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The Influence of Digital Affordances and Generativity on Digital Platform Leadership

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Short Paper

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Abstract

The increasing importance of digital platforms is undisputed. Digital platforms integrate and orchestrate an ecosystem of autonomous actors to co-create value instead of relying solely on internal innovation capabilities. To achieve this, the platform owner provides digital affordances through boundary resources that an ecosystem of complementors can use to create value-adding services. The platform combines internal innovation capabilities by providing digital affordances and utilizes external innovation capabilities between complementors that refer to the generativity of the ecosystem. However, it remains unclear how the provision of affordances and the interaction of complementors led to the tremendous success of digital platforms. To disentangle both internal and external innovation capabilities, we adhere to a fuzzy-set qualitative comparative analysis based on a set of 47 platforms. Preliminary results reveal four configurations of leading platforms that combine affordances of the platform and generativity in an ecosystem to point toward a fruitful area for future research.

Keywords: Digital platform ecosystems, platform leadership, generativity, affordances

Introduction

Digital platforms shifted the locus of value creation from inside the firm to an ecosystem of complementors (Parker et al. 2016a). An example is Apple's App Store, where the majority of applications originate from an ecosystem of third-party developers. The platform owner provides boundary resources such as software development kits (SDKs) to increase the digital affordances of the platform, where affordances represent opportunities for complementors to co-create value-adding complements (Ghazawneh and Henfridsson 2013; Nambisan et al. 2019). Those value-adding complements result from the actualization of affordances and can produce unprompted changes by autonomous actors, which defines the generativity of a digital platform ecosystem (Zittrain 2005). For example, Apple's provision of ARKit provides developers with new affordances or ways to develop applications. In turn, developers can use the generativity of the ecosystem by sharing their knowledge with peers to come up with novel applications in the field of augmented reality.

This interplay of providing digital affordances and the subsequent actualization of those affordances with an ecosystem of autonomous complementors illustrates that the success of digital platform ecosystems depends on both the internal innovation capabilities of the platform owner and the capabilities of external complementors in a digital platform ecosystem. Hence, by combining research on the internal facilitation (Baldwin and Woodard 2009; Tiwana et al. 2010) and the external actualization of affordances, which define generativity (Henfridsson and Bygstad 2013; Yoo et al. 2010), it is possible to understand why some platforms strive and others fail.

Research on the internal perspective of digital platforms (Baldwin and Woodard 2009; Tiwana et al. 2010) elaborates on how the platform owner can increase digital affordances of the technical platform (Nambisan et al. 2019). The measures to increase affordances include design criteria such as the malleability of the digital platform (Tilson et al. 2010; Tiwana et al. 2010) or the innovation capabilities of the platform owner represented by patents (Pavitt 1985). Research on the external perspective evaluates an ecosystem of autonomous actors (Adner and Kapoor 2016; Jacobides et al. 2018) and incorporates external measures such as the degree of knowledge sharing in an ecosystem (Dokko et al. 2014) or the autonomy of complementors (Ye and Kankanhalli 2018) that influence the generativity of a digital platform.

To synthesize both perspectives, scholars introduced new concepts such as the distributed tuning of boundary resources through the interaction of the platform owner and actors in the ecosystem (Eaton et al. 2015). These and other results (Henfridsson et al. 2018; Karhu et al. 2018) hint toward the complex and interdependent relationship between the provision of digital affordances through boundary resource development and their actualization by external complementors, which leads to generativity. However, on a holistic perspective, it is still unclear how the interplay of affordances and generativity influence the success of digital platforms (de Reuver et al. 2018). The importance of the provision of affordances, such as ARKit, to gain a competitive advantage is unclear. Alternatively, it is essential to know whether digital platforms depend more strongly on the capabilities of peers, like in the case of knowledge sharing, to utilize the generativity of the ecosystem. In addition, it is necessary to know whether platforms that depend on the provision of affordances are more successful than those that depend on the generativity of their ecosystem. To identify patterns of interaction between the internal and external innovation perspective, we pose the research question: *How do affordances and generativity influence the success of digital platforms?*

Owing to the complexity and interdependencies between affordances provided by the platform owner and generativity created by the ecosystem, we adhere to a fuzzy-set qualitative comparative analysis (fsQCA) (Fiss 2007; Ragin 2008) in the context of 47 digital platforms. The platforms are in different stages of a venture life cycle such as conceptualization, monetization, and growth stages (Fisher et al. 2016). To obtain more detailed results, we added platform cases that failed to establish a new venture and cases where the platform achieved platform leadership (Gawer and Cusumano 2002). On the basis of these stages, we use the concepts of affordances and generativity to derive patterns of successful digital platforms that increase our understanding of how leading platforms use the provision of affordances and the generativity of autonomous complementors to strive. The patterns of the interplay between internal and external innovation capabilities can further guide research toward a more nuanced understanding of platform leadership (Gawer 2014) and inform practitioners on the design criteria of digital platforms.

As part of an ongoing research effort, we preliminarily identify four configurations of affordances and generativity that foster digital platform leadership. However, this is only the first iteration to derive more robust and compelling results on interaction patterns between internal and external innovation capabilities in digital platform ecosystems. For future research work, we plan to conduct further interviews to refine and recalibrate the causal conditions of internal innovation as affordances and those of external innovation as generativity. In addition, we plan to extend the results toward the patterns of failing platform ecosystems.

Related Work

This study is based on the literature on digital platforms (Constantinides et al. 2018; de Reuver et al. 2018) and includes the internal construct of technological platforms (Baldwin and Woodard 2009; Tiwana et al. 2010) or digital infrastructures (Henfridsson and Bygstad 2013; Tilson et al. 2010), and the external construct of ecosystems (Adner and Kapoor 2016; Jacobides et al. 2018). From an internal perspective, the platform owner provides boundary resources to increase digital affordances, as shown by the example of Apple providing ARKit. From an external perspective, autonomous complementors in the ecosystem actualize the affordances by using the generativity of the ecosystem to develop value-adding complements. An example is combining capabilities of complementors to develop novel augmented reality applications.

The Provision of Affordances in Digital Platforms

Digital platforms are central to an ecosystem and orchestrate supply and demand between different actors (Parker et al. 2016a; Parker et al. 2016b). From a technical perspective, actors in the ecosystem access a digital infrastructure through boundary resources such as application programming interfaces (APIs) to create and cultivate digital goods or services (Constantinides et al. 2018; Ghazawneh and Henfridsson 2013). An example is the application platform iOS, where third-party developers use APIs and SDKs to develop applications. Then, the digital platform distributes the applications to an ecosystem of users. In the remainder of this paper, we refer to the construct of a digital platform as "*a set of digital resources—including services and content—that enable value-creating interactions between external producers and consumers"* (Constantinides et al. 2018; Parker et al. 2016b).

Digital platforms, like any other form of technology venture, pass through various stages of development (Evans 2009; Fisher et al. 2016). First, the conceptualization stage describes how new ventures act under uncertainty regarding the plausibility of their underlying technology and the targeted market segment. Second, the commercialization stage demonstrates how the new ventures decrease technological and market-based uncertainties and establish a plausible business model (Kazanjian 1988). Third, the growth stage indicates how the new venture exploits its technology to harvest short-term financial returns (Rajgopal et al. 2003). On the basis of the target market, ventures can either try to ignite the platform into a mass-market, as shown by the example of Facebook, or establish a niche as demonstrated by Dribble. Consequently, the aggressive ignition of a digital platform requires more capital than the slow growth in a niche market (Evans 2009). Last, there can be the stage of platform leadership that emphasizes how the platform establishes a central and dominant position in the market (Gawer and Cusumano 2002).

A crucial characteristic of digital platforms is the provision of digital affordances (Nambisan et al. 2019; Tan et al. 2016), which defines *"what an individual or organization with a particular purpose can do with a technology"* (Majchrzak and Markus 2013). The digital platform needs to be inherently malleable to provide new affordances; specifically, it can be reconfigured to adapt user needs and to prompt new technological advances (Yoo et al. 2010). In addition, digital platforms are built on a modular architecture that ensures composability by integrating new modules without compromising the entire system (Baldwin and Clark 2000; Tiwana et al. 2010). An example is Apple's introduction of the ARKit that complements the iOS platform and is now a breeding ground for third-party developers. This measure illustrates that the degree of malleability or ease with which a platform or modules can be reconfigured can create new affordances for the entire ecosystem (Tiwana et al. 2010). This observation also implies that the platform owner depends on the internal innovation capabilities to introduce new functionality that an ecosystem of complementors can use as new affordances. Studies that try to operationalize the internal innovation capability of a firm use metrics such as patents or the number of new products developed (Balkin et al. 2000; Romijn and Albaladejo 2002).

Furthermore, the platform owner provides boundary resources that enable an ecosystem of complementors to actualize affordances on the digital platform (Eaton et al. 2015; Ghazawneh and Henfridsson 2013). Boundary resources can be APIs that define the openness of digital platforms, SDKs that provide boilerplate code to decrease the cognitive distance between platforms and their ecosystems, and documentation that define work processes on how to use boundary resources (Hein et al. 2019; Karhu et al. 2018). In addition, boundary resources represent the joint effort of the platform owner and complementors to increase the generativity of a digital platform ecosystem. An example is the process of distributed tuning that describes the dynamics between the platform owner and the ecosystem actors on altering boundary resources (Eaton et al. 2015).

Establishing Generativity by Integrating Complementors

The creation of economic value shifted during the last decades from production within single firms to collaboration with individual customers to the co-creation of value in complex ecosystems. From a theoretical perspective, the integration of external actors into the value creation process of a firm goes back to the concept of lead-user integration (Von Hippel 1986) and was seized by other researchers as open innovation (Chesbrough 2012) and value co-creation (Prahalad and Ramaswamy 2004; Vargo and Lusch 2016; Vargo et al. 2008). In addition, the literature on digital platform ecosystems is inherently built on the integration of customers and other partners to leverage external innovation capabilities (Parker et al.

2016a). More recently, scholars in the field of strategy research emphasized the importance of ecosystems as a construct of scientific inquiry (Adner and Kapoor 2016; Jacobides et al. 2018). We follow Jacobides et al. (2018) who define ecosystems as *"a set of actors with varying degrees of multilateral, nongenetic, complementarities that are not fully hierarchically controlled."*

A crucial characteristic of a digital platform ecosystem is its generativity (Henfridsson and Bygstad 2013; Yoo et al. 2010), which defines *"a technology's overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences"* (Zittrain 2005). While the digital platform provides affordances in the form of digital infrastructure, the large variety of ecosystem actors fuels the generativity with individual innovation capabilities (Nambisan et al. 2019). An example is the application development industry, where more external complementors on the platform lead to a wider variety and number of complements on the platform (Boudreau 2012). Thus, the decision-making and work-method autonomy of complementors directly influence the number of innovative complements on the digital platform (Ye and Kankanhalli 2018). In addition, the degree of knowledge-sharing in the ecosystem is another factor that increases the creative generativity in the ecosystem (Dokko et al. 2014).

Furthermore, the degree of openness determines the boundaries of an ecosystem and, thus, the generative potential of the digital platform (Nambisan et al. 2019). Gawer (2014) classifies platforms as internal, supply chain, and industry platforms on the basis of the autonomy of agents and the degree of competition in the ecosystem. Internal platforms limit the ecosystem to internal employees with little competition, while technological platforms include an ecosystem of autonomous agents that can compete with one another. Restricting the degree of openness can further reduce competition and increase the control of the platform owner over the installed base of complements (Ghazawneh and Henfridsson 2013). In turn, relinquishing control and increasing the degree of openness can limit the platform owner's influence on complementors but fuel the generativity of the broader ecosystem (Remneland-Wikhamn et al. 2011).

Thus, the success of a digital platform can be operationalized through the different stages of platform development; digital affordances can be operationalized through the degree of malleability and internal innovation capabilities of the platform owner; generativity of the platform ecosystem can be operationalized through the degree of knowledge-sharing and the autonomy of complementors in the ecosystem. Finally, boundary resources align both perspectives and can be operationalized by APIs and the degree of platform openness and the cognitive distance through the provision of SDKs.

Method

This study builds on a fsQCA as a novel methodology for modeling complex and causal relations *"that are frequently better understood in terms of set-theoretic relations rather than correlation."* (Fiss 2007; Ragin 2008). The fsQCA has proven to be useful in conditions where the relationship between different causal conditions cannot be observed in isolation but can be classified as a *"conjunctural causation"* (Durand and Vaara 2009). In the context of digital platforms, both affordances provided by the platform and the interactions of an ecosystem to actualize those affordances to create generativity are needed to make a digital platform strive. To determine configurations of core and peripheral conditions of an outcome, such as platform leadership, the fsQCA uses logical minimization of a truth table that represents causal conditions such as affordances and generativity. The design of APIs refers to technological openness, and the design of SDKs describes cognitive distance between platform owner and complementors (Ragin 2008).

The fsQCA identifies differences and commonalities across a set of cases (digital platforms) to yield configurations that share the same outcome. Hence, we use a sampling strategy that incorporates digital platforms at different lifecycle stages ranging from failure, conceptualization, monetization, small growth in niche markets, ignition into mass markets, and platform leadership. On the basis of the recommendation of Ragin (2008), we selected 47 digital platforms, which we categorized as follows: six – failure stage, four – conceptualization stage, nine – monetization stage, thirteen – small niche market growth stage, eight – mass-market growth stage, and seven – platform leadership stage cases. As an empirical basis, we conducted 51 semi-structured interviews with the platform owners to gather information on how they provide affordances, how the ecosystem contributes to the generativity, and on the design of boundary resources. We triangulated the data with market reports, patent data, and archival data gathered in a period from mid-2018 to the end of the first quarter of 2019.

We use the literature on digital platforms to guide the calibration process of the causal conditions regarding the set membership. In particular, we integrate the internal perspective of the platform owner and the provision of affordances and the external perspective of ecosystem actors that foster generativity by identifying antecedents of platform failure and leadership. During the calibration process, we follow prior research (Ragin 2008) that defines 0 as full-non membership, 0.5 as maximum ambiguity, and 1 as full membership. In addition, we use qualitative data in the form of interview transcripts and quantitative data such as archival data from GitHub to calibrate hard to measure constructs, such as knowledge sharing in an ecosystem (Vasilescu et al. 2014). We followed the stepwise procedure of Basurto and Speer (2012) to calibrate the qualitative data starting with the operationalization of conditions, development of anchor points, conduction of content analysis, summarizing of the coded data, and determining the fuzzy-set scale. Because this contribution is part of an ongoing research endeavor, further iterations of interviews will provide new insights that help to recalibrate causal conditions to obtain more meaningful configurations.

Data Sources

Measuring the success of digital platforms can be a challenging task. For example, Uber is an undisputed platform leader in terms of market share even though in the year of 2018 its losses were greater than profits (Zaveri and Bosa 2019). However, niche markets may have a low degree of market penetration but sustainable profits. Hence, we decided to use digital platform lifecycle stages (OUT) as a proxy for platform success. We used market data from CrunchBase, empirical results from interviewees and market reports, and archival data to calibrate a platform's current lifecycle stage. The value of 0 means that the platform went bankrupt or failed, 0.2 refers to a newly emerging platform that tries to establish a concept, 0.4 refers to platforms that try to monetize their concepts, 0.6 refers to platforms growing into niche markets, 0.8 refers to platforms that rapidly ignite into mass markets, and 1 refers to platform leadership.

The first causal condition represents the platform owners' ability to file patents (PU) as a preliminary proxy of the ability to provide *digital affordances*. We code companies that filed patents subject to their digital platform as 1 and companies without patents as 0. During the next iteration of interviews, we plan to inquire on more sophisticated metrics such as the degree of the malleability of the technical infrastructure to refine the first results of the fsQCA.

We measure the *generativity* of a digital platform on the basis of the complementors' autonomy (CA) and the degree of knowledge sharing (KS). For the complementor's autonomy, we adhere to decision-making autonomy (Ye and Kankanhalli 2018). We differentiate between no autonomy, which refers to the internal provision of complements by the platform owner as 0 to a low degree of autonomy, which is represented by the tight coupling with few, strategic partnerships as 0.33, to a tight coupling with many contractually-bounded partners as 0.66, to high autonomy and loosely-coupled complementors as 1. In addition, on the basis of the active number of GitHub repositories, we determine the degree of knowledge-sharing (Vasilescu et al. 2014). We fuzzified the repositories on the basis of the direct method and the three anchor points (Ragin 2008) of 10 repositories, which indicate limited-knowledge sharing, 50 as the cross-over point, and more than 500 as a high degree of knowledge sharing. We selected the anchor points on the basis of the substantive knowledge of reviewing GitHub commits and issues discussed in the repositories.

Furthermore, we measure the use of *boundary resources* on the basis of the degree of cognitive distance (CD) between platform owner and complementor and the technological openness (TO) of APIs. The cognitive distance indicates the ease of providing new products or service on the platform by offering tools and information on how to interact. We coded a high degree of cognitive distance as 0, when the platform owner does not provide SDKs, code snippets, or documentation on how to interact with the platform; 0.33 if documentation, such as code snippets, or an internal developer website, is available; 0.66 if the platform owner provides SDKs that lack documentation; and 1 if the platform owner provides both documentation and SDKs. The degree of technological openness describes whether the platform is closed or open. We adhere to similar metrics to measure the cognitive distance that codes digital platforms: 0 if they provide no APIs or other ways to integrate complements; 0.33 if the platform does not offer APIs but has a restricted process to integrate complements; 0.66 if APIs are available but there is no further documentation; 1 if both APIs and documentation are available.

Analysis

On the basis of the five causal conditions and the calibrated fuzzy sets, the fsQCA proceeds with a three-step approach (Fiss 2007). First, we use the R package QCA to construct a truth table where each row includes zero to many cases that describe all logically possible combinations of causal conditions toward an outcome variable. Second, the fsQCA proceeds with a minimization of the truth table to derive cases that fulfill the minimum number of cases, and that adhere to a minimum consistency level required. We set the minimum number of cases to two and the consistency level to 0.80, which is above the suggested threshold of 0.75 (Ragin 2008). Last, the truth table algorithm calculates the consistency scores of raw consistency and proportional reduction in inconsistency (PRI), both of which determine the reliability of configurations. While the raw consistency gives credit for inconsistencies resulting from "near misses," the PRI accounts for cases that have simultaneous membership in both the complements and outcome. Similar to prior studies (Park et al. 2017), we set the cutoff for the raw consistency and PRI to 0.80. Table 1 shows the minimized truth table of succeeding digital platform configurations.

Table 1 Minimized truth table of succeeding digital platform configurations

PU	CA	KS	TO	CD	OUT	Number	Raw consistency	PRI consistency	Cases
0	1	1	1	0	1	2	1.00	1.00	37, 39
1	1	1	1	0	1	2	1.00	1.00	33, 43
1	1	1	1	1	1	8	.97	.97	22, 38, 41, 42, 44, 45, 46, 47
1	0	0	0	1	1	2	.96	.93	28, 34
1	0	0	0	0	1	2	.92	.86	35, 40

Preliminary Results, Discussion, and Next Steps

The preliminary results yielded by the intermediate solution of our analysis suggest that there are four configurations of sufficient conditions for the leading digital platforms (Table 2). We build on the notation introduced by Fiss (2011), who uses large circles to denote core conditions and small circles to denote peripheral conditions. Black circles indicate the presence of a condition, while crossed-out circles indicate its absence. Empty cells indicate that the condition is not relevant for a particular configuration.

Table 2 Configurations of the leading digital platforms

Theme	Configuration elements	Configurations for leading platforms: Innovation	Technology	Transaction	Integration
Affordances	Patent use	⬤	⬤		⊗
Generativity	Complementor autonomy	●	⊗	●	●
	Knowledge-sharing	⬤	⊗	⬤	⊗
Boundary resources	Technological openness	●	⊗	●	●
	Cognitive distance			⊗	⬤
Consistency		.97	0.91	1.00	0.80
Raw coverage		.35	.11	.17	.18
Unique coverage		.30	.11	.04	.10
Overall solution consistency		**.91**			
Overall solution coverage		**.68**			

The core conditions indicate that each configuration utilizes different aspects of affordances, generativity, and boundary resources. *Innovation platforms* rely both on the internal provision of affordances and the generativity of the ecosystem, which can be illustrated by the core conditions of patent use and knowledge sharing. In addition, innovation platforms indicate technological openness through the provision of APIs that complementors can use to co-create value-adding complements. Examples are application stores, where the platform provides boundary resources that an ecosystem of autonomous complementors can use to create new applications. In turn, each complementor has access to a variety of applications to obtain new ideas, which increases the generativity of the ecosystem.

Technology platforms depend solely on the internal provision of affordances, as indicated by the core condition of patent use indicates. In addition, technology platforms show the absence of complementor autonomy, knowledge-sharing, and technology openness. The occurs because technology platforms are closed and are only fueled by the internal innovation capabilities of the platform owner. The direct consequence is that the platform does not take advantage of the generativity of ecosystem partners, because the technology platform enables value-creating interactions only within the boundaries of the partners' company. Hence, partners do not mirror innovations back to the platform owner. The examples include technology platforms that aid ecosystem partners to co-create new applications using artificial intelligence.

Transaction platforms do not rely on the provision of new affordances. Rather, they rely on the generativity of a vibrant ecosystem, as shown by the core condition of knowledge sharing. The generativity is further fueled by the high autonomy of complementors and technological openness. In addition, the cognitive distance is high, as the main goal is the orchestration of generic services between the supply and demand and not the integration of innovative complements. The examples include digital platforms that focus on the convenient facilitation of generic goods and services such as marketplaces and transportation services.

Integration platforms do not utilize the provision of affordances and only partly take advantage of the generativity of their ecosystem. They are characteristics by the high degree of complementor autonomy, technological openness, and the absence of patents and knowledge sharing. A key characteristic is the low cognitive distance, which demonstrates that integration platforms try to make the provision of new complements as easy as possible. This configuration illustrates that integration platforms are reactive and either allow complementors to use the data provided by the platform or to integrate their services on a meta platform. Both cases can be illustrated on the basis of the case of mobility, where the platform can be the source of data due to open APIs and SDKs or the aggregator of mobility services acting as a meta platform.

The four configurations reveal how internal innovation capabilities or affordances and the external actualization of those affordances, which are represented as generativity, influence the success of digital platforms. First, innovation platforms rely on internal innovation capabilities by providing boundary resources that allow deep integration of complements into the digital platform (Ghazawneh and Henfridsson 2013). The complements are supermodular, which means that every new complement increases the overall value of the platform (Jacobides et al. 2018), which makes the platform less vulnerable to multi-homing effects and fuels the generativity of the ecosystem. However, innovation platforms need internal resources to keep up with the latest innovations and development to stay competitive. In addition, they need a malleable and composable infrastructure (Tiwana et al. 2010) to continuously provide new affordances to the ecosystem. Second, technology platforms depend solely on their internal resources to provide affordances to a closed set of ecosystem partners. The complements show a unique complementary, which means that companies need to use the platform to create new services (Jacobides et al. 2018). However, because the services are not mirrored back to the platform owner, the platform does not profit from the generativity of the ecosystem. Third, transaction platforms benefit from a first-mover advantage and strong indirect network effects (McIntyre and Srinivasan 2017). However, the interviews also revealed that they are prone to multi-homing effects because they do not have internal innovation capabilities and rely on generic goods and services. Fourth, integration platforms build on SDKs to reduce the cognitive dissonance and technological openness through APIs to enable autonomous actors to either integrate their services or to use the data provided. The integration foster supermodularity because new services increase the value of the platform. However, the boundary resources strictly define what services can be integrated, which limits the generativity of the ecosystem.

The intersection analysis reveals that only innovation platforms and technology platforms intersect; all other configurations are disjoint (Park et al. 2017). A reason for this intersection is that patents can be filed in transaction platforms to improve the efficiency of transaction platforms. However, patents are not used to mirror new affordances to the ecosystem, which indicates that patents need to be analyzed more carefully to determine the provision of affordances. By interpreting conditions as patterns of equifinality (Fiss 2011), the configurations reveal that transaction platforms can transition toward innovation platforms if they build internal innovation capabilities. However, technology platforms need to shift from the absence of technology openness, knowledge-sharing, and complementor autonomy toward fostering generativity by opening up the digital platforms (Ondrus et al. 2015). The configurations reveal the different pattern on how successful platforms utilize affordances and the generativity of an ecosystem. Research on digital platforms can use the four configurations to specify the term digital platform more carefully, hence, accounting for the different patterns of providing affordances and utilizing the ecosystem generativity through boundary resources. Besides, practitioners can use the results to learn how different platform configurations use internal and external innovation capabilities to be successful.

This study presents preliminary results and is part of a larger research endeavor. While we already conducted 51 interviews to establish theoretical sensitivity, more interviews are needed to refine and recalibrate variables. In addition, more specific questions that are informed by the preliminary results could help to provide additional information on the relationship between internal innovation capabilities and the provision of affordances, and the ecosystem that actualizes the affordances to create generativity.

References

Adner, R., and Kapoor, R. 2016. "Innovation Ecosystems and the Pace of Substitution: Re-Examining Technology S-Curves," *Strategic Management Journal* (37:4), pp. 625-648.

Baldwin, C. Y., and Clark, K. B. 2000. *Design Rules: The Power of Modularity*. Cambridge, MA: MIT Press.

Baldwin, C. Y., and Woodard, C. J. 2009. "The Architecture of Platforms: A Unified View," in *Platforms, Markets and Innovation,* A. Gawer (ed.). Cheltenham, UK: Edward Elgar Publishing Limited.

Balkin, D. B., Markman, G. D., and Gomez-Mejia, L. R. 2000. "Is Ceo Pay in High-Technology Firms Related to Innovation?," *Academy of Management Journal* (43:6), pp. 1118-1129.

Basurto, X., and Speer, J. 2012. "Structuring the Calibration of Qualitative Data as Sets for Qualitative Comparative Analysis (Qca)," *Field Methods* (24:2), pp. 155-174.

Boudreau, K. J. 2012. "Let a Thousand Flowers Bloom? An Early Look at Large Numbers of Software App Developers and Patterns of Innovation," *Organization Science* (23:5), pp. 1409-1427.

Chesbrough, H. 2012. "Open Innovation: Where We've Been and Where We're Going," *Research-Technology Management* (55:4), pp. 20-27.

Constantinides, P., Henfridsson, O., and Parker, G. G. 2018. "Introduction—Platforms and Infrastructures in the Digital Age," *Information Systems Research* (29:2), pp. 3-6.

de Reuver, M., Sørensen, C., and Basole, R. C. 2018. "The Digital Platform: A Research Agenda," *Journal of Information Technology* (33:2), pp. 124-135.

Dokko, G., Kane, A. A., and Tortoriello, M. 2014. "One of Us or One of My Friends: How Social Identity and Tie Strength Shape the Creative Generativity of Boundary-Spanning Ties," *Organization Studies* (35:5), pp. 703-726.

Durand, R., and Vaara, E. 2009. "Causation, Counterfactuals, and Competitive Advantage," *Strategic Management Journal* (30:12), pp. 1245-1264.

Eaton, B., Elaluf-Calderwood, S., Sorensen, C., and Yoo, Y. 2015. "Distributed Tuning of Boundary Resources: The Case of Apple's Ios Service System," *MIS Quarterly* (39:1), pp. 217-243.

Evans, D. S. 2009. "How Catalysts Ignite: The Economics of Platform-Based Start-Ups," in *Platforms, Markets and Innovation,* A. Gawer (ed.). Cheltenham, UK: Edward Elgar Publishing, pp. 99-128.

Fisher, G., Kotha, S., and Lahiri, A. 2016. "Changing with the Times: An Integrated View of Identity, Legitimacy, and New Venture Life Cycles," *Academy of Management Review* (41:3), pp. 383-409.

Fiss, P. C. 2007. "A Set-Theoretic Approach to Organizational Configurations," *Academy of Management Review* (32:4), pp. 1180-1198.

Fiss, P. C. 2011. "Building Better Causal Theories: A Fuzzy Set Approach to Typologies in Organization Research," *Academy of Management Journal* (54:2), pp. 393-420.

Gawer, A. 2014. "Bridging Differing Perspectives on Technological Platforms: Toward an Integrative Framework," *Research Policy* (43:7), pp. 1239-1249.

Gawer, A., and Cusumano, M. A. 2002. *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*. Harvard Business School Press Boston, MA.

Ghazawneh, A., and Henfridsson, O. 2013. "Balancing Platform Control and External Contribution in Third-Party Development: The Boundary Resources Model," *Information Systems Journal* (23:2), pp. 173-192.

Hein, A., Weking, J., Schreieck, M., Wiesche, M., Böhm, M., and Krcmar, H. 2019. "Value Co-Creation Practices in Business-to-Business Platform Ecosystems," *Electronic Markets* (In print), pp. 1-16.

Henfridsson, O., and Bygstad, B. 2013. "The Generative Mechanisms of Digital Infrastructure Evolution," *MIS Quarterly* (37:3), pp. 907-931.

Henfridsson, O., Nandhakumar, J., Scarbrough, H., and Panourgias, N. 2018. "Recombination in the Open-Ended Value Landscape of Digital Innovation," *Information and Organization* (28:2), pp. 89-100.

Jacobides, M. G., Cennamo, C., and Gawer, A. 2018. "Towards a Theory of Ecosystems," *Strategic Management Journal* (39:8), pp. 2255-2276.

Karhu, K., Gustafsson, R., and Lyytinen, K. 2018. "Exploiting and Defending Open Digital Platforms with Boundary Resources: Android's Five Platform Forks," *Information Systems Research* (29:2), pp. 479-497.

Kazanjian, R. K. 1988. "Relation of Dominant Problems to Stages of Growth in Technology-Based New Ventures," *Academy of Management Journal* (31:2), pp. 257-279.

Majchrzak, A., and Markus, M. L. 2013. "Technology Affordances and Constraints in Management Information Systems (Mis)," in *Encyclopedia of Management Theory,* E. Kessler (ed.). Thousand Oaks, CA: SAGE Publications, p. 832.

McIntyre, D. P., and Srinivasan, A. 2017. "Networks, Platforms, and Strategy: Emerging Views and Next Steps," *Strategic Management Journal* (38:1), pp. 141-160.

Nambisan, S., Wright, M., and Feldman, M. 2019. "The Digital Transformation of Innovation and Entrepreneurship: Progress, Challenges and Key Themes," *Research Policy* (In print), pp. 1-9.

Ondrus, J., Gannamaneni, A., and Lyytinen, K. 2015. "The Impact of Openness on the Market Potential of Multi-Sided Platforms: A Case Study of Mobile Payment Platforms," *Journal of Information Technology* (30:3), pp. 260-275.

Park, Y., El Sawy, O. A., and Fiss, P. 2017. "The Role of Business Intelligence and Communication Technologies in Organizational Agility: A Configurational Approach," *Journal of the Association for Information Systems* (18:9), pp. 649-686.

Parker, G., Van Alstyne, M., and Jiang, X. 2016a. "Platform Ecosystems: How Developers Invert the Firm," *MIS Quarterly* (41:1), pp. 255-266.

Parker, G. G., Van Alstyne, M. W., and Choudary, S. P. 2016b. *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You*. New York, NY: WW Norton & Company.

Pavitt, K. 1985. "Patent Statistics as Indicators of Innovative Activities: Possibilities and Problems," *Scientometrics* (7:1-2), pp. 77-99.

Prahalad, C. K., and Ramaswamy, V. 2004. "Co-Creation Experiences: The Next Practice in Value Creation," *Journal of Interactive Marketing* (18:3), pp. 5-14.

Ragin, C. C. 2008. *Redesigning Social Inquiry: Fuzzy Sets and Beyond*. Chicago, IL: Univ. of Chicago Press.

Rajgopal, S., Venkatachalam, M., and Kotha, S. 2003. "The Value Relevance of Network Advantages: The Case of E–Commerce Firms," *Journal of Accounting Research* (41:1), pp. 135-162.

Remneland-Wikhamn, B., Ljungberg, J., Bergquist, M., and Kuschel, J. 2011. "Open Innovation, Generativity and the Supplier as Peer: The Case of Iphone and Android," *International Journal of Innovation Management* (15:1), pp. 205-230.

Romijn, H., and Albaladejo, M. 2002. "Determinants of Innovation Capability in Small Electronics and Software Firms in Southeast England," *Research Policy* (31:7), pp. 1053-1067.

Tan, T. C. F., Tan, B., and Pan, S. L. 2016. "Developing a Leading Digital Multi-Sided Platform: Examining It Affordances and Competitive Actions in Alibaba.Com," *Communication of the AIS* (38), pp. 739-760.

Tilson, D., Lyytinen, K., and Sørensen, C. 2010. "Research Commentary—Digital Infrastructures: The Missing Is Research Agenda," *Information Systems Research* (21:4), pp. 748-759.

Tiwana, A., Konsynski, B., and Bush, A. A. 2010. "Research Commentary—Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics," *Information Systems Research* (21:4), pp. 675-687.

Vargo, S. L., and Lusch, R. F. 2016. "Institutions and Axioms: An Extension and Update of Service-Dominant Logic," *Journal of the Academy of Marketing Science* (44:1), pp. 5-23.

Vargo, S. L., Maglio, P. P., and Akaka, M. A. 2008. "On Value and Value Co-Creation: A Service Systems and Service Logic Perspective," *European Management Journal* (26:3), pp. 145-152.

Vasilescu, B., Serebrenik, A., Devanbu, P., and Filkov, V. 2014. "How Social Q&a Sites Are Changing Knowledge Sharing in Open Source Software Communities," *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*, Baltimore, MD: ACM, pp. 342-354.

Von Hippel, E. 1986. "Lead Users: A Source of Novel Product Concepts," *Management Science* (32:7), pp. 791-805.

Ye, H., and Kankanhalli, A. 2018. "User Service Innovation on Mobile Phone Platforms: Investigating Impacts of Lead Userness, Toolkit Support, and Design Autonomy," *MIS Quarterly* (42:1).

Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010. "Research Commentary—the New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research," *Information Systems Research* (21:4), pp. 724-735.

Zaveri, P., and Bosa, D. 2019. "Uber's Growth Slowed Dramatically in 2018." Retrieved 01.04.2019, 2019, from https://www.cnbc.com/2019/02/15/uber-2018-financial-results.html

Zittrain, J. L. 2005. "The Generative Internet," *Harvard Law Review* (119), pp. 1975-2039.