






The Role of Actors in Platform Ecosystems: A Systematic Literature Review and Comparison Across Platform Types

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Abstract. The information systems literature has acknowledged the importance of external actors for the success of platform ecosystems. Thus far, these actors have either been studied on a particular platform type or have been generalized across multiple platform types. We see opportunities in scrutinizing the varying roles that actors play on platforms of different types. For instance, actors who develop third-party applications are hardly comparable to actors that sell physical goods on an electronic marketplace. We conducted a systematic literature review and compared actors and their activities across different platform types. Specifically, we analyzed 68 scientific studies and distilled five platform types: social media platforms, e-commerce platforms, sharing platforms, crowdsourcing platforms, and software platforms. Next, we analyzed the actors that engage on those platforms and found that each platform type is associated with a specific set of actors: e-commerce platforms involve sellers and buyers, sharing platforms involve lenders and borrowers, crowdsourcing platforms involve workers and crowdsourcers and software platforms involve application developers and users. On social media platforms, actors occupy a double role as prosumers. Additionally, we investigated the interactions between these actor types and found that same-side interactions are especially prevalent among application developers who share knowledge with one another. The main contribution of our study is a comparative overview on platform types, actors and activities.

Keywords: Platform ecosystem · Platform governance · Platform typology · Actor engagement · Actor typology · Complementor

1 Introduction

During the last decades, digital platforms have made inroads into various industries such as tourism, retail, and software [1]. At the same time, researchers and practitioners have shown significant interest in digital platforms, mainly because of their economic success and their potential to scale [2]. While the scientific literature on digital platforms continues to grow [3], there are two limitations that hinder the generalization of existing research findings. First, the term ‘digital platform’ has been used to characterize

a plethora of different digital artifacts. Whereas some authors used it as an umbrella term for social media platforms such as Facebook and LinkedIn [4], others used it to describe electronic commerce (e-commerce) platforms such as Amazon and Alibaba [5] or software platforms such as Android and iOS [6]. In fact, most of the scientific literature has focused on a particular platform type, but only a few authors have analyzed the characteristics and differences between platform types [7]. Hence, most of the existing research findings are limited to a specific platform type. For instance, findings regarding network structures on social media platforms are not transferable to e-commerce platforms without further ado [e.g., 8]. The second limitation pertains to the actors that engage on digital platforms. Similar to the platform types, actors and their activities have either been studied on a particular platform type [e.g., 9] or have been generalized across multiple platform types [e.g., 10]. It is necessary to consider that actors and their activities vary across platform types. For example, e-commerce platforms involve buyers who purchase products and sellers who offer those products [11]. In contrast, software platforms rely on application developers who create complementary software applications and users who install and use these applications [12]. Lastly, social media platforms depend on actors who actively create social media content and actors who passively consume that content – oftentimes actors do both [13].

The information systems literature has acknowledged the importance of actors for the success of digital platforms. Some authors even characterized actors and their activities as the “value units” of digital platforms [1, p. 30]. We see opportunities in comparing actors and their activities across different platform types through a multi-level typology. The information systems literature has yet to provide such a typology, although it contributes to the literature in several ways. First, research on digital platforms has grown rapidly and a comparison of platform and actor types synthesizes the vast body of scholarly research. Second, such a typology also contributes to existing literature by explaining how actors add value to different platform types. This opens up several avenues for future research, especially with regards to value co-creation and platform governance. The reason is that each actor type is typically governed through a specific set of governance mechanisms. For example, actors who develop software applications are governed through software development kits [14], while sellers on e-commerce platforms are governed through customer relationship management tools [11]. Third, a comparison of platform and actor types sheds light onto the generalizability of existing research findings. For example, insights from an existing study might be generalizable to platforms and actors of the same type, but not to other types. Hence, such a typology helps to identify the right scope for the generalization of existing findings. We conclude that the comparison of platform and actor types is a promising research area and propose the following research question:

What types of digital platforms, actors, and actor activities exist and how should they be considered in future research?

To answer our research question, we followed the guidelines of Webster and Watson [15] and vom Brocke et al. [16] and conducted a systematic literature review. To do so, we leveraged the fact that actors on digital platforms are part of larger communities such as the host community of Airbnb [17], the seller community of Amazon

[18], or the user groups of SAP [19]. Specifically, we analyzed 68 scientific studies and distilled five platform types: social media platforms, e-commerce platforms, sharing platforms, crowdsourcing platforms, and software platforms. Next, we analyzed the actors that engage on those platforms and found that each platform type is associated with a specific set of actors: e-commerce platforms involve sellers and buyers, sharing platforms involve lenders and borrowers, crowdsourcing platforms involve workers and crowdsourcers and software platforms involve application developers and users. Additionally, we investigated the interaction patterns between these actor types and found that same-side interactions are especially prevalent among application developers who share knowledge with one another. The main contribution of our study is a comparative overview on platforms, actors and activities.

The remainder of this paper is structured as follows. In the next section, we briefly explain the theoretical background and the community concept of our study. Thereafter, we clarify the design of our literature review and present the results of our study. Finally, we interpret and discuss our findings before we conclude with a future research agenda.

2 Theoretical Background

In this paper, we adopt an integrated perspective on digital platforms and define them as IT artifacts that enable “value-creating interactions between external producers and consumers” [1, p. 5]. Thus, our perception of digital platforms includes both a technical-oriented and a market-oriented perspective [3]. For our study, this is necessary because we analyze the functional scope of digital platforms simultaneously with the actors that engage on those platforms. Moreover, we use the term ‘platform owner’ to refer to the organizational entity that governs the platform.

Much of the existing literature has embedded digital platforms in the larger scope of so-called ‘platform ecosystems’ [e.g., 20]. Borrowed from biology, the term ecosystem pertains to all structural elements that are located in the periphery of a digital platform [21]. This includes not only the products and services that complement a platform [22], but also the actors that create those complementary offerings [23]. In this study, we focus on the actors and their activities. Hence, we define platform ecosystems as “the community of organizations, institutions, and individuals” [24, p. 1325] that impact a digital platform. Moreover, we use the term ‘actor’ to refer to the organizational-, institutional- and individual entities that are involved in such ecosystems.

Digital platforms typically cater two or more independent groups of actors [25]. Yet, these actor groups can often be divided into a producer side and a consumer side. Whereas producers create offers on a platform, consumers buy and use these offerings [26]. For example, on Amazon, the producer side comprises sellers who offer products and the consumer side consists of individuals and organizations who buy these products. Another example is the Android platform, which encompasses app developers on the producer side and app users on the consumer side. In this paper, we rely on this producer-consumer distinction to classify the actors that engage on a digital platform. We refrain from using the term ‘complementor’ due to its limitation to the producer side [27, 28].

Following our definition of ecosystems, we conceptualize the combination of producers and consumers as the community of a platform ecosystem [3, 24]. More precisely, we define the community of a platform ecosystem as the collective of producers

and/or consumers that engage and interact on a platform. This conceptualization allows us to harmonize the varying terminologies that are used to describe actors on digital platforms, especially when conducting our literature search. Thereby, it is necessary to integrate existing terminologies within and across platform ecosystems. On the one hand, researchers have used different terms to describe a particular actor group. For instance, producers on software platforms have been labeled as third-party developers [12], app developers [29] or complementors [30]. On the other hand, we have to harmonize the vocabulary across different platform types. For example, consumers on e-commerce platforms are buyers [31], whereas consumers on software platforms are users [32]. By introducing our community concept, we can integrate different expressions for producers and consumers within and across platform ecosystems into a single term that we can use in our literature review. Moreover, we identified several practical examples that support our community concept. For instance, Airbnb has introduced an online community in which hosts can share experiences with one another [17]. Likewise, Amazon is hosting a community forum that enables sellers to ask questions to other sellers [18]. Figure 1 gives an overview of our terminology. Actors are illustrated as white rectangles. Producers and consumers can be organizational or individual entities.

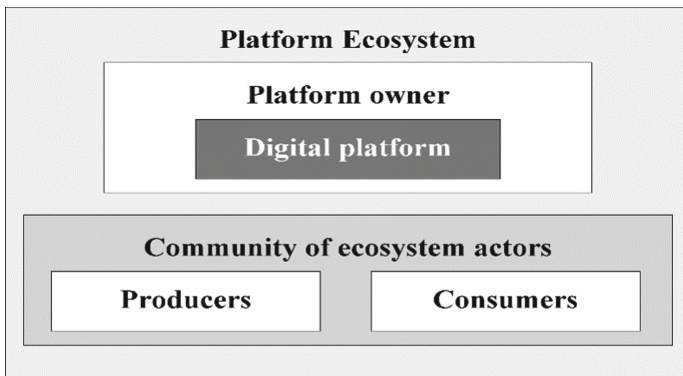


Fig. 1. Terminology

3 Design of the Literature Review

We followed the guidelines of Webster and Watson [15] and vom Brocke et al. [16] for conducting our systematic literature review. In particular, we looked for studies that investigate actors in platform ecosystems and their activities.

We started our literature review with an all-field search in the Association for Information Systems' Senior Scholar Basket of Journals. The basket consists of eight high-quality journals that are generally accepted as the top-tier journals in the information systems field [33]. Our emphasis on basket journals is also consistent with other literature reviews that have been published in information systems outlets [34]. Given the fact that digital platforms have also been studied in the management literature, we expanded

Table 1. Summary of the literature search

Outlet		Search	Hits	Selected
AIS Basket	EJIS	'Platform' AND 'Community' in Title/Abstract/Keywords	165	2
	ISJ		154	9
	ISR		240	15
	JAIS		133	5
	JIT		189	2
	JMIS		222	13
	JSIS		154	3
	MISQ		9	6
Other	Management Science		133	9
	Organization Science		136	4
Total			1535	68

our search for two top-tier management journals. We decided to include Management Science and Organization Science as two renowned management journals. Both journals are listed in the FT50 ranking [35].

Regarding our search string, we linked the terms 'platform' and 'community' with an 'AND' operator. We then used this search string to query the databases of all journals via the journal's or the publisher's websites. We conducted our literature search in September 2019 and received 1535 hits across all journals. On average, we received 153 hits per journal. The hits were relatively evenly distributed across the journals, except for the MIS Quarterly with only nine hits. Our literature search was not limited to a specific time interval. Table 1 summarizes our literature search process.

In the next step, we evaluated the fit between our hits and our research objective. In a first round, we analyzed the title of our hits. In so doing, we excluded studies that did not have a clear link to our study. For example, we excluded studies that focus on sustainability and venture capital. Additionally, we omitted non-empirical hits such as editorials and introductions to special issues. In total, we excluded 1,148 studies in this step.

In the next step, we assessed the remaining 387 studies by screening their abstracts. In so doing, we identified several studies that did not focus on digital platforms explicitly. For instance, some studies investigated information seeking in offline social networks instead of online social networks. Other examples are studies that focused on web services or digital worlds. Moreover, we did not consider studies that investigated company-internal platforms such as intranets. Through the screening of abstracts, we excluded 214 studies and narrowed our sample down to 173 studies.

For the remaining studies, we performed a full-text analysis to decide about their inclusion. To do so, we first retrieved the full-texts for all remaining studies. We then skimmed through these studies and assessed their relevance to our research objective. Thereby, we explicitly selected studies that investigate actors on digital platforms and

their activities. The final selection of studies is available as an open access data set at <https://doi.org/10.5281/zenodo.7075173>. These selected studies focus on topics such as electronic word of mouth, user-generated content, online communities, social media, user behavior, sharing behavior, crowdsourcing, and application development. Figure 2 provides an overview of our literature evaluation process. We also performed forward and backward search [15], but we did not identify any studies that enhance our final sample substantially.

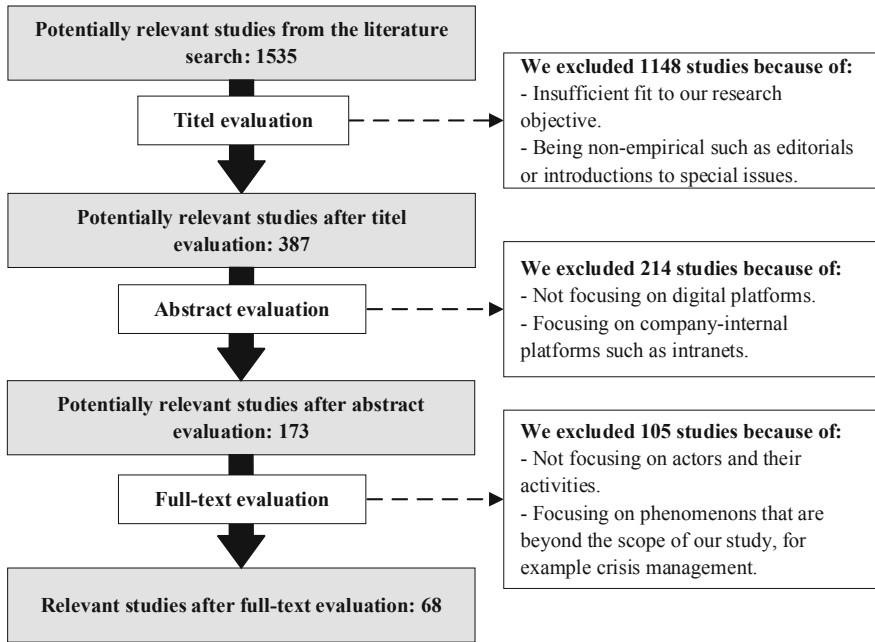


Fig. 2. Literature evaluation process

Next, we coded the studies while following a multi-dimensional and concept-centric coding approach [15]. In particular, we coded the studies along two dimensions and stopped the development of new codes once we reached saturation. Within the first coding dimension, we typologized digital platforms. In the beginning, we relied upon the basic differentiation between innovation and transaction platforms as proposed by Cusumano et al. [7]. However, we soon realized that this binary distinction is not sufficient to explain variations in our second coding dimension. Consequently, we increased the granularity of our platform typology until we reached conclusive results. In the second coding dimension, we used our platform typology as the foundation for the coding of different actor types. Specifically, we typologized ecosystem actors and assigned them to the producer or the consumer side of a platform. While most actors could be assigned rather clearly to a particular side, we also identified actors that have a dual role, meaning that they produce and consume at the same time. In a second iteration, we coded the

interaction patterns between the actor types. The results from the coding are also available at <https://doi.org/10.5281/zenodo.7075173>.

4 Results

In this section, we summarize the insights that we derived from our literature review. We structured our results along our two coding dimensions: platform types and actor types.

4.1 Platform Typology

We distilled five platform types from the existing literature: social media platforms, e-commerce platforms, sharing platforms, crowdsourcing platforms, and software platforms. In Table 2, we provide an overview of our platform typology. For each platform type, we present a short description, recurring research topics, practical examples, and an excerpt of sources.

The first type are **social media platforms** which comprise blogging [36] and microblogging platforms [37], online communities [38], electronic networks of practice [39], and social networking platforms [40]. Social media platforms enable users to connect and exchange information with other users. Moreover, they enable the formation of social ties while facilitating interactions among users [41]. Hence, many papers have focused on network structures and reciprocity on social media platforms [e.g., 42, 43].

The second type are **e-commerce platforms** which are electronic marketplaces that provide functionality for buying and selling products or services. E-commerce platforms such as Amazon or Taobao “provide an interface between a firm and its customers and suppliers, and provide another channel to market products and services” [44]. Most studies on e-commerce platforms have focused on the impact and design of electronic word of mouth and online reviews [e.g., 45, 46].

The third platform type are **sharing platforms** such as Airbnb or Turo. Sharing platforms are based on the idea that individuals are willing to share products, services and media with others [47]. This platform type can be traced back to peer-to-peer music and file sharing platforms such as Napster and Grooveshark [48, 49], but its central idea has been applied to several new contexts in recent years. Sharing platforms derive their value “from the fact that many resources are acquired to satisfy infrequent demand but are otherwise poorly utilized” [50]. Hence, many papers focus on concepts such as collaborative consumption, product ownership, social welfare, and trust [50–52].

The fourth type are **crowdsourcing platforms**. Crowdsourcing is characterized by open calls and requests that invite widely distributed crowds to perform tasks or to generate new ideas [53]. The literature distinguishes between two crowdsourcing practices. On the one hand, crowdsourcing can occur via freelancing practices, for example on platforms such as Fiverr and Upwork [e.g., 53, 54]. Thereby, the platform enables requestors to access and request a widely distributed crowd of workers. On the other hand, crowdsourcing also refers to crowdsourcing communities in which community members propose their own ideas for new products or services. Those practices are often part of companies’ open innovation strategies. Examples of crowdsourcing communities are Dell’s IdeaStorm Community [55], Lego’s Cusoo [56], and SAP’s SAPIens [57].

Table 2. Platform typology

	Social media	E-commerce	Sharing	Crowd-sourcing	Software
Short description	Provide users with the ability to connect and exchange information with other users	Provide functionalities for buying and selling products or services electronically	Enable the sharing of durable goods, services or media, typically among consumers	Enable open calls and requests that invite widely distributed crowds to perform tasks or to generate new ideas	Systems whose core functionality can be extended through applications
Research topics	Content generation, knowledge diffusion, network structures, reciprocity	Electronic word of mouth, online reviews, user- and marketer-generated content	Collaborative consumption, pricing, product ownership, social welfare, trust	Ethics and worker exploitation, ideas competition, user motivation and behavior	Application development, boundary resources, knowledge sharing, platform governance
Examples	Facebook, LinkedIn, Patients-LikeMe, Stack Overflow, Weibo	Alibaba, Amazon, Ebay, Taobao	Airbnb, GetMyBoat, Turo, Zilok	IdeaStorm, Kickstarter, Fiverr, Upwork	Android, Firefox, SAP's Business Technology Platform, Xbox
Exemplary sources	[8, 40, 58, 59]	[31, 45, 46, 60]	[47, 48, 50, 51]	[53, 54, 57, 61]	[20, 29, 62, 63]

The fifth platform type are **software platforms**. Software platforms are “an extensible technological foundation [...] on top of which outside firms can build platform-augmenting applications [29]. Hence, the central idea of software platforms is that third-party applications can extend the functional scope of the platform. Software platforms have found their way into various software domains, for example, mobile operating systems [12], enterprise software [62, 63], video games [64], or web browsers [29]. In our literature review, we identified that application development [12, 29], boundary resources [e.g., 12, 63], knowledge sharing [e.g., 62, 63] and platform governance [20, 65] are common research topics. Additionally, we identified that software platforms can operate on two different technological layers: the system layer and the application layer. On the system layer, software platforms function as an operating system that enables the installation of applications, for example on Android or Xbox. On the application layer, however, software platforms are best described as own applications that can be extended with additional modules, libraries, or plugins, as for example SAP's Business Technology Platform or Mozilla Firefox.

Thus far, we have described five established platform types that emerged from the literature review. Besides, we also identified that digital platforms are currently making inroads into two new domains, namely e-government [74] and health care [e.g., 75, 76]. In both domains, digital platforms have a specific purpose that differs from the platform types mentioned above. While the former serves as a means for the provisioning of governmental services to citizens, the latter is used for storing and exchanging health data, for example through an electronic health record platform. Although e-government and health care are two promising domains for digital platforms, the existing literature

Table 3. Actor and activity typology

	Social media	E-commerce	Sharing	Crowd-sourcing	Software
Producer	Actors on social media platforms are prosumers : they produce own content but also consume content of others	Sellers offer products or services on the platform’s marketplace	Lenders purchase goods and grant others temporary access to this good by charging a sharing price	Workers accept requests by crowdsourcers and perform a task or generate new ideas	Application developers design modular software applications that add functionality to the platform
Consumer		Buyers purchase products or services from the platform’s marketplace	Borrowers do not purchase a good but aim to get temporary access to a good by paying a sharing price	Crowdsourcers invite or request a widely distributed crowd to perform a task or to generate new ideas	Users utilize the software platform and benefit from the variety of available applications
Producer Activities	Creation of social media content such as text-based posts, images, videos, comments, questions or answers	Offering products or services on the platform’s marketplace, customer relationship management	Provide temporary access to a good, review borrowers	Offer services to crowdsourcers, contribute ideas and evaluate ideas of others, contribute code, donations	Development and distribution of applications, request application certifications
Consumer Activities	Consumption of social media content, for example through likes, reactions, shares or views	Initiate sales transactions by buying products, create reviews for sellers and products	Initiate a sharing encounter by requesting temporary access to a good, review lenders	Request and book services of workers, evaluate ideas of workers	Install and use of applications, create reviews for applications, report bugs
Exemplary sources	[8, 36, 58, 66]	[31, 67–69]	[47, 49–51]	[55, 57, 70, 71]	[12, 29, 72, 73]

on their actors is scarce. Consequently, we could not include them in the remainder of our literature review.

4.2 Actors, Activities, and Interactions

Within the actor dimension, we used two perspectives to analyze actors in platform ecosystem: an activity perspective and an interaction perspective. Activities are the basic unit for actions that are performed by the actors [77]. They describe their behavior and are often associated with a certain outcome. We explicitly focused on activities that have a positive or negative effect on the success of a platform ecosystems. Interactions on the other hand describe which actors engage with one another. They capture who interacts with whom.

Based on our platform typology, we drilled deeper into the literature and derived an actor typology. To do so, we relied on our proposed producer-consumer distinction. Table 3 gives an overview of the actors that engage on digital platforms as well as the activities that are performed by those actors. In line with our research question, we found that ecosystem actors vary across platform types. For social media platforms, we

discovered that actors have a dual role, meaning that a single actor can engage as content producer but also content consumer.

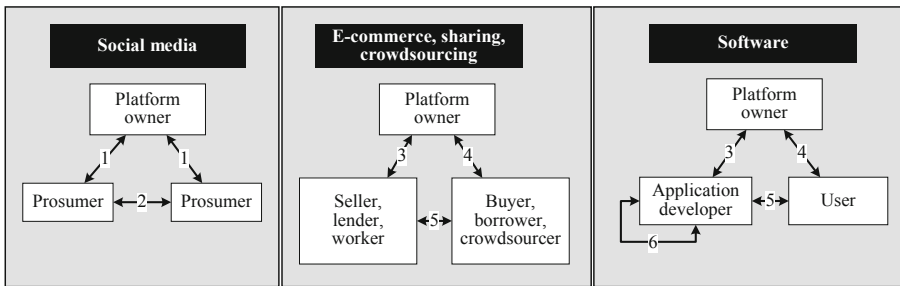


Fig. 3. Interaction patterns

Table 4. Description of interaction patterns

#	Interaction	Description
1	Platform owner to prosumer	Platform owners attempts to stimulate sustained participation and content generation on social media platforms [e.g., 78, 79]
2	Prosumer to prosumer	The influence that prosumers exert on other prosumers, also known as peer influence [80]. Examples are the influence of social media contributions on one another or the recommendation of a platform to others [e.g., 58]
3	Platform owner to producer	Platform owners’ governance of the producer side. Depending on the platform type, this ranges from pricing and discount functionalities [11] to consumer review systems [81] and software development tools [12]
4	Platform owner to consumer	Platform owners’ governance of the consumer side. Examples are pricing and transaction fees [82], the provisioning of product [46] and app review systems [72], and the measurement of buyer satisfaction [31]
5	Consumer to producer	The influence that consumers exert on producers and vice versa. Studies that investigated this interaction type often focused on cross-side network effects [e.g., 40, 72]. Cross-side network effects refer to the phenomenon that the size and growth of one side reinforces the size and growth of the other side [72]
6	Producer to producer	The influence that producers exert on other producers. This interaction type is especially prevalent for software platforms, where application developers share knowledge with one another [62, 63]

Within the second actor perspective, we coded interactions between ecosystem actors. Thereby, we considered producers, consumers, prosumers, and the platform owner as potential interaction partners. We included the platform owner to capture their approaches to govern platform ecosystems. In total, we discovered six interaction patterns which are illustrated in Fig. 3. Detailed descriptions of the interaction patterns are summarized in Table 4.

5 Interpretation and Future Research

The purpose of this study was to develop a typology of digital platforms, ecosystem actors, and their activities. We provided rich descriptions for our typologies and contribute to the current discourse by showing that the role of ecosystem actors varies significantly across platform types. Additionally, our results indicate that research on digital platforms is hardly comparable across platform types because ecosystem actors perform distinct activities. For instance, the development of software applications differs from selling goods on an e-commerce platform. Moreover, we revealed that actors on social media platforms have a double role as prosumers, and that software platforms benefit from an additional interaction, the developer-to-developer interaction. Researchers have already started to investigate this specific interaction more in-depth [e.g., 83, 84]. A major reason for the existence of developer-to-developer interaction is that software development is a knowledge-intensive task. Hence, developers benefit from sharing knowledge with one another. Lastly, our study also contributes to the literature on digital platforms by extending existing typologies. While Cusumano et al. [7] suggested a differentiation between transaction and innovation platforms, we found that a more fine-grained typology is necessary to explain variations among actors and their activities.

Our literature review opens up several avenues for future research. First, we found that much of the existing literature has focused on the influence that a specific actor type exerts on other actor types. However, empirical evidence on how actors of the same type influence one another is scarce. Outside of the social media and software domain, we were not able to identify many papers that investigate the influence of consumers on other consumers or the influence of producers on other producers. Hence, scholars may analyze this effect also for e-commerce, sharing, and crowdsourcing platforms. Second, we uncovered the relevance of knowledge sharing for software platforms. Future research may therefore examine how platform owners can optimize knowledge sharing in software platform ecosystems. This is an important matter because software development is a knowledge intensive task but knowledge has to be shared across firm boundaries. To do so, researchers may also take on the relatively understudied perspective of application developers [3]. Third, we revealed that actors on digital platforms may occupy a double role as consumer and producer. Further analyses are needed to clarify such double roles for e-commerce, sharing, crowdsourcing, and software platforms [e.g., 85]. Fourth, future research may examine how platform governance varies across platform and actor types. The information systems field yet lacks a systematic overview on how platform governance varies among platform types because the existing platform governance literature has either focused on a particular platform type [e.g., 20, 65] or generalized across multiple platform types [e.g., 10, 86].

During our literature review, we discovered an additional characteristic that distinguishes platform types from one another. We identified that the ease with which actors can switch from the consumer to the producer side depends upon the platform type. For instance, prosumers on social media platforms can switch effortlessly from being content consumer to being content producer. On Facebook or LinkedIn, users can switch almost instantly from passively scrolling through one's newsfeed to actively commenting on posts others. This effortless transition is a result of actors being able to use a single account for producer and consumer behavior. For sharing and e-commerce platforms, we identified a medium level of consumer-to-producer switching ease. The reason is that actors have to own a specific good in order to engage on the producer side. For example, on sharing platforms, lenders must be able to share a good or service with a consumer. Thus, producers, such as hosts on Airbnb, must own a property in order to offer it for short-term rental. E-commerce platforms have a similar ownership requirement for producers. The main difference is that an individual product can be sold only once but shared several times. Hence, product ownership does not shift temporarily but permanently. Due to the consequential necessity of resupply, we observed a slightly higher effort to engage as a producer on e-commerce platforms than on sharing platforms. On crowdsourcing platforms, the ease with which consumers can switch to producers varies significantly. For instance, workers on Fiverr offer a high variety of services such as translating documents or web development. This discrepancy makes it difficult to assess the consumer-to-producer switching ease for crowdsourcing platforms on a general level. Finally, we found that actors on software platforms require the highest amount of effort to switch from the consumer to the producer side. The reason is that software development is a knowledge-intensive task and that users have to acquire a profound amount of knowledge before they can start developing applications. This knowledge acquisition process is time-consuming and it requires knowledge to cross organizational borders. As indicated by our producer-to-producer interaction, an emerging research stream has started to investigate how platform owners satisfy the high knowledge requirements of application developers [62, 63, 87, 88].

Acknowledgements. This work was in part funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – project no. 444990299.

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