; Sambamurthy et al. 2003; Straub and Watson 2001; Subramaniam and Venkatraman 2001; Tanriverdi and Venkatraman 2005; Wheeler 2002). Much more, IT enables “different forms of dynamic capabilities suitable for turbulent environments” (Bharadwaj et al. 2013, p. 472; Pavlou and El Sawy 2006, 2010), transforms the structure of social relationships for both, users and organizations, (e.g., Susarla et al. 2012), and increasingly tangles products and services with their underlying IT infrastructure (e.g., El Sawy 2003; Orlikowski 2010). These three characteristics facilitate the interaction between organizations and users in the digital world, which in many cases results in digital platforms of various kinds. Unsurprisingly, such platforms are the centerpiece of many of today’s digital giants (Gawer 2014), and became ubiquitous in the modern world (Parker et al. 2016; Tiwana 2014).

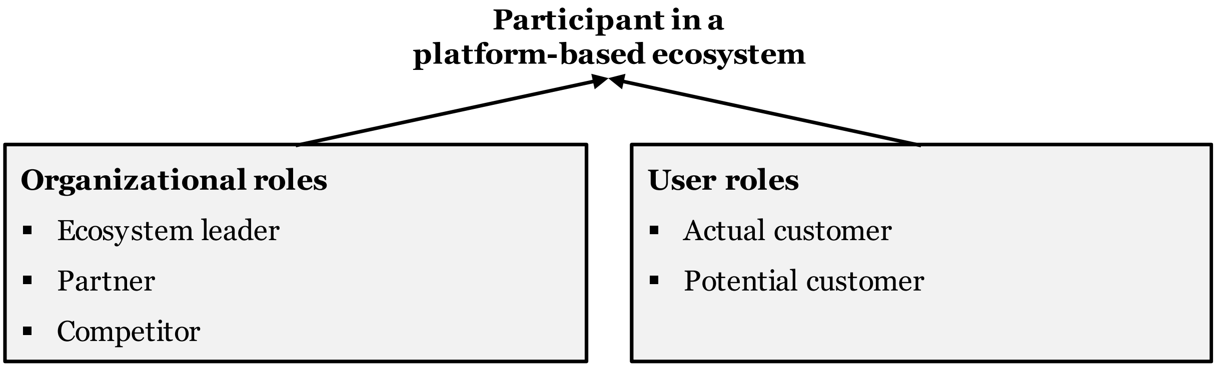
The evolvement of digital platforms changed a multitude of phenomena in the IT landscape (de Reuver et al. 2018). User interaction with organizations changed due to online communities of consumers (Spagnoletti et al. 2015). Inter-organizational relationships for the development of information systems changed due to the connection of app development and platform provision (Eaton et al. 2015; Ghazawneh and Henfridsson 2013; Tiwana et al. 2010). The architecture of organizations changed due to the development of modular instead of monolithic systems (Tiwana et al. 2010). Digital platforms are defined as the extensible codebase of a software- or hardware-based system that provide core functionality (Baldwin and Woodard 2009; Eisenmann et al. 2006), and usually serve as places where at least two parties interact. However, since platforms are not a new phenomenon (Clark 1985; Katz and Shapiro 1994), they differ in terms of various characteristics such as homogenization (Kallinikos et al. 2013; Yoo et al. 2010) and standardization (Yoo et al. 2010). Within these platform-based ecosystems, organizations work together as partners, or compete for customers (Hannah and Eisenhardt 2018). Thus, organizations participate in platform-based ecosystems to create value from the participation. The creation of value is either through stand-alone activities (e.g., selling products, offering services), or through cooperation with other ecosystem participants. The cooperative creation of value with other organizations or users in the platform-based ecosystem coined the term value co-creation (Constantinides et al. 2018; Song et al. 2018).

Resulting from the emergence of ecosystems, competition increasingly shifted towards them. Adner (2017) also distinguishes two perspectives on ecosystems: The ecosystem as affiliation, which views “ecosystems as communities of associated actors defined by their network and platform affiliations”, and ecosystems as structure, “which sees ecosystems as configurations of activity defined by a value proposition" (Adner 2017, p. 40). This doctoral thesis focuses on the view of ecosystems as affiliation. In the following, Sections 2.2 and 2.3 resume describing the participants of ecosystems and explaining their objective for participation.

2.2. PARTICIPANTS IN PLATFORM-BASED ECOSYSTEMS

Within platform-based ecosystems, different participants interact with each other. Such participants can be either organizations (organizational roles) or users (user roles). For this purpose, Figure 3 summarizes the participants that this thesis considers.

Figure 3. Structural visualization of typical participants in a platform-based ecosystem (own representation based on Schultz 2007)



2.2.1. Ecosystem Leader

Early research on platform-based ecosystems identified organizational "leaders" (Gawer and Cusumano 2002) or "keystone firms" (Iansiti and Levien 2004) (e.g., Google, Apple, Facebook, cf., Gawer 2014). The leader is the coordinator, and orchestrates other organizations and their roles within the ecosystem. Ecosystem leaders manage the ecosystem, and are oftentimes able to dictate the ecosystem governance (grant or deny access), e.g., by switching off or changing application programming interfaces, by charging fees, or by allowing the utilization of data (Tiwana et al. 2010). In many cases such as Facebook, Google, or Apple, the value of being the ecosystem leader is the primary access to the data and the resulting opportunities.

Ecosystem leaders must make complex strategic decisions with regard to the other organizations in the ecosystem, which can be partners or competitors (Gawer and Cusumano 2014). For example, if an ecosystem leader develops novel technological approaches that target products or services of other organizations, the extension of the scope may eliminate these organizations, and thus, eliminates their participation and innovation capabilities from the ecosystem (Gawer and Cusumano 2014). As a consequence, the integration of other organizations in the ecosystem fails due to too much competition, and eventually can result in the failure of the ecosystem (Ozcan and Santos 2015). In contrast, if ecosystem leaders cooperate too much, others overtake their market position, or even absorb others' value proposition (Hannah and Eisenhardt 2018). From the ecosystem leader's perspective, this requires the management's awareness of the decisions' interdependencies (Ceccagnoli et al. 2011).

Cusumano and Gawer (2002) identify four levers of ecosystem leadership: *Scope* is the determination of the amount of internal innovation and external complementation. *Product technology* is the architecture behind the product or service enabling complementation or replication. *Determination of relationship* is the collaborative or cooperative *relationship with* *external organizations*. And *internal organization* is the internal structure suiting the first three aspects and the management of conflicts of interest (Cusumano and Gawer 2002). In their study, they propose eight ideas for managing ecosystem leadership: *First*, protect the core technology, but share interface technology. *Second*, put the industry's common good before short term interest. *Third*, leave the partners' scope to them. *Fourth*, test approaches low-key before pushing the agenda on a high-key level. *Fifth*, support partner organizations protecting their intellectual property. *Sixth*, separate the internal production from the support of external partner organizations. *Seventh*, leverage internal processes. *Eighth*, communicate carefully and thoroughly with internal and external stakeholders.

2.2.2. Partners

Partners are organizations participating in the platform-based ecosystem for cooperation. They create value by providing products or services that are complementary to other goods and services within the ecosystem. On average, partners are able to increase their operational performance from participation in an ecosystem (Ceccagnoli et al. 2011). As a result, organizations have an incentive to become partners and to participate in an ecosystem. However, partners are also dependent on the ability to participate in an ecosystem, which is usually managed by an ecosystem leader (Cusumano and Gawer 2002) (cf., Section 2.2.1).

In many cases, partners identify unique niche value propositions complementing other organizations' products or services. Consequentially, partners rely on the success of the organization providing the product or service ("dance with the elephant", Cusumano and Gawer 2002, p. 54). Before entering such ecosystems, partners consider how actively the ecosystem leader collaborates with other organizations, how open the ecosystem's design is, and how likely the other organizations are to compete (Cusumano and Gawer 2002). As a result, partners need to be alert on product plans, novel innovations, and quickly react accordingly (Cusumano and Gawer 2002).

Partners with protected intellectual property rights are able to benefit from greater returns, and partners with unprotected intellectual property rights need to be very cautious when entering ecosystems (Ceccagnoli et al. 2011). The ecosystem leader indirectly benefits from partners' intellectual property rights, because strong partners nurture the platform-based ecosystem by contributing strong innovations (Ceccagnoli et al. 2011). This leads to additional customers using the platform-based ecosystem, and in turn encourages more organizations to become partners (Ceccagnoli et al. 2011). Hence, from an ecosystem perspective, innovative partners are welcome since the ecosystem benefits from their participation, and also more likely to participate since they are welcomed by the ecosystem's organizations (Huang et al. 2009).

For partner organizations, the benefits from collaborating can be manifold: Organizations share information on specific markets, applications, R&D plans, roadmaps, customize products, develop joint products, realize joint marketing, and set joint standards and licenses (Kapoor 2014). By joining the platforms, partners avoid these costs, and even indicate compatibility with the other products and platforms within the ecosystem (Ceccagnoli et al. 2011). Partners can work together by integrating their products and services, for example through application programming interfaces or by synchronizing product development plans. Generally, the raise of platform-based ecosystems facilitates novel forms of inter-organizational cooperation. In many cases, this results in organizations adjusting each other's products and processes according to their ecosystem.

2.2.3. Competitors

In many cases, the differentiation between competitors and partners is not obvious. For example Apple, Google, and Microsoft started to integrate their central document processing applications, such as Word, Excel, and PowerPoint. However, these organizations are not partners, but live with the mutual integration of single applications into each other's ecosystems. This is because all of the three mentioned organizations have interoperating users that do not want to restrict themselves to one single ecosystem.

Competitors are organizations that target the value proposition and aim to access market potential. In many cases, the ecosystem leader tries to exclude competitors from the platform. In platform-based ecosystems, strong network effects and high switching costs often secure ecosystem leaders and their partners form entry of competitors (Eisenmann et al. 2011; Farrell and Saloner 1984; Katz and Shapiro 1985). For this purpose, competitors propose ecosystems with superior value proposition, replacing existing ones (Evans and Schmalensee 2002). This often leads to winner-takes all battles. A strategy for competitors is platform envelopment, which is a strategy that does not rely on Schumpeterian innovation and Eisenmann et al. (2011) explore for the first time. In this context, organizations bundle their functionality to an existing ecosystem leader to leverage shared user relationships and common components. However, in cases where ecosystems are too settled and the existing organizations have aligned themselves too much, the platform even benefits from competitors and therefore the proposed value for participants increases. Competition in ecosystems especially moves to an ecosystem level, where ecosystems compete against each other, and on a complementor level, where organizations compete against each other to be the favorite complementor (e.g., for the ecosystem leader).

2.2.4. Users

Users refer to existing and potential customers of organizations participating in the ecosystem. Users in ecosystems vary and differentiate in the frequency, volume, type, and quality of digital content they produce and consume (Trusov et al. 2010). In the academic discourse, users are categorized as passive or active depending on their activities (Burnett 2000; Preece et al. 2004). Active users are interested in engaging in the ecosystem by creating and sharing information, participating in activities, or helping others (Casaló et al. 2007). Passive users only browse online groups, and consume content, without participating in the community or activities (Burnett 2000; Preece et al. 2004).

Interaction between users and organizations within platform-based ecosystems can be manifold. In this term, this doctoral thesis does not provide an exhaustive overview of all possible interactions. To enable and utilize the cooperation potential between organizations and users effectively, incentives for both are necessary. Therefore, certain aspects are important: It is important to have incentives in place – in some cases these can be intangible incentives (e.g., recognition, opinion leadership), while in other cases economic incentives are necessary (Sawhney et al. 2005). The incentives for both organizations and users need to be well-designed, which can have a remarkable impact on the outcome of the interaction (Toubia 2006). It is essential to have rules in place regarding intellectual property rights, so that the organization is able to use the results of the interaction (e.g., innovative ideas) (Sawhney et al. 2005).

2.3. PARTICIPATION OBJECTIVES IN PLATFORM-BASED ECOSYSTEMS

Participants in platform-based ecosystems participate to achieve positive network effects (Constantinides et al. 2018; Song et al. 2018). Examples include reputation enhancement, experimentation, relationship building, value creation, and value co-creation as key-factors. Besides the typical organization-centric value creation (e.g., sell products, provide services), value co-creation increasingly becomes a motivation for organizations to participate in ecosystems (Pera et al. 2016). Value co-creation is defined as a "common benefit that accrues to alliance partners through combination, exchange, and co-development of idiosyncratic resources" (Dyer and Singh 1998; Lavie 2006). Value co-creation is based on the resource-based view of the firm, which combines managerial perspectives with the rationale of economics (Das and Teng 2000; Lavie 2006; Wade and Hulland 2004). In the traditional perspective, organizations were depicted as independent entities (Barney 1991; Dierickx and Cool 1989; Wernerfelt 1984). This perspective has changed in today's digital world in the presence of ecosystems, where value co-creation is the value created from relation-specific assets, knowledge-sharing routines, complementary resources, and effective governance mechanisms (Lavie 2006). This value can only be extracted from intentionally committed and shared or jointly possessed resources (Lavie 2006).

In ecosystems, value is co-created by complex interactions within a network of various participants (Gyrd-Jones and Kornum 2013). The presence and interaction of participants influences the character of the ecosystem, and this process differentiates the ecosystem from common networks (Wieland et al. 2012). The participants jointly co-create value by participating, and benefit from the ecosystem by giving and receiving resources (Greer et al. 2016; Merz et al. 2009). The interest of value co-creation is the synergy of involved participants compared to stand-alone value creation (Gyrd-Jones and Kornum 2013). Within these ecosystems, organizations need to balance competition and cooperation – too much cooperation decreases value generation, and not enough cooperation compromises the formation of the ecosystem (Hannah and Eisenhardt 2018; Ozcan and Santos 2015).

Further, the experience of users becomes important, where customer-to-customer, customer-to-community, and customer-to-organization interaction is central (Prahalad and Ramaswamy 2004). Customer co-creation is the term when the value creation process shifts outside the firm and includes informed, connected, empowered, and active customers, so the customer participates in the creation process, is involved in problem definition and solution, co-constructs personalized experience, or participates in innovation processes (Prahalad and Ramaswamy 2004).

2.3.1. Objectives of organizational participants

The access to users is still among the key objectives why organizations participate in ecosystems, and the target for organizations' value proposition. In today's ecosystems, users play a central role in value co-creation (e.g., Anker et al. 2015; Grönroos 2011; Payne et al. 2008; Vargo and Lusch 2008). Value co-creation with customers originates from a dual collaborative interaction between organization and customer (Pera et al. 2016). In platform-based ecosystems, participation in such ecosystems is generally associated with an increase in sales and under some conditions, with increasing business performance (Ceccagnoli et al. 2011). Thus, organizations have an incentive to become part of and to participate in ecosystems.

Further, from an organizational perspective, value co-creation offers significant potentials to improve the innovation capability (Frow et al. 2015), and can enhance the innovation process (Nambisan 2002). Cooperative innovation between organizations and users is a form of value co-creation. Thus, organizations join ecosystems in order to co-create value, which can also be novel innovation, incremental invention, and complementary development.

Ecosystems utilize the internet to facilitate such user interaction in three ways (Sawhney et al. 2005; Sawhney and Prandelli 2000): First, it allows organizations to continuously and multi-directionally interact with users. Second, it allows organizations to utilize knowledge shared among users groups. Third, it allows organizations to extend the reach and scope of the user interaction through independent third parties (e.g., non-customers, competitors' customers, prospective customers).

In the era of digitization, the innovation process and its outcomes have changed (Nambisan et al. 2017). The ecosystem's inherent platforms differ in terms of its layered modular architecture, which accelerates the ability for innovation, and thus, creates value (Rai et al. 2019). To co-create value in and profit from ecosystems, organizations themselves need to remain innovative. In the era of digitalization, organizations address every aspect of innovation using IT to shape and transform their key business activities (Hess et al. 2016; Matt et al. 2015). As a result, organizations need to face the technological changes that lead to opportunities, such as greater flexibility, reactivity and product individualization (Rachinger et al. 2018).

2.3.2. Objectives of users

From a user's perspective, the incentive to participate in ecosystems is to benefit from it. In many cases, organizations integrate users into their value creation activities, and incentivize users to be part of them (e.g., by financial benefits such as discounts). For this purpose, organizations and users cooperate to create value. Ecosystems achieve this by making life easier for the customer (Miller et al. 2002), solving a customer's problem (Sawhney et al. 2006), supporting the customer's peace of mind (Woodruff 1997), satisfying customer needs (Tuli et al. 2007), or simply relieving the customer of some responsibility (e.g., Normann and Ramírez 1993).

Further, users participate in ecosystems to connect with other users, interact in social relationships like becoming friends, receiving recognition for achievements, and exchanging information (about products and services, as well as personal things). These aspects often take place in ecosystems that base on social media platforms like Facebook.

3. DEVELOPMENT OF PLATFORM-BASED ECOSYSTEMS: ICO DESIGN PARAMETERS FOR ECOSYSTEM DEVELOPMENT

This Section explains the general outline of ecosystem development. Since the blockchain-technology can play an important role when developing an ecosystem using blockchain-based tokens, this Section further explains the key characteristics of blockchain and how initial coin offerings (ICO) work. Finally, this Section provides a methodology to structure and cluster the plethora of design parameters of ICO-based ecosystem development in advance of a decision.

3.1. ECOSYSTEM DEVELOPMENT AND THE ROLE OF BLOCKCHAIN

In Section 2, this doctoral thesis provided an overview of ecosystems and key participants. As stated, the ecosystem leader organizes the ecosystem and its governance. This leader has to determine the infrastructure of the ecosystem (e.g., the set-up of platforms, availability of application programming interfaces, coordination of modules), incentives for other organizations and users to participate in the ecosystem, and barriers for competitors. In this context, organizations need to define the handling of openness, control, and intellectual property rights within the ecosystem (Parker and van Alstyne 2018). These design aspects of development directly influence the outline of the ecosystem. Openness is the extent of restrictions on participation, development, or use that ecosystems pose on their participants (Eisenmann et al. 2009), and the choice of the governance model between participants (Laffan 2012). Control is the ability of the ecosystem leader to dictate advancements in the ecosystem, or even restrict external access via application programming interface by other partners (Parker and van Alstyne 2018). Intellectual property rights relate to the content that platform participants create in platform participation.

Ecosystems benefit from innovation (cf., Section 2.2 and 2.3), and the respective innovation originators have an interest to remain the intellectual property owners. However, ecosystems also benefit from sharing intellectual property, e.g., so other ecosystem participants can build on and enhance newly developed intellectual property (e.g., applications, modules, platforms) (Boudreau 2010; Parker and van Alstyne 2018). As a result, the development of an ecosystem demands various design decisions. Opening an ecosystem to other organizations (i.e., competitors) poses the trade-off of between adoption and appropriability, which is the tradeoff between encouraging wider adoption (of the own technology) through transparency versus sharing profits due to reduced entry barriers (Parker and van Alstyne 2018; West 2003).

A novel approach to develop ecosystems in a particularly open design is the application of ICO, which is a phenomenon based on the blockchain-technology. ICOs promise to be a tool for developing ecosystems in a way that organizations and users participate in the development process from the beginning, and are able to shape the design of the ecosystem. In the following, this Section briefly introduces the basis concept of blockchain, and resumes with explaining the phenomenon of ICOs.

In the past years, the blockchain-technology attracted attention in close to all business sectors. Blockchain is supposed to enable novel ecosystems and platforms in a way that entire business models arise, and other business models vanish. Even experts do not agree upon the manifold effects that the technology promises (Hans et al. 2017; Manski 2017; Miscione et al. 2018). However, blockchain also enables decentral and trustful value co-creation between organizations, organizations and users, and even between users. Blockchain is one of the most rapidly emerging digital technologies of the past years (Lemieux 2016). The technology is a distributed, tamper-resistant, transparent, and peer-to-peer transaction registry, which applies cryptography to ensure security trust between untrusted participants (Lemieux 2016; Levy 2014; Xu et al. 2017). It became famous for its first instantiation Bitcoin in 2008 (Nakamoto 2008). In the following years, this instantiation caused a hype around crypto-currencies, which peaked in 2018.

The initial instantiation of Bitcoin also stimulated a great variety of use-case applications that utilize the characteristics of the underlying technology (Fridgen, Lockl et al. 2018). To date, researchers identified many different use-case patterns, such as neutral platforms, forgery-proof documentation, (payment) transactions, cross-organizational workflows management, digital identities, digital documents, ubiquitous digital services (without service provider), and economically autonomous machines (Fridgen et al. 2019). Various communities develop and propel the idea of blockchain to pursue certain ideological objectives and provide an alternative to established centralized systems (Reijers et al. 2016).

Besides Bitcoin, second generation blockchains are the underlying technology of ICOs, and therefore enable the phenomenon. Some of these blockchain technologies come with a built-in turing-complete programming language and enable smart contracts (Buterin 2014). Smart contracts are programs that automatically execute program code under certain conditions, and therefore allow parties to securely transact without trust (Beck et al. 2016; Glaser 2017; Sillaber and Waltl 2017; Szabo 1997). Further, these second generation blockchains enable the creation of usage tokens (Buterin 2014). Usage tokens are digital units of account that can be transferred on the blockchain to serve several purposes like currency, or access to platforms and services (Glaser and Bezzenberger 2015; Schweizer et al. 2017). With these tokens, a wide variety of use-cases emerged, such as crowdfunding, managing digital assets, or implementing trust-free asset trade (Nærland et al. 2017).

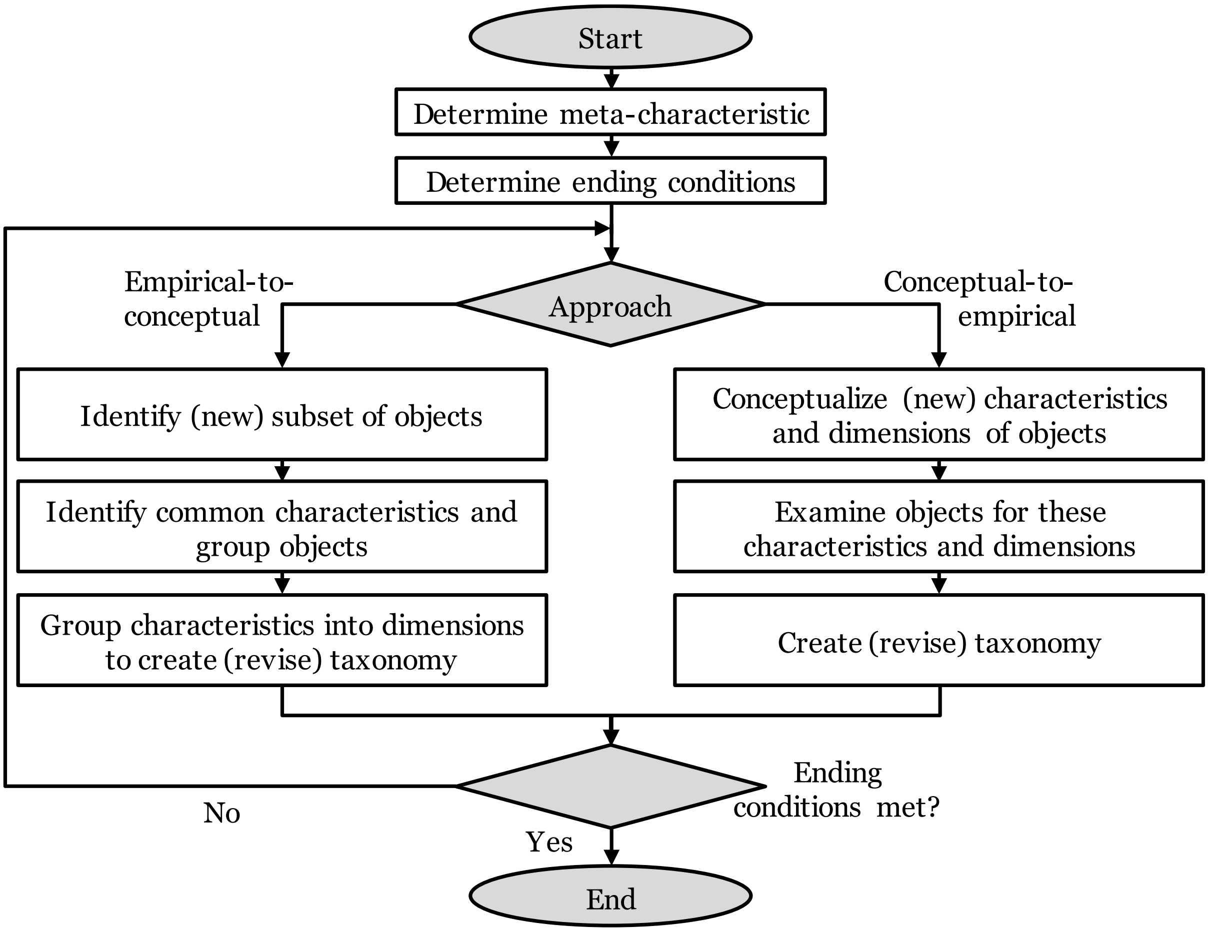
The sale of these tokens depicts a novel (crowd) funding mechanism, referred to as ICOs (Boreiko and Sahdev 2018; Chanson et al. 2018; Schweizer et al. 2017). Instead of having to rely on an investor, ICOs enable participating investors to actually participate in an anonymous way in the funding, development, and revenue collection via tokens (Li and Mann 2018). Additionally, the successful distribution of the underlying tokens draws a great number of participants toward the issued token, and therefore literally develops an ecosystem. This coined the term “ecosystem tokenization via blockchain” (cf., Unibright.io 2018). Recently, ICOs became a popular alternative to finance novel and innovative ideas in the organizational context (Boreiko and Sahdev 2018; Li and Mann 2018; Schweizer et al. 2017). Organizational objectives of such ecosystems include manifold examples: Fishcoin aims to introduce an ecosystem for the global seafood industry in order to data-fuel the trade and regulation (Fishcoin.io 2018). snowball.money is the first Smart crypto investment automation platform that enables everyone to invest like professional investors (snowball.money 2019). Civic enables people to take control and protect their identity via an ID platform or reusable know-your-customer requirements (Civic.com 2019).

To date, ICOs are a very new phenomenon, and both research and practice only started to analyze and evaluate the characteristics and dynamics. However, since many organizations – especially start-ups – currently prefer ICOs over traditional financing approaches, a further understanding is necessary (Adhami et al. 2018). To this end, ICOs demand complex decisions to set-up this multilayered funding approach. For this purpose, it is necessary to analyze design parameters of ICOs in more detail, and to find clusters in real-world cases that indicate which practices exist. The following Subsection 3.2 provides a methodology on how organizations are able to determine the right design parameters for their ecosystem development decisions (Bachmann, Drasch, Fridgen et al. 2019; Bachmann, Drasch, Miksch et al. 2019).

3.2. ANALYSIS OF DESIGN PARAMETERS FOR ICO-BASED ECOSYSTEM DEVELOPMENT

When organizations face difficult decisions, or even lack the understanding of a novel phenomenon, it is necessary to derive insights in the first place. For this purpose, following a methodological approach in order to find a solution suggests an appropriate interim stage. A very suitable approach to analyze characteristics of a novel phenomenon is taxonomy development. A taxonomy is a particular classification scheme that is often used to empirically or conceptually describe systems of groupings of objects (Nickerson et al. 2013). Therefore, a taxonomy provides a set of unifying constructs and a systematic organization of observable states (Glass and Vessey 1995). From a research perspective, a taxonomy is “useful in discussion, research, and pedagogy” (Miller and Roth 1994, p. 286), in order to organize knowledge (Wand et al. 1995), and to increase understanding (Gregor 2006). In the context of ICO design parameters, organizations are able to structure observable characteristics. Hence, it is possible to organize a previously unknown phenomenon and to gain knowledge in a distinct field. Because taxonomies are also easily adaptable, they are suitable for evolving and developing fields: Since organizations often struggle to oversee new phenomena at an early stage, changes, adaptions, or recreation of the understanding are necessary. The taxonomy development approach according to Nickerson et al. (2013) integrates conceptual and empirical perspectives into one comprehensive method, which requires seven iterative steps. Figure 4 visualizes the taxonomy development method by Nickerson et al. (2013).

Figure 4. Taxonomy development method (own visualization based on Nickerson et al. 2013)



After having proposed a first structure (e.g., development of a taxonomy) to an unknown phenomenon, there are still hundreds of combinations of dimensions and characteristics. In this context, the taxonomy is a first step, but requires further activities. One possible second step is the clustering of observable combinations to derive archetypes. In this case, an organization is able to link the design of derived archetypes to observable common practices and purposes in the field, and potentially conclude recommendations for its own endeavor. This step supports the identification of predominant or successful pathways before choosing between alternatives. Consequently, organizations search for existing archetypes and their characteristics. To address this demand, it is necessary to cluster observable real-world cases and derive patterns.

Pattern recognition is closely related to artificial intelligence, data mining and machine learning, and is often used interchangeably with these terms (Bishop 2006). For pattern recognition, various algorithms exist, such as classification algorithms, clustering algorithms, multilinear and linear regression algorithms, or ensemble learning. Especially when aiming to search entities of similar kind, cluster analysis is a statistical technique helping to identify respective groups. In general, cluster analysis is applicable to describe generic archetypes of entities (Everitt et al. 2011; Hair et al. 2009). According to an analysis of 55 articles in IS research, scholars chose this method regularly to classify observations of specific objects (Balijepally et al. 2011). For example, when working with previously developed taxonomies, a three-step clustering approach is conductible: The first step selects the clustering variables. This is a fundamental step, because it directly impacts the resulting clusters (Punj and Stewart 1983). If the clustering follows a deductive approach, the variables need to be linked closely to extant theory. For this purpose, it is also common to draw on taxonomy dimensions (Haas et al. 2014; Ketchen et al. 1993; Ketchen and Shook 1996). The second step selects an appropriate clustering algorithm. Here, the selection of hierarchical and non-hierarchical methods is well recognized. The third step quantitatively and qualitatively evaluates resulting clusters, and thus, analyzes clusters and draws conclusions.

To provide a structure of ICO design parameters, Fridgen, Regner et al. (2018) develop a taxonomy from conceptual and empirical data (Nickerson et al. 2013). Based on their result, Bachmann, Drasch, Miksch et al. (2019) and Bachmann, Drasch, Fridgen et al. (2019) further refine the taxonomy and derive archetypes (cf., Appendix B.1 and B.2). The development process utilizes 84 real-world ICO examples, 6 expert interviews, and the current scientific discourse. The resulting taxonomy consists of 23 relevant dimensions encompassing 66 characteristics resulting from the specific meta-characteristics (Bachmann, Drasch, Fridgen et al. 2019; Bachmann, Drasch, Miksch et al. 2019). Table 1 visualizes the final taxonomy. For an explanation of the taxonomy's dimensions and characteristics, please refer to Fridgen, Regner et al. (2018) and Bachmann, Drasch, Miksch et al. (2019).

Table 1. Taxonomy of design characteristics for ICOs (own representation based on Bachmann, Drasch, Miksch et al. 2019)

<table>
<tr><th>Dimension</th><th colspan="12">Characteristics</th></tr>
<tr><td>Token implementation level</td><td colspan="4">on-chain</td><td colspan="4">native</td><td colspan="4">sidechain</td></tr>
<tr><td>Token purpose/type</td><td colspan="2">usage</td><td colspan="2">work</td><td colspan="2">funding</td><td colspan="2">staking</td><td colspan="2">equity security</td><td colspan="2">non-equity security</td></tr>
<tr><td>Token supply growth</td><td colspan="4">fixed</td><td colspan="4">adaptive inflation</td><td colspan="4">fixed inflation</td></tr>
<tr><td>Token supply cap</td><td colspan="6">capped</td><td colspan="6">uncapped</td></tr>
<tr><td>Token burning</td><td colspan="6">yes</td><td colspan="6">no</td></tr>
<tr><td>Token distribution deferral</td><td colspan="6">yes</td><td colspan="6">no</td></tr>
<tr><td>Token holder voting rights</td><td colspan="6">yes</td><td colspan="6">no</td></tr>
<tr><td>Issuing legal structure</td><td colspan="6">foundation</td><td colspan="6">limited</td></tr>
<tr><td>Team company token share</td><td colspan="4">minority</td><td colspan="4">majority</td><td colspan="4">half</td></tr>
<tr><td>Team lockup period</td><td colspan="4">no</td><td colspan="4">single period</td><td colspan="4">multiple periods</td></tr>
<tr><td>Pre-sale before ICO</td><td colspan="3">no</td><td colspan="3">private</td><td colspan="3">public</td><td colspan="3">both</td></tr>
<tr><td>Pre-sale discount</td><td colspan="6">yes</td><td colspan="6">no</td></tr>
<tr><td>Planned occurrence</td><td colspan="4">multiple rounds</td><td colspan="4">single round</td><td colspan="4">unspecified</td></tr>
<tr><td>Registration needed</td><td colspan="6">yes</td><td colspan="6">no</td></tr>
<tr><td>Eligibility restrictions</td><td colspan="3">none</td><td colspan="3">geographic</td><td colspan="3">accreditation</td><td colspan="3">multiple</td></tr>
<tr><td>Purchase amount limit</td><td colspan="3">none</td><td colspan="3">minimum</td><td colspan="3">maximum</td><td colspan="3">both</td></tr>
<tr><td>Auction mechanism</td><td colspan="6">yes</td><td colspan="6">no</td></tr>
<tr><td>Sales price</td><td colspan="6">fixed</td><td colspan="6">floating</td></tr>
<tr><td>Price fixing currency</td><td colspan="6">crypto</td><td colspan="6">fiat</td></tr>
<tr><td>Funding currency</td><td colspan="4">crypto</td><td colspan="4">both</td><td colspan="4">none</td></tr>
<tr><td>Funding cap</td><td colspan="3">none</td><td colspan="3">hard cap</td><td colspan="3">soft cap</td><td colspan="3">multiple</td></tr>
<tr><td>Time horizon</td><td colspan="4">block time</td><td colspan="4">fixed date</td><td colspan="4">open end</td></tr>
<tr><td>Time-based discount</td><td colspan="4">none</td><td colspan="4">single rate</td><td colspan="4">multiple rates</td></tr>
</table>

Based on this taxonomy (cf., Table 1), Bachmann, Drasch, Miksch et al. (2019) and Bachmann, Drasch, Fridgen et al. (2019) apply a clustering method according to the explanation earlier in this Section to derive ICO archetypes (cf., Appendix B.1 and B.2). Following the three-step clustering approach, the study utilizes the underlying real-world cases to identify prevailing patterns. In the context of ICOs, the clustering approach resulted in five archetypes, which have high variation between them and low variation within them (Bachmann, Drasch, Fridgen et al. 2019; Bachmann, Drasch, Miksch et al. 2019). Table 2 visualizes the resulting archetypes. The archetypes are the visionary ICO (1), the liberal ICO (2), the average ICO (3), the compliant ICO (4), and the native ICO (5). For an explanation of the archetypes, please refer to Bachmann, Drasch, Miksch et al. (2019) and Bachmann, Drasch, Fridgen et al. (2019).

Table 2. Resulting archetypes of cluster analysis (own representation based on Bachmann, Drasch, Fridgen et al. 2019)

Dimension	**Archetype**				
	1	**2**	**3**	**4**	**5**
Token implementation level	On-chain (84%)	On-chain (80%)	On-chain (93%)	On-chain (100%)	Native (86%)
Token purpose/type	Usage (42%)	Usage (80%)	Usage (59%)	Usage (78%)	Staking (71%)
Token supply growth	Fixed (84%)	Fixed (80%)	Fixed (90%)	Fixed (89%)	fix infl. (71%)
Token supply cap	Capped (89%)	Capped (90%)	Capped (97%)	Capped (100%)	uncap. (100%)
Token burning	No (58%)	No (90%)	No (72%)	Yes (89%)	No (100%)
Token distribution deferral	No (63%)	No (70%)	Yes (66%)	Yes (56%)	Yes (86%)
Token holder voting rights	Yes (63%)	No (90%)	No (90%)	No (89%)	Yes (71%)
Issuing legal structure	Limited (100%)	Limited (75%)	Limited (90%)	found. (67%)	found. (57%)
Team company token share	Minor. (100%)	minor. (75%)	minor. (97%)	minor. (89%)	minor. (100%)
Team lockup period	multi. (47%)	No (60%)	single (59%)	multi. (78%)	No (57%)
Pre-sale before ICO	No (53%)	No (70%)	Private (69%)	Public (56%)	No (71%)
Pre-sale discount	No (79%)	No (75%)	Yes (100%)	Yes (78%)	No (71%)
Planned occurrence	single (84%)	single (50%)	Single (97%)	single (89%)	single (57%)
Registration needed	Yes (84%)	No (85%)	Yes (93%)	Yes (89%)	No (86%)
Eligibility restrictions	geogr. (68%)	None (100%)	geogr. (55%)	None (56%)	None (86%)
Purchase amount limit	None (79%)	None (80%)	None (72%)	min. (44%)	None (86%)
Auction mechanism	No (100%)	No (90%)	No (97%)	No (100%)	No (71%)
Sales price	Fixed (89%)	Fixed (75%)	Fixed (86%)	Fixed (89%)	Fixed (57%)
Price fixing currency	Fiat (68%)	Crypto (70%)	Crypto (55%)	Crypto (78%)	Crypto (100%)
Funding currency	Crypto (63%)	Crypto (95%)	Crypto (83%)	Crypto (67%)	Crypto (100%)
Funding cap	multi. (74%)	hard (45%)	hard (66%)	multi. (67%)	None (71%)
Time horizon	fixed (95%)	fixed (70%)	fixed (90%)	fixed (89%)	fixed (71%)
Time-based discount	No (58%)	Multiple (55%)	Multiple (52%)	No (56%)	Multiple (43%)

An organization that develops an ecosystem using an ICO design can learn from others (e.g., first movers) and avoid making identical mistakes. Besides, organizations are also able to choose between the outline of different archetypes, and determine the appropriate set of decisions. Therefore, taxonomy and archetype development approaches support a comprehensive and in-depth understanding, and offer tangible suggestions to decision makers. In the context of ICOs, taxonomies and archetypes are two valid IS research artefacts to structure a novel and difficult phenomenon. With the resulting archetypes, organizations are able to identify existing and observable ICOs and derive conclusions before starting their own ICO.

As a result, the described approach can help organizations to reflect upon their approach aiming to develop novel ecosystems. The success of such ecosystems highly depends on the process of starting it. By conducting an ICO and offering a token, this can also be the starting point for the underlying platform, which may depict the centerpiece of the ecosystem.

4. User incentives in platform-based ecosystem development using ICOs

User incentives for ecosystem participation are among the key aspects of ecosystem development. In Section 3, this doctoral thesis already described ICOs as a novel form of ecosystem development. Section 4 goes further into detail of user incentives for participation, and analyzes the user incentives in the ICO context.

4.1. Incentives for ecosystem participation

The development of an ecosystem highly depends on the success of platform adoption. For this, all of the previously described participants need an incentive to join a developing ecosystem. Only if users as (potential) customers and organizations mingle in the ecosystem, value generation for both sides is satisfactorily (direct and indirect network effects). The value of an ecosystem to its participants results from the relative contribution of the ecosystem to the goal of the participating actors, and therefore directly links to the participation in the network. For this purpose, participants often utilize platforms in the ecosystem to exchange products or services, or to co-create value. These platforms are called multi-sided platforms, which mediate between the participants in several ways (e.g., Amazon, eBay, Uber, Airbnb) (Hagiu and Wright 2015).

When developing a new ecosystem, the incentive to join is low for users and other organizations. An example refers to the introduction of the telephone network. In the 1850s, the telephone landline started operation. Whenever the first person purchased a telephone, the utility of having a telephone (e.g., being part of the telephone landline ecosystem) was low. There was simply nobody else to call. The second person who joined the telephone landline ecosystem had a somehow different perspective: Already one other person had a telephone, so at least there was one other person to call. For every other person joining the ecosystem, the utility increased. Thus, the incentive for a person to join the telephone platform is higher, when there are more users already using the platform (Caillaud and Jullien 2003). This coined the term “chicken and egg problem”, when more participants would increase the utility of an ecosystem, but participants have no incentive to join the ecosystem due to its low utility. Once the platform reaches a critical mass and enough users participate, network effects start to accelerate the platform growth (Evans 2014; Katz and Shapiro 1985; Liebowitz and Margolis 1994; Oren and Smith 1981). Therefore, growth is an important aspect to determine ecosystem success. The faster a newly developed ecosystem grows, the faster it proposes value generation for organizations and users.

However, the expected benefit from participating in the ecosystem decides upon joining or not joining. In the example of established ecosystems such as Facebook, Instagram, or Twitter, the decision is easier. On Facebook nearly 2.5 billion users are active on a monthly basis (as of December, 2018, cf., Statista 2019a), on Instagram 1 billion users are active on a monthly basis (as of June, 2018, cf., Statista 2019b), and on Twitter, more than 300 million monthly active users share news (as of March, 2019, cf., Statista 2019c). Many other organizations observe the high amount of users in these ecosystems and decide to participate as well, offer their products and services, and propose additional value. Further, utility for users comes from connecting to other users, socially being connected, and exchanging information (about products and services, as well as personal things). For other organizations, the utility of joining Facebook, Instagram, or Twitter is very high, as the potential users and user networks are obvious.

4.2. Applying ICOs to incentivize ecosystem participation

Blockchain is a technology associated to have the necessary potential to change the established rules of ecosystem development (Karnjanaprakorn 2017; Lindman et al. 2017; Walter 2017). Experts assume that organizations can achieve this by offering utility tokens via an ICO (cf., Section 3.1). When organizations decide to develop ecosystems based on ICOs, the offered tokens are a means of payment in exchange for a right (of participation, a product, or a service) (Swan 2015). In a blockchain-based ecosystem, participants use digital tokens for various purposes, e.g., as an internal unit of account, for the verification of block-writing, as a facilitation of transactions, or for more creative use-cases such as preventing unintended use of the blockchain, or granting token owners access (Conley 2017; Fridgen, Regner et al. 2018; Glaser 2017; Schweizer et al. 2017). By issuing such a utility token, early participants can benefit from their early adoption: With a growing platform, the utility token is associated with increasing value. In the example of the telephone landline ecosystem, this equals an incentive to be among the first users, and to benefit from users joining the ecosystem later. As a result, ecosystems grow faster, and organizations are able to accelerate the growth. Consequently, it is highly relevant to understand blockchain-based platforms and the functionality of the token economy in respect to ecosystem development. Therefore, it is necessary to understand the promised benefit that incentivizes users to join. Further, it is important to understand the implications of this effect on platform adoption.

To understand these needs, Drasch et al. (2019) apply a two-step approach to evaluate user incentives in platform adoption (cf., Appendix B.3). They conduct a qualitative assessment to explain the changes in the token value, and to draw conclusions on the platform adoption. The results are that the utility token's inherent combination of payment measure and financial incentive does not positively affect each other. After the platform launch, the users' incentive to participate actively on the platform does not hold, but rather incentivizes speculation about the financial development. In that case, activity on the platform is low and results in deflation of the token value.

Hence, organizations need to be careful with the users' incentive in case they want to accelerate the growth of the ecosystem using a utility token. This is especially important, as the inherent idea contradicts the financial incentive. To avoid making that mistake, it is important that organizations consciously weigh their alternatives, and make sure to set out the right incentives. As a result, the described approach is suitable to analyze one of many incentives that are associated with the development of platform-based ecosystems. Drasch et al. (2019) demonstrate the difficulty to evaluate blockchain-related incentives. Although many experts predict blockchain to be the solution to many of today's problem in our ecosystem-centric digital world, a careful assessment is necessary.

5. Cooperation in platform-based ecosystems: Design evidence from banks and fintechs

Cooperation in ecosystems is among the key aspects of organizational objectives to participate in platform-based ecosystems (cf., Section 2.3.1). This Section goes into detail of cooperation in the organizational context. In some cases, cooperation is a form of reacting to intruders, when alien organizations enter an existing ecosystem and incumbents' only choice to secure their market position is to cooperate with them (e.g., banks and fintechs in the financial service industry). Further, this Section provides an analysis approach to structure cooperation designs, when affected organizations have to determine the characteristics of cooperation.

5.1. THE OBJECTIVE OF COOPERATION

When organizations participate in ecosystems, their aim is to benefit from their participation, e.g., by co-creating value with ecosystem users or other organizations (cf., Section 2.2 and 2.3). For this purpose, organizations determine the relation to other organizations in the ecosystem. Before Facebook became one of the most dominant ecosystems, many different platforms such as MySpace and Bebo tried to draw users' attention and get them to join. However, Facebook launched its social media platform in 2004, managed to become the number one platform provider, and built one of the largest ecosystems around it. In the ecosystem, Facebook encourages and supports other organizations to integrate products, services, and other applications, e.g., via application programming interface (Cormode and Krishnamurthy 2008). Thus, Facebook opens its ecosystem for other organizations, so they can become complementors. Within the Facebook ecosystem, Facebook's complementors are potential competitors to each other.

In contrast to the example of Facebook, organizations are not necessarily interested in having organizations within their ecosystems interacting with the users. This is especially relevant in cases, where organizations are not as dominant as Facebook. A recent example is the banking industry, where the digital transformation also brings fundamental changes for established banks (Chishti and Barberis 2016), affecting IT departments, IT strategy, IT business processes, and the alignment of the business model (Veit et al. 2014). Subsequently, banks need to question their value delivery and customer interaction, all of which are central in ecosystems.

5.2. REACTING TO INTRUDERS IN PLATFORM-BASED ECOSYSTEMS

In the financial services industry, the digital transformation also enabled financial technology start-ups (fintechs) to enter formerly closed ecosystems of banks. Fintechs utilize the technological change and create novel technology-enabled value propositions. Many of these fintechs converted technology into service-, product-, or process-innovation. In contrast to existing incumbents in the financial services industry, fintechs are by far quicker and more agile and implement solutions without inconvenient coordination and governance. Thus, fintechs currently receive a lot of attention and started to advance into the bank-dominated financial service industry (Dapp 2014).

As a result, many banks are torn back and forth between alternative opinions about fintechs: On the one side, fintechs started to take over the low margins in the industry, so banks perceive them as competitors. On the other side, fintechs deliver value propositions through innovative solutions for existing customers, which makes it difficult to keep them outside the ecosystem. As a result, many banks realized the need to understand fintechs as novel organizations within their ecosystems. Banks innovation generation and implementation is too slow in comparison to fintechs, thus lacks competitiveness in this regard. Consequently, different reactions to fintechs are possible. First, banks can setup banking ecosystems and exclude the fintechs from the ecosystem (e.g., closed ecosystem). However, this deprives the ecosystem's users (the bank's customers) from using the fintech innovations. Second, banks can open their ecosystems so other banks and fintechs are able to interact with the customers. However, this encourages other banks to entice customers, and even lowers the barriers for customer churn. Third, a decision can be to acquire the fintech to incorporate the value proposition in the ecosystem. After a while, the integration of the fintechs' innovation capability would again decrease concerning the bank's slow processes and reactions. Fourth, banks can uphold their ecosystems and even strengthen the barriers, but selectively grant access for partners such as fintechs or organizations from other domain. Thus, competitors cannot easily poach customers, but customers benefit from innovation (Dapp 2014, 2015).

However, fintechs see no need to restrict their activity to the cooperation with a single partner or ecosystem. Currently, many banks demand their innovation capacity and capability at the same time. As a result, fintechs started to cooperate with various partners, and mingle in different ecosystems, therefore bridging the gap between various banks. However, fintechs are not the weak partner in the industry. Consequently, the decision on how to interact with a fintech is difficult, because the integration of the fintech's value proposition from a bank's perspective is in the center. Thus, it is important for banks to understand the characteristics of bank-fintech interaction, and deciding on design parameters for the cooperation before granting fintechs derogatory access to the ecosystem.

Yet, research did not address the challenge of determining cooperation, and best practices on bank-fintech cooperation are absent. Nevertheless, from an academic and practical perspective, the understanding of such cooperation is important. To address this research gap, taxonomy development can serve as a suitable methodology. A taxonomy is a particular classification scheme that is often used to empirically or conceptually describe systems of groupings of objects (Nickerson et al. 2013) (for further details on the taxonomy development methodology, please cf., Section 3). Drasch et al. (2018) address the aforementioned challenge by developing a theoretically founded and empirically grounded taxonomy to structure cooperation between incumbents and start-ups in the financial services industry (cf., Appendix B.4). The taxonomy bases on the meta-characteristic of design parameters for bank-fintech cooperation in the context of innovation capability enhancement (Drasch et al. 2018). It utilizes existing literature, 136 real-world cases, and 12 expert interviews, and results in a taxonomy of 13 relevant dimensions encompassing 106 characteristics. Additionally, the empirical examination based on the real-world cases allows identifying prevailing cooperation patterns. Table 3 visualizes the resulting taxonomy.

Table 3. Taxonomy for bank-fintech cooperation to enhance technology innovation (own representation based on Bachmann, Drasch, Fridgen et al. 2019)

	Dimensions	Characteristics				
Cooperation	Cooperation type	Acquisition (7)	Alliance (119)	Incubation (9)	Joint venture (1)	
	Innovation type	Bank-to-customer process (22)	Customer-to-customer process (16)	Product (98)		
	Maturity of innovation	Introduction / Uncoordinated (28)	Growth / Segmental (105)	Maturity / Systemic (3)		
	Value chain location	Customer common interface (21)	Channel solutions and interaction platforms (21)	Customer-oriented financial market infrastructure (54)	Core banking systems (37)	Financial market infrastructure
	Business ecosystem	Restricted by bank (24)	Restricted by fintech (90)	Restricted by both (20)	No restriction (2)	
	Innovation holder	Fintech (125)	Bank (11)			
Bank	Bank type	Commercial bank (119)	Cooperative bank (14)	Savings bank (3)		
	The bank's main distribution channel	Branches (83)	Online (53)			
	The bank's role	Services provider (64)	Services consumer (28)	Investor (44)		
	The bank's strategic objective	Market access (57)	Technology access (79)			
Fintech	Category of fintech	API and infrastructure (16)	Cross-product services (20)	Current account (7)		
		Lending (23)	Payment (39)	Investing (30)	Insurance (1)	
	The fintech's maturity	Startup (33)	Emerging growth (98)	Mature stage (5)		
	Fintech holding a full banking license	Yes (3)	No (133)			

The proposed taxonomy enables banks to analyze the complex task of cooperating with fintechs, and vice versa. By comparing the target system of a bank to examples from the real-world cases, the bank is able to determine characteristics on how to design the cooperation. Additionally, our findings enhance theory of fintechs, their integration into the banking sector, and cross-organizational cooperation. Further, this paper has a practical implication. In the context of platform-based ecosystems, the taxonomy is a potential first step to analyze the dynamics of cross-organizational cooperation. More generally, the research paper suggests dimensions and characteristics that distinguish various bank-fintech cooperation patterns. The basic idea remains the integration of the innovation. Yet, since many fintechs have become de facto confident market players, banks still need to identify an appropriate pathway to integrate the troublemakers, and to adapt their ecosystem accordingly.

6. Monitoring Customer Interaction in Platform-Based Ecosystem

User interaction is a key purpose of platform-based ecosystems (cf., Section 2), but inhibits certain risks. This Section explains the risks resulting from user interaction and the acceleration role that platform characteristics play in this context. Further, this Section proposes a way to monitor such user interaction.

6.1. RISKS FOR ORGANIZATIONS FROM USER INTERACTION IN ECOSYSTEMS

As described above, organizations participate in ecosystems to create value. One aspect of value creation is through user interaction, which in many cases takes place on platforms within the ecosystem. As a result, users play a key role in the value creation for organizations in platform-based ecosystems (Hanna et al. 2011). With the origin of social networks like Facebook and Instagram, novel features increasingly enabled the digital co-creation process through user interaction in general (e.g., creation of profile pages, user connections, user content) (Cormode and Krishnamurthy 2008). Today, social media platforms are predominant in ecosystems for communication and interaction between companies and users, as well as among customers themselves (Goh et al. 2013; Kietzmann et al. 2011). Prior literature identified different categories of such platforms: (Micro-)blogs, online social networks (often also called social networking sites), virtual social worlds, collaborative products, content communities, and virtual game worlds (Kaplan and Haenlein 2010). Taking their common characteristics into account, social media platforms are a "[...] group of internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content" (Kaplan and Haenlein 2010, p. 61).

In the context of ecosystems and the interaction between their participants, online reviews, ratings, and critiques of users are the most important source of information for the search of products and services (Chen and Xie 2008; Dellarocas 2003; Dellarocas et al. 2007; Moon et al. 2010). This so-called electronic word-of-mouth (eWOM) puts platforms into a particularly important position in companies' marketing communications (Albuquerque et al. 2012; Faase et al. 2011; Forman et al. 2008). Companies even support the engagement of customer-to-customer interactions in their platform-based ecosystems (Harris and Dennis 2011; Poynter 2008). Indeed, prior research emphasized on the positive effects of eWOM for creating business value (e.g., Goes 2013; Moe and Trusov 2011; Rishika et al. 2013).

However, user generated eWOM can also entail risks for organizations. This is the case when users generate eWOM to share negative experience related to a specific organization, or to a certain product or service. The reasons for negative eWOM are manifold: In some cases, the organization or one of its employees made a mistake. In other cases, a misconception in the organization-to-user interaction occurred. Maybe, a product disappointed some customer's expectation. All of these reasons happen frequently and do not result from ecosystems, platforms, or digital technology. Nevertheless, platforms in ecosystems facilitate the spread of negative eWOM to other users, and therefore can directly affect an unforeseeable number of other users. The following Subsection puts the spread of eWOM and the characteristics of platforms into context.

6.2. THE ROLE OF PLATFORM CHARACTERISTICS IN THE WORST-CASE

van Dijck and Poell (2014) theorize on the grounding principles of social media platforms, which are programmability, popularity, datafication, and connectivity. *Programmability* is defined as the "ability of a social media platform to trigger and steer users' creative or communicative contribution, while users, through their interaction with these coded environments, may in turn influence the flow of communication and information activated by such platform" (van Dijck and Poell 2014, p. 5). The platforms algorithms and socio-economic components condition *popularity*. Both can be used to influence or manipulate (van Dijck and

Poell 2014). In contrast to the early reputation that social media is more egalitarian, its filtering became more sophisticated (van Dijck and Poell 2014). *Datafication* is the ability to render many aspects such as relationships, music, preferences, or GPS-locations into data (Mayer-Schönberger and Cukier 2014). Datafication enables platforms to know their users, and accordingly apply real-time and predictive measures to fine-tune advertising effectiveness (van Dijck and Poell 2014). *Connectivity* is defined as "the socio-technical affordance of networked platforms to connect content to user activities and advertisers" (van Dijck and Poell 2014, p. 8). Connectivity is distinct from spreadibility, which recognizes the "importance of social connections among individuals" (Jenkins et al. 2018, p. 6). However, platforms merely amplify the connections between individuals. Connectivity instead allows the forming of fan groups, communities, and even alliances. On social media platforms, the underlying network is based on these technical features that allow users to build online relationships with many other users (e.g., Facebook friends) and communicate intensively among one another (e.g., via wallposts and comments in Facebook). As a result, users form dense network clusters (Benevenuto et al. 2009; Mislove et al. 2007; Wilson et al. 2009). Within these clusters, the information flow is usually relatively constant and unrestrained. Consequently, an enormous number of people can be reached by eWOM within a short period of time (Pfeffer et al. 2014).

This also holds for negative eWOM. As a result, platforms accelerate and intensify the exposure of users to negative eWOM. Within minutes and hours, a single negative eWOM can reach hundreds of thousands of users, which may have the effect of other users tuning in, also sharing their negative experiences and therefore contributing to further spread of negative eWOM. In many famous examples, organizations such as Coca Cola, DELL, and others experienced such events. For very intense forms of such examples, practitioners and researchers coined the term "online firestorm", which can be defined as "[...] the sudden discharge of messages containing negative [e]WOM and complaint behavior against a person, company, or group in social media networks" (Pfeffer et al. 2014, p. 118). Typically, there is only a very short period of time until the next piece of information (Pfeffer et al. 2014), which supports the fast spread of information and provides the fuel for online firestorms (Drasch et al. 2015; Lotan 2012). This domino effect can lead to a general drop in customer satisfaction, and even affect organizations' share price (Drasch et al. 2015).

With the risk of thousands of (potential) customers being affected in a very short time, organizations need to take timely actions. Otherwise, if the emergence of an online firestorm is detected too late, the diffusion of negative eWOM cannot be stopped (Stich et al. 2014). Hence, monitoring user interaction and the general sentiment in ecosystems and respective platforms is crucial to avoid (in the best case) the actual outburst of an online firestorm. At least, organizations need to initiate countermeasures as soon as possible (e.g., by showing public regret and apologizing, cf., Munzel et al. 2012). Because of the rapid nature and huge volume of eWOM, automated, real-time detection approaches are necessary.

6.3. MONITORING CUSTOMER INTERACTION FOR RISK MITIGATION

To enable organizations to monitor customer interaction, Drasch et al. (2015) develop an online firestorm detector using design science research that allows organizations the early identification of online firestorms (cf., Appendix B.5). The proposed approach enables to monitor and detect the raise of positive or negative sentiment by utilizing the characteristics of diffusing information and anomaly detection. The detector comprises three steps: In the first step, the detector monitors social media channels and collects eWOM. In the second step, the detector analyses the collected eWOM according to its sentiment. In the third step, the detector conducts anomaly detection, which is inspired by an algorithm from epidemiological surveillance (Farrington et al. 1996; Noufaily et al. 2013). Figure 5 visualizes the three-step development approach of the online firestorm detector.

Figure 5. Three-step approach of the Online Firestorm Detector (own representation based on Drasch et al. 2015)

The resulting artefact allows organizations to monitor user-generated eWOM and to react timely to negative eWOM. In ecosystems where organizations crowd users and their customers around them, this can be a great advantage to meet the risks of user interaction. As a result, it enables organizations to ensure they realize when problems arise. In the context of ecosystems, this is very important since the emergence of online firestorms contradicts the efforts of organizations.

7. CONCLUSION

7.1. SUMMARY

In today's digital world, platform-based ecosystems are central for the online interaction between organizations and users. Therefore, organizations need to manage ecosystems, and position themselves with respect to other participants. The objective of organizations is to develop ecosystems that suit their requirements, to incentivize organizations and users to participate within them, to cooperate with other participants in order to create value, and to monitor the ecosystem to detect negative advancements. This requires novel approaches to manage platform-based ecosystems. The doctoral thesis at hand provides an overview of platform-based ecosystems and the participants within them, and proposes novel approaches inspired by research methods. After providing general insights in Sections 1 and 2, these approaches divide the doctoral thesis into five parts.

The first part discusses the development of novel ecosystems. ICOs introduce new pathways to start such development. However, ICOs require multilayered decisions, for which both, research and practice, have not yet developed supportive measures. In order to support the decision-making, this thesis presents a taxonomy of design parameters for ICOs. Further, the taxonomy and real-world cases serve as basis for a clustering algorithm to determine predominant ICO archetypes. These archetypes are guidance for other organizations considering an ICO. Thus, this work provides insights to the phenomenon of ICOs, and suggests a theoretically founded methodology to structure and analyze unknown phenomena.

The second part focuses on user incentives for ecosystem participation. Ecosystems have the particular problem that users have little incentives to join at an early stage, which hampers ecosystem development (e.g., telephone landline, chicken and egg problem). ICOs seem to be an alternative that provides an additional financial incentive for early ecosystem participation. In order to investigate this phenomenon, this doctoral thesis introduces a two-step approach and analyzes the financial incentive related to ICOs. The results suggest refraining from the presumption of the financial incentive, and propose a different finding. Moreover, it is important to carefully weigh and design incentives for platform participation. Thus, this work provides insights to the financial incentive and urges practitioners to consider cautiously the incentives behind an ICO.

The third part engages with cooperation between organizations in ecosystems. Inter-organizational cooperation in ecosystems requires management attention in order to balance cooperation and competition at a target-aimed level. Ecosystems require a structured approach on cooperation, especially where new organizations enter and cooperation is absolutely necessary and inevitable. For this purpose, this doctoral thesis provides a taxonomy to analyze existing forms of cooperation. This taxonomy enables practitioners to structure inter-organizational cooperation, before deciding between different alternatives.

The fourth part discusses the necessity to monitor user interaction in ecosystems. Although organizations encourage interaction between ecosystem participants to benefit, the technical characteristics of platform-based ecosystems can depict a risky drawback. Unintentional mistakes or even misunderstandings can become a boomerang when negative eWOM spreads across such ecosystems. As resulting effects can be serious, monitoring and timely identification of raising online firestorms are necessary. For this purpose, this doctoral thesis proposes an online firestorm detector to monitor user generated eWOM. The detector enables organizations to monitor interaction effectively within ecosystems, and enriches existing research on the dark side of eWOM and its diffusion.

In summary, this thesis provides guidance on the development of approaches to manage platform-based ecosystems, and on how organizations are able to utilize these approaches. The thesis contributes to the scientific discourse by building upon existing research and designing new artefacts, which address previously identified, relevant research gaps in today's society. Moreover, this work supports practitioners by providing novel approaches to manage platform-based ecosystems.

7.2. LIMITATIONS AND FUTURE RESEARCH

The research articles underlying this doctoral thesis are subject to limitations. This subsection does not reiterate the individual limitations of each artefact, but provides an aggregated overview of the thesis' limitations, and gives an outlook on further research towards platform-based ecosystems.

This thesis addresses engineering oriented aspects of IS research. In this context, it develops artefacts, e.g., by applying design science research, or taxonomy development. These artefacts deal with specific challenges that arise from participating in ecosystems, namely the development of ecosystems, incentives for participating in ecosystems, cooperating in ecosystems, and monitoring of ecosystems. The development of the artefacts follows a certain practically relevant problem, and focuses on its solution. Further, the evaluation of the artefacts takes place in the narrow problem context and bases on the respective data. As a result, the solution is not necessarily applicable in other or general contexts. Yet, an artefact is the first important step towards the development of higher order theory, where the artefact's full potential can be utilized. Therefore, further empirical investigations, theoretical modelling and real-world experiments to validate the results are necessary.

In addition, the addressed approaches to manage ecosystems require a holistic discussion and an interdisciplinary perspective from various research disciplines. This thesis captures an IS perspective and applies methods and knowledge in this regard. Thus, it makes a first step by proposing the aforementioned approaches. To further understand and fully analyze ecosystems and their platform-based nature, there is a fundamental need for a transdisciplinary dialog with the involvement of researchers, practitioners, and politicians.

The objective for future development of ecosystems is manifold: First, further market penetration of artificial intelligence, blockchain, and internet-of-things will certainly influence "daily life" in platform-based ecosystems. Examples are the interaction with artificially intelligent participants in ecosystems, the discussion on blockchain-enabled neutral platforms, or the results from interconnected things on ecosystems. Research needs to address the opportunities, challenges, and changes that these changes bring to platform-based ecosystems.

Second, research on ecosystem development and design objectives is scarce. Nevertheless, this question is among the central ones when starting to develop an ecosystem. Third, research addressing competition within ecosystems has not yet reached its full potential. However, many organizations consider entering into competing ecosystems for the sake of growing their market share. When alien organizations enter an ecosystem, organizations need to take countermeasures. However, the identification of such countermeasures from a researcher's perspective is absent.

By developing and proposing novel approaches to manage ecosystems, future research should focus on practically relevant problems, and transfer research methods to enable solution development. In the context of the development of novel ecosystems, research should build on the taxonomy and archetypes derived in Drasch et al. (2018). More insights about implications from design decisions in ecosystem development are necessary, as well as further knowledge on predominant patterns. For example, an in-depth analysis of ecosystem characteristics with respect to the chosen archetype or a long-term analysis on success factors within such ecosystems would greatly benefit future knowledge development. In the context of ecosystem participation and its incentives, more analysis is necessary on how to solve the chicken and egg problem. Since ICOs are supposed to be a promising approach, the results of Drasch et al. (2019) can serve as a suitable starting point. In the context of ecosystem cooperation between organizations, the taxonomy of Drasch et al. (2018), proposes a first structure for the case between banks and fintechs. The taxonomy opens a variety of research opportunities, such as specific case studies, or empirical performance analysis. In the context of ecosystem monitoring, Drasch et al. (2015) consider the dark side of ecosystems, e.g., the risk from negative eWOM. Here, further analysis of countermeasures, timely reaction, and specific case studies is necessary to understand how to react in these events.

7.3. Acknowledgement of Previous Work

The research underlying this doctoral thesis integrates in the research stream conducted by employees at the FIM Research Center and the Project Group Business and Information Systems Engineering of the Fraunhofer Institute for Applied Information Technology (FIT). Thus, this Section points out how the research papers underlying this doctoral thesis builds on the previous work of these organizations in research on ecosystems, blockchain, and IT portfolio management.

Research on ecosystems started with the topic of cloud computing, which is considered in several papers, especially Dorsch and Häckel (2014), Keller, Häfner et al. (2019), König (2014), Keller and König (2014), and König et al. (2013). Additionally, the contribution of Keller, Oesterle et al. (2018), Keller, Röhrich et al. (2019), and Keller (2018) in the realm of platform-based ecosystems inspired the outline of the thesis at hand. Further, research in the context of IT governance has set the pathway for this doctoral thesis, especially Buhl et al. (2013), Fridgen et al. (2015), Fridgen and Mueller (2009, 2011), Urbach et al. (2013), Urbach and Würz (2012), Zare Garizy et al. (2018), Keller and König (2014), and Keller, Schott et al. (2018). Although only marginally included in this thesis, research on IT project management and IT project portfolio management and the work of Buhl (2012), Beer et al. (2013), Beer et al. (2015), Fridgen and Zare Garizy (2015), Fridgen et al. (2015), Keller (2016), Keller, Schott et al. (2018), Neumeier et al. (2018), Radszuwill and Fridgen (2017), and Wolf (2015) inspired some of the thoughts and ideas included herein. Although blockchain is only a very young phenomenon, the underlying research papers follow an established stream of research of the aforementioned organizations, such as Fridgen, Radszuwill and Schweizer (2018), Fridgen, Radszuwill, Urbach et al. (2018), Fridgen, Regner et al. (2018), Kremser et al. (2019), Schlatt et al. (2016), and Schweizer et al. (2017). Thus, this thesis fits well with this preceding work, continuing successful research streams relating to ecosystems and IT portfolio management, and contributing to relatively new streams of future work such as blockchain research.

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The doctoral thesis at hand bases on five research papers (cumulative thesis / cumulative dissertation). These papers are the result of collaborative work between various authors (for the declaration of authorship, please cf., Appendix A). Some of the research papers are already published at the finalization of this doctoral thesis; others are in the reviewing process. For the published research papers, please confer to the publishing outlets for the entire manuscript (for the reference of published and unpublished research papers, please cf., Appendix B). In order not to violate future publication rights, extended abstracts for all of the research papers are included in Appendix B of this doctoral thesis. Several passages of the following Sections have been compiled in the context of the following publications and working papers: Bachmann, Drasch, Fridgen et al. (2019), Bachmann, Drasch, Miksch et al. (2019), Drasch et al. (2019), Drasch et al. (2015), Drasch et al. (2018), Fridgen, Regner et al. (2018). To improve readability of the text, I omit the standard labeling of these citations.

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REFERENCES

Adhami, S., Giudici, G., & Martinazzi, S. (2018). Why do businesses go crypto? An empirical analysis of initial coin offerings. *Journal of Economics and Business, 100,* 64–75. doi:10.1016/j.jeconbus.2018.04.001

Adner, R. (2017). Ecosystem as Structure. *Journal of Management, 43*(1), 39–58. doi:10.1177/0149206316678451

Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal, 31*(3), 306–333. doi:10.1002/smj.821

Albuquerque, P., Pavlidis, P., Chatow, U., Chen, K.-Y., & Jamal, Z. (2012). Evaluating Promotional Activities in an Online Two-Sided Market of User-Generated Content. *Marketing Science, 31*(3), 406–432. doi:10.1287/mksc.1110.0685

Anker, T. B., Sparks, L., Moutinho, L., & Grönroos, C. (2015). Consumer dominant value creation: A theoretical response to the recent call for a consumer dominant logic for marketing. *European Journal of Marketing, 49*(3/4), 532–560. doi:10.1108/EJM-09-2013-0518

Bachmann, N., Drasch, B. J., Fridgen, G., Miksch, M., Regner, F., Schweizer, A., & Urbach, N. (2019). Tarzan and Chain: Exploring the ICO Jungle and Evaluating Design Archetypes. *Working paper*.

Bachmann, N., Drasch, B. J., Miksch, M., & Schweizer, A. (2019). Dividing the ICO Jungle: Extracting and Evaluating Design Archetypes. *Proceedings of the 14th International Conference on Wirtschaftsinformatik, Siegen, Germany*.

Baldwin, C. J., & Woodard, J. (2009). The Architecture of Platforms: A Unified View. In A. Gawer (Ed.), *Platforms, Markets and Innovation* (pp. 19–44). Cheltenham, UK: Edward Elgar Publishing.

Baldwin, C. Y. (2015). Bottlenecks, Modules and Dynamic Architectural Capabilities. *Harvard Business School*(Finance Working Paper No. 15-028). doi:10.2139/ssrn.2512209

Balijepally, V., Mangalaraj, G., & Iyengar, K. (2011). Are we wielding this hammer correctly? A reflective review of the application of cluster analysis in information systems research. *Journal of the Association for Information Systems, 12*(5), 375–413.

Banker, Bardhan, Chang, & Lin. (2006). Plant Information Systems, Manufacturing Capabilities, and Plant Performance. *MIS quarterly, 30*(2), 315–337. doi:10.2307/25148733

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management, 17*(1), 99–120. doi:10.1177/014920639101700108

Beck, R., Stenum Czepluch, J., Lollike, N., & Malone, S. (2016). Blockchain–the gateway to trust-free cryptographic transactions. *Proceedings of the 24th European Conference on Information Systems, Istanbul, Turkey*.

Beer, M., Fridgen, G., Mueller, H.-V., & Wolf, T. (2013). Benefits Quantification in IT Projects. *Proceedings of the 11th International Conference on Wirtschaftsinformatik, Leipzig, Germany*.

Beer, M., Wolf, T., & Zare Garizy, T. (2015). Systemic risk in IT portfolios–an integrated quantification approach. *Proceedings of the 36th International Conference on Information Systems, Fort Worth, Texas, USA*.

Benevenuto, F., Rodrigues, T., Cha, M., & Almeida, V. (2009). Characterizing user behavior in online social networks. In *Proceedings of the 9th ACM SIGCOMM conference on Internet measurement conference* (pp. 49–62).

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: toward a next generation of insights. *MIS quarterly, 37*(2), 471–482.

Bishop, C. M. (2006). *Pattern recognition and machine learning*. New York, NY, USA: springer.

Boreiko, D., & Sahdev, N. K. (2018). To ICO or not to ICO – Empirical analysis of Initial Coin Offerings and Token Sales. *SSRN Electronic Journal*. doi:10.2139/ssrn.3209180

Boudreau, K. (2010). Open Platform Strategies and Innovation: Granting Access vs. Devolving Control. *Management Science, 56*(10), 1849–1872. doi:10.1287/mnsc.1100.1215

Buhl, H. U. (2012). The Contribution of Business and Information Systems Engineering to the Early Recognition and Avoidance of “Black Swans” in IT Projects. *Business & Information Systems Engineering, 4*(2), 55–59. doi:10.1007/s12599-012-0206-8

Buhl, H. U., Fridgen, G., & König, C. (2013). Using financial derivatives to hedge against market risks in IT outsourcing projects – a quantitative decision model. *Journal of Decision Systems, 22*(4), 249–264. doi:10.1080/12460125.2013.834680

Burnett, G. (2000). Information exchange in virtual communities: a typology. *Information research, 5*(4).

Buterin, V. (2014). *A next-generation smart contract and decentralized application platform*. Retrieved from https://cryptorating.eu/whitepapers/Ethereum/Ethereum_white_paper.pdf

Caillaud, B., & Jullien, B. (2003). Chicken & Egg: Competition among Intermediation Service Providers. *The RAND Journal of Economics, 34*(2), 309–328. doi:10.2307/1593720

Casaló, L., Flavián, C., & Guinalíu, M. (2007). The impact of participation in virtual brand communities on consumer trust and loyalty. *Online Information Review, 31*(6), 775–792. doi:10.1108/14684520710841766

Ceccagnoli, M., Forman, C., Huang, P., & Wu, D. J. (2011). Co-creation of value in a platform ecosystem: The case of enterprise software. *MIS quarterly, 36*(11), 263–290.

Chandy, R. K., & Tellis, G. J. (2000). The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation. *Journal of Marketing, 64*(3), 1–17. doi:10.1509/jmkg.64.3.1.18033

Chanson, M., Risius, M., & Wortmann, F. (2018). Initial Coin Offerings (ICOs): An Introduction to the Novel Funding Mechanism Based on Blockchain Technology. *Proceedings of the 24th Americas Conference on Information Systems, New Orleans, Louisiana*.

Chen, Y., & Xie, J. (2008). Online Consumer Review: Word-of-Mouth as a New Element of Marketing Communication Mix. *Management Science, 54*(3), 477–491. doi:10.1287/mnsc.1070.0810

Chishti, S., & Barberis, J. (Eds.). (2016). *The Fin Tech Book: The financial technology handbook for investors, entrepreneurs and visionaries*. Chichester: John Wiley & Sons Ltd.

Civic.com. (2019). *Civic Secure Identity Ecosystem*. Retrieved from https://www.civic.com/

Clark, K. B. (1985). The interaction of design hierarchies and market concepts in technological evolution. *Research Policy, 14*(5), 235–251. doi:10.1016/0048-7333(85)90007-1

Conley, J. P. (2017). Blockchain and the economics of crypto-tokens and initial coin offerings. *Vanderbilt University Department of Economics Working Papers*(17-00008).

Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Introduction—Platforms and Infrastructures in the Digital Age. *Information Systems Research, 29*(2), 381–400. doi:10.1287/isre.2018.0794

Cormode, G., & Krishnamurthy, B. (2008). Key differences between Web 1.0 and Web 2.0. *First Monday, 13*(6). doi:10.5210/fm.v13i6.2125

Cortada, J. (2019). *Lessons from IBM for Google, Amazon and Facebook*. Retrieved from https://theconversation.com/lessons-from-ibm-for-google-amazon-and-facebook-111716

Cusumano, M. A., & Gawer, A. (2002). The elements of platform leadership. *MIT Sloan management review, 43*(3), 51.

Dapp, T. (2014). *Fintech–The digital (r) evolution in the financial sector*. Frankfurt am Main. Retrieved from Deutsche Bank Research website: http://www.dbresearch.com/PROD/RPS_EN-PROD/PROD0000000000451941/Fintech_%E2%80%93_The_digital_%28r%29evolution_in_the_financia.pdf

Dapp, T. (2015). *Fintech reloaded–Traditional banks as digital ecosystems: With proven walled garden strategies into the future*. Frankfurt am Main. Retrieved from Deutsche Bank Research website: https://www.dbresearch.com/PROD/RPS_EN-PROD/PROD0000000000451937/Fintech_reloaded_%D0_Traditional_banks_as_digital_ec.PDF

Das, T. K., & Teng, B.-S. (2000). A resource-based theory of strategic alliances. *Journal of Management, 26*(1), 31–61. doi:10.1016/S0149-2063(99)00037-9 de Reuver, M. de, Sørensen, C., & Basole, R. C. (2018). The Digital Platform: A Research Agenda. *Journal of Information Technology, 33*(2), 124–135. doi:10.1057/s41265-016-0033-3

Dellarocas, C. (2003). The Digitization of Word of Mouth: Promise and Challenges of Online Feedback Mechanisms. *Management Science, 49*(10), 1407–1424. doi:10.1287/mnsc.49.10.1407.17308

Dellarocas, C., Zhang, X., & Awad, N. F. (2007). Exploring the value of online product reviews in forecasting sales: The case of motion pictures. *Journal of Interactive Marketing, 21*(4), 23–45. doi:10.1002/dir.20087

Dierickx, I., & Cool, K. (1989). Asset Stock Accumulation and Sustainability of Competitive Advantage. *Management Science, 35*(12), 1504–1511. doi:10.1287/mnsc.35.12.1504

Dorsch, C., & Häckel, B. (2014). Combining models of capacity supply to handle volatile demand: The economic impact of surplus capacity in cloud service environments. *Decision Support Systems, 58,* 3–14. doi:10.1016/j.dss.2013.01.011

Drasch, B. J., Fridgen, G., Manner-Romberg, T., Nolting, F., & Radszuwill, S. (2019). The Token's Secret: The tow-faced Financial Incentive of the Token Economy. *Working paper.*

Drasch, B. J., Huber, J., Panz, S., & Probst, F. (2015). Detecting Online Firestorms in Social Media. *Proceedings of the 36th International Conference on Information Systems, Fort Worth, Texas, USA.*

Drasch, B. J., Schweizer, A., & Urbach, N. (2018). Integrating the 'Troublemakers': A taxonomy for cooperation between banks and fintechs. *Journal of Economics and Business, 100,* 26–42.

Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review, 23*(4), 660–679. doi:10.5465/amr.1998.1255632

Eaton, B., Elaluf-Calderwood, S., Sørensen, C., & Yoo, Y. (2015). Distributed Tuning of Boundary Resources: The Case of Apple's iOS Service System. *MIS quarterly, 39*(1), 217–243. doi:10.25300/MISQ/2015/39.1.10

Eisenmann, T., Parker, G., & van Alstyne, M. (2009). Opening platforms: How, when, and why? In A. Gawer (Ed.), *Platforms, Markets and Innovation* (pp. 131–162). Cheltenham, UK: Edward Elgar Publishing.

Eisenmann, T., Parker, G., & van Alstyne, M. (2011). Platform envelopment. *Strategic Management Journal, 32*(12), 1270–1285. doi:10.1002/smj.935

Eisenmann, T., Parker, G., & van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard business review, 84*(10).

El Sawy, O. A. (2003). The IS Core IX: The 3 Faces of IS Identity: Connection, Immersion, and Fusion. *Communications of the Association for Information Systems, 12,* 588–598. doi:10.17705/1CAIS.01239

Ettlie, J. E., & Pavlou, P. A. (2006). Technology-Based New Product Development Partnerships. *Decision Sciences, 37*(2), 117–147. doi:10.1111/j.1540-5915.2006.00119.x

Evans, D. S. (2014). Economic aspects of bitcoin and other decentralized public-ledger currency platforms. *University of Chicago Coase-Sandor Institute for Law & Economics Research Paper*(685).

Evans, D. S., & Schmalensee, R. (2002). Some economic aspects of antitrust analysis in dynamically competitive industries. *Innovation Policy and the Economy, 2.*

Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011). *Cluster Analysis*. Chichester, UK: John Wiley & Sons, Ltd.

Faase, R., Helms, R., & Spruit, M. (2011). Web 2.0 in the CRM domain: defining social CRM. *International Journal of Electronic Customer Relationship Management, 5*(1), 1–22. doi:10.1504/IJECRM.2011.039797

Fagerberg, J. (2005). Innovation: A guide to the literature. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *The Oxford handbook of innovations* . Oxford University Press.

Farrell, J. v. R., & Saloner, G. (1984). Standardization, compatibility and innovation. *The RAND Journal of Economics, 16*(1), 70–83.

Farrington, C. P., Andrews, N. J., Beale, A. D., & Catchpole, M. A. (1996). A Statistical Algorithm for the Early Detection of Outbreaks of Infectious Disease. *Journal of the Royal Statistical Society, 159*(3), 547–563. doi:10.2307/2983331

Fishcoin.io. (2018). *Fishcoin: A Blockchain Based Data Ecosystem For The Global Seafood Industry*. Retrieved from https://fishcoin.co/files/fishcoin.pdf

Forman, C., Ghose, A., & Wiesenfeld, B. (2008). Examining the Relationship Between Reviews and Sales: The Role of Reviewer Identity Disclosure in Electronic Markets. *Information Systems Research, 19*(3), 291–313. doi:10.1287/isre.1080.0193

Fridgen, G., Guggenberger, N., Hoeren, T., Prinz, W., & Urbach, N. (2019). *Chancen und Herausforderungen von DLT (Blockchain) in Mobilität und Logistik*. Retrieved from Fraunhofer-Institut für Angewandte Informationstechnik FIT website: https://www.fit.fraunhofer.de/en/fb/wirtschaftsinformatik.html

Fridgen, G., Klier, J., Beer, M., & Wolf, T. (2015). Improving Business Value Assurance in Large-Scale IT Projects—A Quantitative Method Based on Founded Requirements Assessment. *ACM Transactions on Management Information Systems, 5*(3), 1–17. doi:10.1145/2638544

Fridgen, G., Lockl, J., Radszuwill, S., Rieger, A., Schweizer, A., & Urbach, N. (2018). A solution in search of a problem: a method for the development of blockchain use cases. *Proceedings of the 24th Americas Conference on Information Systems, New Orleans, Louisiana, USA*.

Fridgen, G., & Mueller, H.-V. (2009). Risk/cost valuation of fixed price IT outsourcing in a portfolio context. *Proceedings of the 30th International Conference on Information Systems, Phoenix, Arizon, USA*.

Fridgen, G., & Mueller, H.-V. (2011). An Approach for Portfolio Selection in Multi-Vendor IT Outsourcing. *Proceedings of the 32nd International Conference on Information Systems, Shanghai, China*.

Fridgen, G., Radszuwill, S., & Schweizer, A. (2018). Blockchain Won't Kill the Banks: Why Disintermediation Doesn't Work in International Trade Finance. *Working paper*.

Fridgen, G., Radszuwill, S., Urbach, N., & Utz, L. (2018). Cross-organizational workflow management using blockchain technology-towards applicability, auditability, and automation. *Proceedings of the 51st Hawaiin International Conference on System Sciences, Waikoloa, Hawaii, USA*.

Fridgen, G., Regner, F., Schweizer, A., & Urbach, N. (2018). Don't Slip on the Initial Coin Offering (ICO): A Taxonomy for a Blockchain-enabled Form of Crowdfunding. *Proceedings of the 26th European Conference on Information Systems, Portsmouth, England*.

Fridgen, G., & Zare Garizy, T. (2015). Supply Chain Network Risk Analysis-A Privacy Preserving Approach. *Proceedings of the 23rd European Conference on Information Systems, Münster, Germany*.

Frow, P., Nenonen, S., Payne, A., & Storbacka, K. (2015). Managing Co-creation Design: A Strategic Approach to Innovation. *British Journal of Management, 26*(3), 463–483. doi:10.1111/1467-8551.12087

Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy, 43*(7), 1239–1249. doi:10.1016/j.respol.2014.03.006

Gawer, A., & Cusumano, M. A. (2002). *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation*. Boston, Massachusetts, USA: Harvard Business School Press.

Gawer, A., & Cusumano, M. A. (2014). Industry Platforms and Ecosystem Innovation. *Journal of Product Innovation Management, 31*(3), 417–433. doi:10.1111/jpim.12105

Ghazawneh, A., & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: the boundary resources model. *Information Systems Journal, 23*(2), 173–192. doi:10.1111/j.1365-2575.2012.00406.x

Gimpel, H., Hosseini, S., Huber, R., Probst, L., Röglinger, M., & Faisst, U. (2018). Structuring digital transformation: a framework of action fields and its application at ZEISS. *Journal of Information Technology Theory and Application, 19*(1), 31–54.

Glaser, F., & Bezzenberger, L. (2015). Beyond cryptocurrencies-a taxonomy of decentralized consensus systems. *Proceedings of the 23rd European Conference on Information Systems, Münster, Germany*.

Glaser, F. (2017). Pervasive decentralisation of digital infrastructures: a framework for blockchain enabled system and use case analysis. *Proceedings of the 50th Hawaii International Conference on Information Systems, Waikoloa Village, Hawaii.*

Glass, R. L., & Vessey, I. (1995). Contemporary application-domain taxonomies. *IEEE Software, 12*(4), 63–76. doi:10.1109/52.391837

Goes, P. B. (2013). Editor's comments: information systems research and behavioral economics. *MIS quarterly, 37*(3), iii–viii.

Goh, K.-Y., Heng, C.-S., & Lin, Z. (2013). Social Media Brand Community and Consumer Behavior: Quantifying the Relative Impact of User- and Marketer-Generated Content. *Information Systems Research, 24*(1), 88–107. doi:10.1287/isre.1120.0469

Greer, C. R., Lusch, R. F., & Vargo, S. L. (2016). A service perspective. *Organizational Dynamics, 45*(1), 28–38. doi:10.1016/j.orgdyn.2015.12.004

Gregor, S. (2006). The Nature of Theory in Information Systems. *MIS quarterly, 30*(3), 611–642. doi:10.2307/25148742

Grönroos, C. (2011). Value co-creation in service logic: A critical analysis. *Marketing Theory, 11*(3), 279–301. doi:10.1177/1470593111408177

Gyrd-Jones, R. I., & Kornum, N. (2013). Managing the co-created brand: Value and cultural complementarity in online and offline multi-stakeholder ecosystems. *Journal of Business Research, 66*(9), 1484–1493. doi:10.1016/j.jbusres.2012.02.045

Haas, P., Blohm, I., & Leimeister, J. M. (2014). An empirical taxonomy of crowdfunding intermediaries. *Proceedings of the 35th International Conference on Information Systems, Auckland, New Zealand.*

Hagiu, A., & Wright, J. (2015). Multi-sided platforms. *International Journal of Industrial Organization, 43,* 162–174. doi:10.1016/j.ijindorg.2015.03.003

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2009). *Multivariate Data Analysis* (Seventh edition). New Jersey, USA: Person.

Hanna, R., Rohm, A., & Crittenden, V. L. (2011). We're all connected: The power of the social media ecosystem. *Business Horizons, 54*(3), 265–273. doi:10.1016/j.bushor.2011.01.007

Hannah, D. P., & Eisenhardt, K. M. (2018). How firms navigate cooperation and competition in nascent ecosystems. *Strategic Management Journal, 39*(12), 3163–3192. doi:10.1002/smj.2750

Hans, R., Zuber, H., Rizk, A., & Steinmetz, R. (2017). Blockchain and Smart Contracts: Disruptive Technologies for the Insurance Market. *Proceedings of the 23rd American Conference on Information Systems, Boston, Massechusetts, USA.*

Harris, L., & Dennis, C. (2011). Engaging customers on Facebook: Challenges for e-retailers. *Journal of Consumer Behaviour, 10*(6), 338–346. doi:10.1002/cb.375

Haverans, R. (2019). *TOP 12 REAL-WORLD DIGITAL TRANSFORMATION SUCCESS STORIES*. Retrieved from Brainbridge website: https://www.brainbridge.be/news/top-12-real-world-digital-transformation-success-stories

Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016). Options for formulating a digital transformation strategy. *MIS Quarterly Executive, 15*(2), 123–139.

Hevner, A. R. von, March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS quarterly, 28*(1), 75–105.

Huang, P., Ceccagnoli, M., Forman, C., & Wu, D. J. (2009). When do ISVs join a platform ecosystem? Evidence from the enterprise software industry. *Proceedings of the 30th International Conference on Information Systems, Phoenix, Arizona, USA.*

Iansiti, M., & Levien, R. (2004). *The keystone advantage: What the new dynamics of business ecosystems mean for strategy, innovation, and sustainability*. Boston, Massachusetts, USA: Harvard Business School Press.

Jenkins, H., Ford, S., & Green, J. (2018). *Spreadable media: Creating value and meaning in networked culture : with a new afterword. Postmillennial Pop: Vol. 15*. New York, New York, USA: New York University Press.

Kallinikos, J., Aaltonen, A., & Marton, A. (2013). The ambivalent ontology of digital artifacts. *MIS quarterly, 37*(2), 357–370.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons, 53*(1), 59–68. doi:10.1016/j.bushor.2009.09.003

Kapoor, R. (2014). Collaborating with complementors: What do firms do? In R. Adner, J. E. Oxley, & B. S. Silverman (Eds.), *Advances in Strategic Management: Vol. 30. Collaboration and competition in business ecosystems* (pp. 3–25). Bingley, United Kingdom: Emerald Group Publishing Limited.

Karimi, J., & Walter, Z. (2015). The Role of Dynamic Capabilities in Responding to Digital Disruption: A Factor-Based Study of the Newspaper Industry. *Journal of Management Information Systems, 32*(1), 39–81. doi:10.1080/07421222.2015.1029380

Karnjanaprakorn, M. (2017). *Token Network Effects: New business model for a decentralized web*. Retrieved from https://www.freecodecamp.org/news/token-network-effects-a-new-business-model-for-a-decentralized-web-6cde8b4e862/

Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *American economic review, 75*(3), 424–440.

Katz, M. L., & Shapiro, C. (1994). Systems Competition and Network Effects. *Journal of Economic Perspectives, 8*(2), 93–115. doi:10.1257/jep.8.2.93

Keller, R. (2016). Analyse von Risikomanagementstrategien in Cloudnetzwerken – Was tun bei verknüpften, voneinander abhängigen Cloud Services? *HMD Praxis der Wirtschaftsinformatik, 53*(5), 674–687. doi:10.1365/s40702-016-0252-7

Keller, R. (2018). *Cloud Networks as Platform-based Ecosystems. Detecting Management Implications for Actors in Cloud Networks* (Doctoral Thesis). Bayreuth University, Bayreuth.

Keller, R., Häfner, L., Sachs, T., & Fridgen, G. (2019). Data-Driven Decision Support on Temporal Flexibility of Cloud Computing Customers. *Business & Information Systems Engineering, Forthcoming*.

Keller, R., & König, C. (2014). A reference model to support risk identification in cloud networks. *Proceedings of the 35th International Conference on Information Systems, Auckland, New Zealand*.

Keller, R., Oesterle, S., Urbach, N., & Xin, Y. (2018). Keeping Control in the Cloud – Developing and Validating a Framework for Managing Cloud Computing Providers, *Working paper*.

Keller, R., Röhrich, F., Schmidt, L., & Fridgen, G. (2019). Sustainability's Coming Home: Preliminary Design Principles for the Sustainable Smart District. *Proceedings of the 14th International Conference on Wirtschaftsinformatik, Siegen, Germany*.

Keller, R., Schott, P., & Fridgen, G. (2018). Platform of Platforms and Services: Bringing Flexible Electricity Demand to the Markets, *Working Paper*.

Ketchen, D. J., & Shook, C. L. (1996). The Application of cluster analysis in strategic management research: An analysis and critique. *Strategic Management Journal, 17*(6), 441–458. doi:10.1002/(SICI)1097-0266(199606)17:6<441::AID-SMJ819>3.0.CO;2-G

Ketchen, D. J., Thomas, J. B., & Snow, C. C. (1993). Organizational Configurations and Performance: A Comparison of Theoretical Approaches. *Academy of Management Journal, 36*(6), 1278–1313. doi:10.5465/256812

Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011). Social media? Get serious! Understanding the functional building blocks of social media. *Business Horizons, 54*(3), 241–251. doi:10.1016/j.bushor.2011.01.005

Kohli, R., & Grover, V. (2008). Business value of IT: An essay on expanding research directions to keep up with the times. *Journal of the Association for Information Systems, 9*(1), 23–39.

König, C., Mette, P., & Mueller, H.-V. (2013). Multivendor Portfolio Strategies In Cloud Computing. *Proceedings of the 21rd European Conference on Information Systems, Utrecht, Netherland*.

König, C. (2014). Gestaltungsspielräume bei Cloud Computing Investitionen. *HMD Praxis der Wirtschaftsinformatik, 51*(4), 494–505. doi:10.1365/s40702-014-0025-0

Kremser, T., Radszuwill, S., Schweizer, A., & Steffek, B. (2019). How do large stakes influence Bitcoin Performance? Evidence from the MT. GOX Liquidation case. *Proceedings of the 27th European Conference on Information Systems, Stockholm-Uppsala, Sweden*.

Laffan, L. (2012). A new way of measuring openness: The open governance index. *Technology Innovation Management Review, 2*(1), 18–24.

Lavie, D. (2006). The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View. *Academy of Management Review, 31*(3), 638–658. doi:10.5465/amr.2006.21318922

Leetaru, K. (2016). *Is Elon Musk Right And Will AI Replace Most Human Jobs?* Retrieved from https://www.forbes.com/sites/kalevleetaru/2016/11/08/is-elon-musk-right-and-will-ai-replace-most-human-jobs/#4308320760f4

Legner, C., Eymann, T., Hess, T., Matt, C., Böhmann, T., Drews, P., . . . Ahlemann, F. (2017). Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community. *Business & Information Systems Engineering, 59*(4), 301–308. doi:10.1007/s12599-017-0484-2

Lemieux, V. L. (2016). Trusting records: is Blockchain technology the answer? *Records Management Journal, 26*(2), 110–139. doi:10.1108/RMJ-12-2015-0042

Levy, J. (2014). *I Love the Blockchain, Just Not Bitcoin*. Retrieved from https://www.coindesk.com/love-blockchain-just-bitcoin

Li, J., & Mann, W. (2018). Initial coin offerings and platform building. *SSRN Electronic Journal*. Retrieved from https://ssrn.com/abstract=3088726

Liebowitz, S. J., & Margolis, S. E. (1994). Network Externality: An Uncommon Tragedy. *Journal of Economic Perspectives, 8*(2), 133–150. doi:10.1257/jep.8.2.133

Lindman, J., Tuunainen, V. K., & Rossi, M. (2017). Opportunities and risks of Blockchain Technologies–a research agenda. *Proceedings of the 50th Hawaii International Conference on Information Systems, Waikoloa, Hawaii*.

Lotan, G. (2012). *Kony2012: See how invisible networks helped a campaign capture the world's attention*. Retrieved from http://www.socialflow.com/7120244932/data-viz-kony2012-see-how-invisible-networks-helped-a-campaign-capture-the-worlds-attention

Manski, S. (2017). Building the blockchain world: Technological commonwealth or just more of the same? *Strategic Change, 26*(5), 511–522. doi:10.1002/jsc.2151

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering, 57*(5), 339–343. doi:10.1007/s12599-015-0401-5

Mayer-Schönberger, V., & Cukier, K. (2014). *Big data: A revolution that will transform how we live, work and think*. Boston, Massachusetts, USA: Houghton Mifflin Harcourt.

McKinsey & Company. (2016). *The internet of things: Mapping the value beyond the hype*. Retrieved from McKinsey Global Institute website: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/The%20Internet%20of%20Things%20The%20value%20of%20digitizing%20the%20physical%20world/The-Internet-of-things-Mapping-the-value-beyond-the-hype.ashx

Merz, M. A., He, Y., & Vargo, S. L. (2009). The evolving brand logic: a service-dominant logic perspective. *Journal of the Academy of Marketing Science, 37*(3), 328–344. doi:10.1007/s11747-009-0143-3

Miller, D., Hope, Q., Eisenstat, R., Foote, N., & Galbraith, J. (2002). The problem of solutions: Balancing clients and capabilities. *Business Horizons, 45*(2), 3–12. doi:10.1016/S0007-6813(02)00181-7

Miller, J. G., & Roth, A. V. (1994). A Taxonomy of Manufacturing Strategies. *Management Science, 40*(3), 285–304. doi:10.1287/mnsc.40.3.285

Miscione, G., Ziolkowski, R., Zavolokina, L., & Schwabe, G. (2018). Tribal governance: The business of blockchain authentication. *Proceedings of the 51st Hawaiin International Conference on System Sciences, Waikoloa, Hawaii*.

Mislove, A., Marcon, M., Gummadi, K. P., Druschel, P., & Bhattacharjee, B. (2007). Measurement and analysis of online social networks. In *Proceedings of the 7th ACM SIGCOMM conference on Internet measurement* (p. 29).

Moe, W. W., & Trusov, M. (2011). The Value of Social Dynamics in Online Product Ratings Forums. *Journal of Marketing Research, 48*(3), 444–456. doi:10.1509/jmkr.48.3.444

Moon, S., Bergey, P. K., & Iacobucci, D. (2010). Dynamic Effects among Movie Ratings, Movie Revenues, and Viewer Satisfaction. *Journal of Marketing, 74*(1), 108–121. doi:10.1509/jmkg.74.1.108

Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard business review, 71*(3), 75–86.

Moore, J. F. (2016). *The death of competition: Leadership and strategy in the age of business ecosystems*. New York, New York, USA: Harper Paperbacks.

Munzel, A., Jahn, B., & Kunz, W. H. (2012). The power of saying sorry–insights on customer service in new media online channels. *Proceedings of the 12th International Research Conference in Service Management, La Londe les Maures, France*.

Nærland, K., Müller-Bloch, C., Beck, R., & Palmund, S. (2017). Blockchain to Rule the Waves-Nascent Design Principles for Reducing Risk and Uncertainty in Decentralized Environments. *Proceedings of the 38th International Conference on Informations Systems, Seoul, South Korea*.

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved from http://www.bitcoin.org/bitcoin.pdf. Accessed 1 August 2017

Nambisan, S. (2002). Designing Virtual Customer Environments for New Product Development: Toward a Theory. *Academy of Management Review, 27*(3), 392–413. doi:10.5465/amr.2002.7389914

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. *MIS quarterly, 41*(1), 223–238.

Neumeier, A., Radszuwill, S., & Zare Garizy, T. (2018). Modeling project criticality in IT project portfolios. *International Journal of Project Management, 36*(6), 833–844. doi:10.1016/j.ijproman.2018.04.005

Nickerson, R. C., Varshney, U., & Muntermann, J. (2013). A method for taxonomy development and its application in information systems. *European Journal of Information Systems, 22*(3), 336–359. doi:10.1057/ejis.2012.26

Normann, R., & Ramírez, R. (1993). From value chain to value constellation: designing interactive strategy. *Harvard business review, 71*(4), 65–77.

Noufaily, A., Enki, D. G., Farrington, P., Garthwaite, P., Andrews, N., & Charlett, A. (2013). An improved algorithm for outbreak detection in multiple surveillance systems. *Statistics in medicine, 32*(7), 1206–1222. doi:10.1002/sim.5595

Oren, S. S., & Smith, S. A. (1981). Critical Mass and Tariff Structure in Electronic Communications Markets. *The Bell Journal of Economics, 12*(2), 467–487. doi:10.2307/3003567

Orlikowski, W. J. (2010). The sociomateriality of organisational life: considering technology in management research. *Academy of Management Journal, 34*(1), 125–141. doi:10.1093/cje/bep058

Ozcan, P., & Santos, F. M. (2015). The market that never was: Turf wars and failed alliances in mobile payments. *Strategic Management Journal, 36*(10), 1486–1512. doi:10.1002/smj.2292

Parker, G., & van Alstyne, M. (2018). Innovation, Openness, and Platform Control. *Management Science, 64*(7), 3015–3032. doi:10.1287/mnsc.2017.2757

Parker, G., van Alstyne, M., & Choudary, S. P. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you* (First edition). New York, USA: W. W. Norton & Company.

Pavlou, P. A., & El Sawy, O. A. (2006). From IT Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development. *Information Systems Research, 17*(3), 198–227. doi:10.1287/isre.1060.0094

Pavlou, P. A., & El Sawy, O. A. (2010). The “Third Hand”: IT-Enabled Competitive Advantage in Turbulence Through Improvisational Capabilities. *Information Systems Research, 21*(3), 443–471. doi:10.1287/isre.1100.0280

Payne, A. F., Storbacka, K., & Frow, P. (2008). Managing the co-creation of value. *Journal of the Academy of Marketing Science, 36*(1), 83–96. doi:10.1007/s11747-007-0070-0

Pera, R., Occhiocupo, N., & Clarke, J. (2016). Motives and resources for value co-creation in a multi-stakeholder ecosystem: A managerial perspective. *Journal of Business Research, 69*(10), 4033–4041. doi:10.1016/j.jbusres.2016.03.047

Peters, G. W., & Panayi, E. (2016). Understanding Modern Banking Ledgers Through Blockchain Technologies: Future of Transaction Processing and Smart Contracts on the Internet of Money. In P. Tasca, T. Aste, L. Pelizzon, & N. Perony (Eds.), *New Economic Windows. Banking Beyond Banks and Money* (pp. 239–278). Cham: springer.

Pfeffer, J., Zorbach, T., & Carley, K. M. (2014). Understanding online firestorms: Negative word-of-mouth dynamics in social media networks. *Journal of Marketing Communications, 20*(1-2), 117–128. doi:10.1080/13527266.2013.797778

Poynter, R. (2008). Viewpoint - Facebook: The Future of Networking with Customers. *International Journal of Market Research, 50*(1), 11–12. doi:10.1177/147078530805000103

Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing, 18*(3), 5–14. doi:10.1002/dir.20015

Preece, J., Nonnecke, B., & Andrews, D. (2004). The top five reasons for lurking: improving community experiences for everyone. *Computers in Human Behavior, 20*(2), 201–223. doi:10.1016/j.chb.2003.10.015

Punj, G., & Stewart, D. W. (1983). Cluster Analysis in Marketing Research: Review and Suggestions for Application. *Journal of Marketing Research, 20*(2), 134–148. doi:10.1177/002224378302000204

Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2018). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management, 53*(3), 41. doi:10.1108/JMTM-01-2018-0020

Radszuwill, S., & Fridgen, G. (2017). Forging a Double-Edged Sword: Resource Synergies and Dependencies in Complex IT Project Portfolios. *Proceedings of the 38th International Conference on Informations Systems, Seoul, South Korea*.

Rai, A., Constantinides, P., & Sarker, S. (2019). Editor’s Comments: Next-Generation Digital Platforms: Toward Human–AI Hybrids. *MIS quarterly, 43*(1), iii–ix.

Rai, A., Pavlou, P. A., Im, G., & Du, S. (2012). Interfirm IT capability profiles and communications for cocreating relational value: evidence from the logistics industry. *MIS quarterly, 36*(1), 233–262.

Rishika, R., Kumar, A., Janakiraman, R., & Bezawada, R. (2013). The Effect of Customers' Social Media Participation on Customer Visit Frequency and Profitability: An Empirical Investigation. *Information Systems Research, 24*(1), 108–127. doi:10.1287/isre.1120.0460

Sambamurthy, Bharadwaj, & Grover. (2003). Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. *MIS quarterly, 27*(2), 237. doi:10.2307/30036530

Sanchez, R., & Mahoney, J. T. (1996). Modularity, flexibility, and knowledge management in product and organization design. *Strategic Management Journal, 17*(S2), 63–76. doi:10.1002/smj.4250171107

Sawhney, M., & Prandelli, E. (2000). Communities of Creation: Managing Distributed Innovation in Turbulent Markets. *California Management Review, 42*(4), 24–54. doi:10.2307/41166052

Sawhney, M., Verona, G., & Prandelli, E. (2005). Collaborating to create: The Internet as a platform for customer engagement in product innovation. *Journal of Interactive Marketing, 19*(4), 4–17. doi:10.1002/dir.20046

Sawhney, M., Wolcott, R. C., & Arroniz, I. (2006). The 12 different ways for companies to innovate. *MIT Sloan management review, 47*(3), 75–81.

Schlatt, V., Schweizer, A., Urbach, N., & Fridgen, G. (2016). *Blockchain : Grundlagen, Anwendungen und Potenziale*. Whitepaper of the Fraunhofer Project Group Business and Information Systems Engineering.

Schultz, D. (2007). *Snackbyte: A view of the ecosystem*. Retrieved from https://www.deborahschultz.com/deblog/2007/11/snackbyte-a-vie.html

Schweizer, A., Schlatt, V., Urbach, N., & Fridgen, G. (2017). Unchaining Social Businesses–Blockchain as the Basic Technology of a Crowdlending Platform. *Proceedings of the 38th International Conference on Informations Systems, Seoul, South Korea*.

Sillaber, C., & Waltl, B. (2017). Life Cycle of Smart Contracts in Blockchain Ecosystems. *Datenschutz und Datensicherheit - DuD, 41*(8), 497–500. doi:10.1007/s11623-017-0819-7

Smith + Crown. (2017). *Token Sale Market Performance*. Retrieved from https://www.smithandcrown.com/token-sale-market-performance/#token-sale-market-performance

snowball.money. (2019). *What ecosystems are in Blockchains?* Retrieved from https://www.snowball.money/post/what-ecosystems-are-in-blockchains

Song, P., Xue, L., Rai, A., & Zhang, C. (2018). The ecosystem of software platform: A study of asymmetric cross-side network effects and platform governance. *MIS quarterly, 42*(1), 121–142.

Spagnoletti, P., Resca, A., & Lee, G. (2015). A Design Theory for Digital Platforms Supporting Online Communities: A Multiple Case Study. *Journal of Information Technology, 30*(4), 364–380. doi:10.1057/jit.2014.37

Statista. (2019a). *Number of monthly active Facebook users worldwide as of 1st quarter 2019 (in millions)*. Retrieved from https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/

Statista. (2019b). *Number of monthly active Instagram users from January 2013 to June 2018 (in millions)*. Retrieved from https://www.statista.com/statistics/253577/number-of-monthly-active-instagram-users/

Statista. (2019c). *Number of monthly active Twitter users worldwide from 1st quarter 2010 to 1st quarter 2019 (in millions)*. Retrieved from https://www.statista.com/statistics/282087/number-of-monthly-active-twitter-users/

Stich, L., Golla, G., & Nanopoulos, A. (2014). Modelling the spread of negative word-of-mouth in online social networks. *Journal of Decision Systems, 23*(2), 203–221. doi:10.1080/12460125.2014.886494

Straub, D. W., & Watson, R. T. (2001). Research Commentary: Transformational Issues in Researching IS and Net-Enabled Organizations. *Information Systems Research, 12*(4), 337–345. doi:10.1287/isre.12.4.337.9706

Subramaniam, M., & Venkatraman, N. (2001). Determinants of transnational new product development capability: testing the influence of transferring and deploying tacit overseas knowledge. *Strategic Management Journal, 22*(4), 359–378. doi:10.1002/smj.163

Susarla, A., Oh, J.-H., & Tan, Y. (2012). Social Networks and the Diffusion of User-Generated Content: Evidence from YouTube. *Information Systems Research, 23*(1), 23–41. doi:10.1287/isre.1100.0339

Swan, M. (2015). *Blockchain: Blueprint for a new economy* (First edition). Sebastopol, California, USA: O'Reilly Media, Inc.

Szabo, N. (1997). Formalizing and securing relationships on public networks. *First Monday, 2*(9).

Tanriverdi, H., & Venkatraman, N. (2005). Knowledge relatedness and the performance of multibusiness firms. *Strategic Management Journal, 26*(2), 97–119. doi:10.1002/smj.435

Teece, D. J. (2010). Business Models, Business Strategy and Innovation. *Long Range Planning, 43*(2-3), 172–194. doi:10.1016/j.lrp.2009.07.003

Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Research Commentary —Digital Infrastructures: The Missing IS Research Agenda. *Information Systems Research, 21*(4), 748–759. doi:10.1287/isre.1100.0318

Tiwana, A. (2014). *Platform ecosystems: Aligning architecture, governance, and strategy*. Burlington, Massachusetts, USA: Morgan Kaufmann.

Tiwana, A., Konsynski, B., & Bush, A. A. (2010). Research Commentary —Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. *Information Systems Research, 21*(4), 675–687. doi:10.1287/isre.1100.0323

Toubia, O. (2006). Idea Generation, Creativity, and Incentives. *Marketing Science, 25*(5), 411–425. doi:10.1287/mksc.1050.0166

Trusov, M., Bodapati, A. V., & Bucklin, R. E. (2010). Determining Influential Users in Internet Social Networks. *Journal of Marketing Research, 47*(4), 643–658. doi:10.1509/jmkr.47.4.643

Tuli, K. R., Kohli, A. K., & Bharadwaj, S. G. (2007). Rethinking Customer Solutions: From Product Bundles to Relational Processes. *Journal of Marketing, 71*(3), 1–17. doi:10.1509/jmkg.71.3.001

Ulrich, K. (1995). The role of product architecture in the manufacturing firm. *Research Policy, 24*(3), 419–440. doi:10.1016/0048-7333(94)00775-3

Unibright.io. (2018). *The Power of Blockchain Ecosystems*. Retrieved from https://medium.com/@UnibrightIO/the-power-of-blockchain-ecosystems-1266e822e1b5

Urbach, N., Buchwald, A., & Ahlemann, F. (2013). Understanding IT Governance Success And Its Impact: Results From An Interview Study. *Proceedings of the 21rd European Conference on Information Systems, Utrecht, Netherland*.

Urbach, N., & Würz, T. (2012). How to Steer the IT Outsourcing Provider. *Business & Information Systems Engineering, 4*(5), 247–259. doi:10.1007/s12599-012-0231-7

van Dijck, J., & Poell, T. (2014). Understanding Social Media Logic. *Media and Communication, 1*(1), 2–14. doi:10.17645/mac.v1i1.70

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science, 36*(1), 1–10. doi:10.1007/s11747-007-0069-6

Veit, D., Clemons, E., Benlian, A., Buxmann, P., Hess, T., Kundisch, D., . . . Spann, M. (2014). Business Models. *Business & Information Systems Engineering, 6*(1), 45–53. doi:10.1007/s11576-013-0400-4

Wade, M., & Hulland, J. (2004). The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS quarterly, 28*(1), 107–142.

Walter, M. (2017). *How Blockchain will transform the platform economy—Part 1*. Retrieved from https://medium.com/platform-innovation-kit/how-blockchain-will-transform-the-platform-economy-part-1-e5994de8663d

Wand, Y., Monarchi, D. E., Parsons, J., & Woo, C. C. (1995). Theoretical foundations for conceptual modelling in information systems development. *Decision Support Systems, 15*(4), 285–304. doi:10.1016/0167-9236(94)00043-6

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 171–180. doi:10.1002/smj.4250050207

West, J. (2003). How open is open enough? *Research Policy, 32*(7), 1259–1285. doi:10.1016/S0048-7333(03)00052-0

Wheeler, B. C. (2002). NEBIC: A Dynamic Capabilities Theory for Assessing Net-Enablement. *Information Systems Research, 13*(2), 125–146. doi:10.1287/isre.13.2.125.89

Wieland, H., Polese, F., Vargo, S. L., & Lusch, R. F. (2012). Toward a Service (Eco)Systems Perspective on Value Creation. *International Journal of Service Science, Management, Engineering, and Technology, 3*(3), 12–25. doi:10.4018/jssmet.2012070102

Williams, K., Chatterjee, S., & Rossi, M. (2017). Design of emerging digital services: a taxonomy. *European Journal of Information Systems, 17*(5), 505–517. doi:10.1057/ejis.2008.38

Wilson, C., Boe, B., Sala, A., Puttaswamy, K. P.N., & Zhao, B. Y. (2009). User interactions in social networks and their implications. In *Proceedings of the fourth ACM european conference on Computer systems* (Nuremberg, Germany).

Wolf, T. (2015). Assessing the Criticality of IT Projects in a Portfolio Context using Centrality Measures. *Proceedings of the 12th International Conference on Wirtschaftsinformatik, Osnabrück, Germany*.

Woodruff, R. B. (1997). Customer value: The next source for competitive advantage. *Journal of the Academy of Marketing Science, 25*(2), 139–153. doi:10.1007/BF02894350

Xu, X., Weber, I., Staples, M., Zhu, L., Bosch, J., Bass, L., . . . Rimba, P. (2017). A Taxonomy of Blockchain-Based Systems for Architecture Design. In *2017 IEEE International Conference on Software Architecture (ICSA)* (pp. 243–252). IEEE.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research Commentary —The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research. *Information Systems Research, 21*(4), 724–735. doi:10.1287/isre.1100.0322

Zare Garizy, T., Fridgen, G., & Wederhake, L. (2018). A Privacy Preserving Approach to Collaborative Systemic Risk Identification: The Use-Case of Supply Chain Networks. *Security and Communication Networks,* 1–18. doi:10.1155/2018/3858592

Appendix A. DECLARATION OF CO-AUTHORSHIP AND INDIVIDUAL CONTRIBUTION

This doctoral thesis bases on five research papers. Three of them are published in scientific journals or scientific conference proceedings. Two of the five research papers belong together, as one is an extension of the other (research paper 1 is an extension of research paper 2). The research papers were developed by different research teams, which integrated the perspectives of researchers with different experiences and, where possible and appropriate, from different disciplines. This heterogeneous (transdisciplinary) collaboration allows this thesis to contribute to the scientific discourse and to support organizations in managing their ecosystems. To assess my contribution to the research projects, I describe the respective settings in the following:

The first research paper Bachmann, Drasch, Fridgen et al. (2019) “Tarzan and Chain: Exploring the ICO Jungle and Evaluation Design Archetypes” is an extension of the second research paper Bachmann, Drasch, Miksch et al. (2019), which bases on the first consideration of Fridgen, Regner et al. (2018). The research team consisted of seven researchers who contributed in the course of the research process. In the project, I had the role of an experienced researcher, and provided feedback and guidance in the entire course of the project. My contribution was to the taxonomy revision, cluster analysis, and token performance analysis. I evaluated the taxonomy, the cluster analysis, and the token performance analysis, and carried out the textual elaboration. For the second research paper, I presented our work at the International Conference on Wirtschaftsinformatik in Siegen, Germany. Thus, my co-authorship is reflected in the entire research project, with a focus on the cluster and token performance analysis.

In the third research project Drasch et al. (2019) “The token’s secret: The two-faced financial incentive of the token economy”, the research team consisted of five researchers. One of them (Prof. Fridgen) is very experienced. In this project, I had the role of an experienced researcher, providing feedback, and guiding the research process. In particular, I contributed to the refinement of the premise of the paper, the development of a specific research objective, the conceptualization of the structure of the paper, the development of the evaluation, the interpretation of the results, and the textual elaboration. Thus, my co-authorship is reflected in the entire research project, especially subsequent to the first submission.

In the fourth research paper Drasch et al. (2018) “Integrating the ‘Troublemakers’: A Taxonomy for Cooperation between Banks and Fintechs”, the research team consisted of three researchers. One of them (Prof. Urbach) is very experienced and mainly provided feedback on the research process. My contribution was to the initiation, development, and elaboration during the entire research project. I contributed to the literature analysis, to the development of the taxonomy, to the evaluation of the taxonomy, to the cluster analysis, and to the textual elaboration. Thus, my co-authorship is reflected in the entire research project.

In the fifth research project Drasch et al. (2015) “Detecting online firestorms in social media”, the research team consisted of four researchers. One of them was very experienced. This paper resulted from one of my first research projects. Under the supervision of two of the co-authors and jointly with the third co-author, I contributed to the development of the idea, the motivation, the research process, the model, and the evaluation. Together with one of my co-authors, I contributed to the generation and interpretation of the results, which we then prepared for the paper. The formulation of the paper was mainly driven by three of the four co-authors (including myself). After acceptance for the International Conference on Information Systems 2015, I presented our research in Forth Worth, Texas, USA. The fourth most experienced co-author contributed by his valuable feedback and experience to the formulation process. Thus, my co-authorship is reflected in the entire research project.

Appendix B. UNDERLYING RESEARCH PAPERS OF THIS DOCTORAL THESIS

B.1. TARZAN AND CHAIN: EXPLORING THE ICO JUNGLE AND EVALUATION DESIGN ARCHETYPES [2]

Authors:	Nina Bachmann, Benedict J. Drasch, Gilbert Fridgen, Michael Miksch, Ferdinand Regner, André Schweizer, Nils Urbach
Citation:	Bachmann, N.; Drasch, B. J.; Fridgen, G.; Miksch, M.; Regner, F.; Schweizer, A.; Urbach, N. (2019): Tarzan and Chain: Exploring the ICO Jungle and Evaluating Design Archetypes. *Working paper*.
Keywords:	Blockchain, ICO, taxonomy, archetypes, success analysis
Ranking of outlet:	Under revision

Extended Abstract

Initial coin offerings (ICO) are drawing increasing attention as a novel funding mechanism. ICO is a form of crowdfunding that utilizes blockchain-based tokens to allow for truly peer-to-peer investments. In 2018, globally raised funding was at about $12bn via ICOs. Although research provided a first structure in the form of taxonomies (Fridgen, Regner et al. 2018) and developed artefacts to cluster predominant characteristics (Bachmann, Drasch, Miksch et al. 2019), an outlook on the development of such ICOs on the secondary market is absent. Similar to investments in cryptocurrencies like Bitcoin and Ethereum so far, it is impossible for issuers and investors to oversee long-term development, benefit, and risks. However, ICOs are only a recent phenomenon, as the start of ICOs was less than five years ago and observable use cases and time periods are small. Regulators and many governmental institutions have just started to take action in the so far mostly unregulated ICO market. To date, research lacks behind in providing a comprehensive and in-depth analyses of ICO designs and their chances of success.

We address this research gap by extending the work of Fridgen, Regner et al. (2018) and Bachmann, Drasch, Miksch et al. (2019) and following a three-phase approach. First, we develop a taxonomy of empirically validated ICO design parameters. We apply the established

[2] This essay was co-authored with Nina Bachmann, Gilbert Fridgen, Michael Miksch, Ferdinand Regner, André Schweizer, and Nils Urbach. At the time of the publication of this thesis, this essay is in the review process of a scientific journal. Thus, I provide an extended abstract that covers the essay's content. Earlier versions of this essay have been published in the Proceedings of the 26th European Conference on Information Systems (ECIS 2018) and in the Proceedings of the 14th Internationale Tagung Wirtschaftsinformatik (WI 2019):

- Fridgen, Gilbert; Regner, Ferdinand; Schweizer, André; Urbach, Nils (2018): Don't Slip on the Initial Coin Offering (ICO) - A Taxonomy for a Blockchain-enabled Form of Crowdfunding. In: Proceedings of the 26th European Conference on Information Systems (ECIS2018). Portsmouth, UK.
- Bachmann, Nina; Drasch, Benedict; Miksch, Michael; Schweizer, André (2019): Dividing the ICO Jungle: Extracting and Evaluating Design Archetypes. In: Proceedings of the 14th Internationale Tagung Wirtschaftsinformatik (WI 2019). Siegen, Germany.

and well-recognized taxonomy development method proposed by Nickerson et al. (2013). Second, we build upon our taxonomy and empirically investigate ICO archetypes to obtain an in-depth understanding of prevailing dimensions and characteristics. As a result, we identify five ICO archetypes, which illustrate different combinations and dominant aspects within the ICO design parameters. Third, we conduct an analysis of the secondary market development of 84 real-world ICO cases. Doing so, we follow the research approach of Smith + Crown (2017). For this purpose, we consider the performance of underlying tokens on the secondary market in order to obtain how both, single cases and aggregated archetypes, develop. We link the indications of the secondary market development to the characteristics of our archetypes, and describe what we observe in detail. To increase the expressiveness of our results and to account for overall market trends, we compare archetypes to the overall token market performance in the short, medium, and long term. We observe differing developments among the identified ICO archetypes.

Our research allows deriving three key findings: First, our taxonomy provides a structure for ICOs. Second, our cluster analysis results in archetypes that summarize ICOs of similar kind. Third, our analysis of secondary market performance provides an outlook on indicative ICO development. We thereby contribute to theory building in the fields of ICOs and provide practitioners with various backgrounds and perspectives on the phenomenon. First, our taxonomy and clustering approach provide a systematic and comprehensive overview of predominant ICO design parameters and ICO archetypes. These artefacts allow structuring the complex domain in a comprehensible way. Second, the archetypes extend existing classifications of ICOs by various aspects and allow for generalizable findings, instead of taking into account single characteristics. Especially, our findings provide a structured guidance for ventures that plan to conduct an ICO. Third, for traditional financial intermediaries including early stage venture capitalists or crowdfunding platforms, the taxonomy and archetypes may help to characterize potential competitors. Fourth, our findings of the short- and long-term ICO archetype performance analysis are of vital importance for research on ICOs and blockchain governance issues, since they allow deriving the impact of different governance configurations.

B.2. Dividing the ICO Jungle: Extracting and Evaluating Design Archetypes

Authors:	Nina Bachmann, Benedict J. Drasch, Michael Miksch, André Schweizer
Citation:	Bachmann, N.; Drasch, B. J.; Miksch, M.; Schweizer, A. (2019): Dividing the ICO Junge: Extracting and evaluating Design archetypes. In *Proceedings of the 14th Internationale Konferenz der Wirtschaftsinformatik*, Siegen, Germany.
Keywords:	Blockchain, initial coin offering, ICO, cluster analysis, design archetypes
Ranking of outlet:	▪ VHB Jourqual 3: Category C ▪ Impact factor (2017): -

Extended Abstract:

The sale of blockchain-based digital tokens as a novel funding mechanism, referred to as initial coin offerings (ICO), has grown exponentially, resulting in $12bn raised globally during the first half of 2018. However, the concept and its implications are unclear to investors, founders, and academia. In particular, a systematic understanding of what exactly constitutes an ICO is missing but required to establish a common knowledge base and enable a widespread use as a commodity service. To date, the young phenomenon is still very heterogeneous, and approaches of standardization are in their infancy. Existing research provides first insights into ICO endeavors and design. However, comprehensive and in-depth analyses of ICO design archetypes and prevailing ICO characteristics are missing.

We address this research gap by extending the work of Fridgen, Regner et al. (2018) and following a two-step approach: First, we extend and enrich the existing ICO taxonomy by following the well-recognized taxonomy development method proposed by Nickerson et al. (2013). Taxonomies as frameworks are well suited to lay the groundwork for emergent fields of research and serve as the first step into systematizing the emerging research domain (Williams et al. 2017). By collecting a data-sample of 84 real-world ICOs with detailed information, we are able to account for recent changes in the ICO market and resulting incompleteness in the initial taxonomy. Second, we apply a two-stage cluster analysis to identify predominant ICO archetypes, with Pearson χ^2, Carmer's V and pairwise post-hoc tests to validate the significance of the clusters (Aldenderfer and Blashfield 1984; Hair et al. 1998; Ketchen and Shook 1996). Cluster analysis serves as an approach to abstract from individual cases, in order to derive insights that are more general. As a result, we obtain a taxonomy with 23 dimensions and 66 characteristics. The cluster analysis suggests five ICO archetypes, which illustrate different combinations and dominant aspects within the ICO design parameters: the average ICO, the liberal ICO, the visionary ICO, the compliant ICO, and the native ICO. We continue by describing the ICO archetypes in detail, and formulate predominant characteristics of the archetypes.

We thereby contribute to a comprehensive and in-depth understanding of the ICO phenomenon and its implications. Further, we offer practitioners tangible design suggestions for future ICOs. First, we provide a systematic and comprehensive overview of predominant ICO design parameters and ICO archetypes. These artefacts allow structuring the complex

domain in a comprehensible way. Second, the archetypes extend existing classifications of ICOs by various aspects and allow for generalizable findings, instead of taking into account single characteristics. Especially, our findings provide a structured guidance for ventures that plan to conduct an ICO.

B.3. THE TOKEN'S SECRET: THE TWO-FACED FINANCIAL INCENTIVE OF THE TOKEN ECONOMY [3]

Authors:	Benedict J. Drasch, Gilbert Fridgen, Tobias Manner-Romberg, Fenja Nolting, Sven Radszuwill
Citation:	Drasch, B. J.; Fridgen, G.; Manner-Romberg, T.; Nolting, F.; Radszuwill, S. (2019) The Token‘s Secret: The two-faced financial incentive of the token economy. *Working paper*.
Keywords:	Multi-sided Platform, Platform Adoption, Blockchain, Tokenization, Token Valuation
Ranking of outlet:	Under revision

Extended Abstract:

Multi-sided platforms such as Amazon, Uber or Airbnb are omnipresent in today's digital world. As of 2016, four of the top 5 organizations used platform-based business models. However, developing a platform is difficult, as potential platform participants expect low platform utility and lack the incentive to join at an early stage. A visualization depicts the introduction of the telephone network in the 1850s: The utility from having a phone was lowest for the first person who purchased a telephone. For every next person joining the network, the utility increased. Once the platform reaches a critical mass of users, network effects take effect and accelerate platform growth. This challenge in platform development coined the term "chicken and egg" problem. Blockchain-enabled utility tokens hold the promise to overcome this problem: They supposedly provide a suitable financial incentive for their owners to join the platform as soon as possible. Although we know little about this financial incentive, investors seemed to believe in the presumption and spent enormous sums in token sales in the past years. Especially blog articles and online communities suggest blockchain-based tokens to be the answer to the chicken and egg problem. To date, this financial incentive remains an assumption, since an in-depth analysis is absent.

We analyze this financial incentive by proposing a two-step approach to develop a model for token valuation. We model user incentives in a two-sided blockchain-based platform where sellers and buyers interact. We divide the model into two distinct phases: Phase 1 is before the platform launch, when the platform is still in the development phase. For this phase, we apply a qualitative assessment of the financial incentive. Phase 2 is after the launch, when sellers and buyers started trading. For this phase, we apply a monetary approach to model the token value. In a first step, we consider each phase individually. In a second step, we consider both phases integrated.

Our results suggest that blockchain-based utility tokens do not incorporate a financial incentive for token owners, and consequently tokens are not a solution for the chicken and egg problem. Phase 1 holds a financial incentive if enough platform participants believe in a positive fulfilling, which is rather a self-fulfilling prophecy. This leads to a decrease in platform activity in Phase 2, which results in a deflationary character of the token's value development.

[3] This essay was co-authored with Gilbert Fridgen, Tobias Manner-Romberg, Fenja Nolting, and Sven Radszuwill. At the time of the publication of this thesis, this essay is in the review process of a scientific journal. Thus, I provide an extended abstract that covers the essay's content.

However, these tokens lead to contradictory incentives for platform participants, and can even inhibit platform adoption.

Our contribution is twofold: First, for the academic audience, our findings suggest that the incorporation of user incentives in the context of blockchain-based platform development using tokens is necessary. For this purpose, our results serve as an initial step, as the research paper is the first to analyze the financial incentive of utility tokens. Thus, we start the creation of a deeper understanding. As our findings propose, the financial incentive is two-faced, and urgently needs further analysis for a deeper understanding. Second, our findings suggest that a careful application of token-based platform development is necessary. We encourage practitioners to revise token design to ensure a sustainable economic cycle on the platform. Especially, to enable long-term success and to avoid “pump and dump” behavior, token application demands for the consideration of theoretical knowledge.

B.4. INTEGRATING THE 'TROUBLEMAKERS'

Authors:	Benedict J. Drasch, André Schweizer, Nils Urbach
Citation:	Drasch, B. J.; Schweizer, A.; Urbach, N. (2018): Integrating the 'Troublemakers': A taxonomy for cooperation between banks and Fintechs. In: *Journal of Economics and Business, (100), pp. 26-42.*
Keywords:	Banking, Fintechs, Digital transformation, Cooperation, Taxonomy
Ranking of outlet:	▪ VHB Jourqual 3: C ▪ Impact factor: -

Extended Abstract:

The banking sector has been subject to fundamental changes from the digital transformation. New technologies enable new banking applications and services and require appropriate and aligned countermeasures. As digitalization progresses, it enables novel technology-driven banking services and creates new customer demands. While banks face sluggish innovation processes, financial technology startup companies (fintechs) create new technology-enabled opportunities to fulfill emerging customer-demanded needs or even create novel customer needs. Consequently, banks need to react to the new contenders in the industry. Although banks have realized that cooperation with fintechs is a key approach to foster innovation, they struggle to address the associated challenges. Yet, there has been little research on this phenomenon (e.g., to establish best practices), because neither bank-fintech cooperation, nor associated and relevant characteristics have been evaluated. However, especially from an economic and financial perspective it is crucial to close this research gap to understand better the design parameters of bank-fintech cooperation. Further, it is necessary to understand how technology-driven organizations and cooperating with them reshapes the financial sector and therefore entire economies.

We address this research gap by proposing a theoretically founded and empirically proven taxonomy. Taxonomies as frameworks are well suited to lay the groundwork for emergent fields of research and serve as the first step into systematizing the emerging research domain (Williams et al. 2017). For the development, we apply the well-recognized taxonomy method proposed by Nickerson et al. (2013). By collecting a data-sample of 136 real-world bank-fintech cooperation cases, based on related literature, and 12 expert interviews, we obtain a taxonomy structuring and describing bank-fintech cooperation through 13 dimensions and 106 characteristics. Further, the empirical examination allows for the identification of prevailing cooperation patterns. 1) Invest in fintechs to form an alliance and access the fintech's ecosystem. 2) Acquire and integrate channel solutions and interaction platform innovation. 3) Innovate lending core banking systems to optimize bank-to-customer processes. 4) Access investment markets by providing banking services to fintechs. 5) Cross-product services to innovate bank-to-customer processes in bank ecosystems. 6) Early-stage cooperation for technology access.

Our research contributes to theory and practice. We lay the foundation for further research into fintechs and their integration into the banking sector, and suggest design parameters that are important for consideration in bank-fintech cooperation. The taxonomy's multidimensionality lays the foundations for analyzing interdependencies among the dimensions and characteristics – a future research area we find promising. Our taxonomy depicts a crucial step towards a deeper understanding of the field, and can serve as a starting point for other economies and industries, where similar phenomena arise. For practitioners, we propose a classification scheme to evaluate efforts at the interaction between banks and fintechs. Practitioners who apply our taxonomy can analyze their own endeavors in integrating fintechs and their innovation, and can evaluate their value proposition within such cooperation. We also find that both parties benefit from the model, and complement each other's strengths and weaknesses.

B.5. DETECTING ONLINE FIRESTORMS

Authors:	Benedict J. Drasch, Johannes Huber, Sven Panz, Florian Probst
Citation:	Drasch, B. J.; Huber, J.; Panz, S.; Probst, F. (2015): Detecting Online Firestorms in Social Media. In: *Proceedings of the 36th International Conference on Information Systems*, Fort Worth, Texas.
Keywords:	Word-of-mouth, social media, online firestorm, information diffusion, design science
Ranking of outlet:	▪ VHB Jourqual 3: A ▪ Impact factor: -

Extended Abstract:

For organizations, customer interaction in today's world shifted toward social media. Here, customers search for information about products and services, and utilize publicly available reviews, ratings, and critiques of fellow consumers. Social media has also changed the way information diffuses, thus increasing the reach and speed of electronic word-of-mouth (eWOM). As a result, it has intensified customers' exposure to negative eWOM as well, and organizations increasingly suffer from massive outbursts of negative eWOM, known as online firestorms. Because of their dynamics, it is nearly impossible to stop online firestorms if their emergence is not detected promptly. However, well-founded approaches that provide automated, real-time detection are missing.

We address this research gap by designing an Online Firestorm Detector based on design science research (Hevner et al. 2004). Our artefact comprises of three major steps: First, we monitor social media and collect eWOM. Second, we conduct a sentiment analysis to analyze the overall sentiment of publicly expressed opinions. Third, we propose an algorithm inspired by epidemiological surveillance systems. For the evaluation of our artefact, we use real-world data from a firestorm suffered by Coca Cola, and prove the utility and validity of the proposed approach. With our firestorm detector and the Coca Cola data sample, we can be reliably detect the outburst of the online firestorm shortly after the first piece of related negative eWOM has been generated. Further, the number of false alarms generated by our Online Firestorm Detector is low. A comparison with competing artefacts indicates that the Online Firestorm Detector is superior to approaches that could be alternatively used.

Our research contributes to theory and practice. We enrich existing IS and marketing literature on the analysis of eWOM in social media to avert its potential dark side, as existing literature mainly focuses on the positive aspects. Especially, the question of when to trigger an alarm if negative eWOM spreads over an entire network needed an answer. Hence, the design of our Online Firestorm Detector constitutes an essential element in averting the potential negative consequences of companies' social media engagements. We contribute to a valid theoretical basis for research on eWOM diffusion in social media. The successful empirical demonstration and evaluation of our artefact indicates that research regarding the early detection of outbreaks of infectious diseases is transferrable to the context of social media. Further, we extend the understanding of online firestorms by showing that not only negative eWOM is necessary in the detection. Our empirical demonstration and evaluation indicates that considering both negative and total eWOM leads to significantly less false alarms. For practitioners, we propose a useful artefact that serves as an automated detector. In fact, our results suggest that common

lightweight solutions are unable to detect reliably online firestorms in social media. Consequently, lightweight solutions demand resources to verify alarms.