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Governance and Design of Digital Platforms: A Review and Future Research Directions on a Meta-Organization

ABSTRACT

The burgeoning digital-platforms literature across multiple business disciplines has primarily characterized the platform as a market or network. Although the organizing role of platform owners is well recognized, the literature lacks a coherent approach to understanding organizational governance in the platform context. Drawing on classic organizational governance theories, this paper views digital platforms as a distinct organizational form where the mechanisms of incentive and control routinely take center stage. We systematically review research on digital platforms, categorize specific governance mechanisms related to incentive and control, and map a multitude of idiosyncratic design features studied in prior research onto these mechanisms. We further develop an integrative framework to synthesize the review and to offer novel insights into the interrelations among three building blocks: value, governance, and design. Using this framework as a guide, we discuss specific directions for future research and offer a number of illustrative questions to help advance our knowledge about digital platforms' governance mechanisms and design features.

Keywords: Digital platform, digitization, platform governance, platform design, organizational governance, incentive, control, meta-organization, organizational form.

INTRODUCTION

Platform businesses have emerged as one of the latest research topics across a range of management disciplines. A platform serves as an interface that facilitates interactions between different parties, usually complementors and customers (Boudreau & Hagiu, 2009). For example, Amazon, the world's largest e-commerce retailer, hosts more than 2.5 million sellers, which offer over 12 million products to buyers (Mohsin, 2020). A recent *Journal of Management* article reports that the platform literature is predominantly shaped by an industrial organization perspective that views platforms as two-sided or multi-sided markets where transactions and interactions between complementors and customers take place (Rietveld & Schilling, 2021). The theorization in such research has mainly focused on the interdependence among different sides of the market, network effects, and platform competition (McIntyre & Srinivasan, 2017; McIntyre & Subramaniam, 2009).

In the meantime, a new perspective is under fast development that departs from the prevailing framing, in that it more explicitly conceptualizes a platform and the related complementors as creating a unique organizational form or a "meta-organization" (Gawer, 2014; Kretschmer, Leiponen, Schilling, & Vasudeva, 2020; McIntyre, Srinivasan, Afuah, Gawer, & Kretschmer, 2020). This organization-centric perspective emphasizes the interdependence between platforms and complementors, i.e., how platform owners manage relationships with complementors, and how the collective actions by complementors and partner firms determine the success of the platform (Chen, Yi, Li, & Tong, 2020a).[1] Notably, Kretschmer et al. (2020) provide a compelling account of how platforms resemble hybrid organizations that are familiar to strategy and management scholars. They contend that platforms "can be viewed as hybrid structures between organizations and markets, providing a mixture of market-based and hierarchical power, and a mixture of market-based and hierarchical incentives." An implicit assumption underlying this literature is that examining platform owners' strategy is the key to understanding platforms as meta-organizations, since by providing and controlling the use of critical productive assets, platform owners occupy the

nexus of multilateral relationships (Helfat & Raubitschek, 2018). While this organizational perspective represents a more recent addition to the literature (Rietveld & Schilling, 2021), it holds substantial promise in advancing platform research (Cennamo & Santaló, 2019).

Taking this view forward, we see the platform as an alternative to "firm vs. market" for solving the management problem of coordinating diverse activities and interests of partner firms. More strikingly, we notice that an important characteristic of a platform in the current world is its utilization of digital technologies in creating and appropriating value. Embracing digital transformation not only facilitates the incubation of novel products and services for customers, but also significantly changes the way platform owners design specific instruments to achieve the desired outcomes of platform governance. E-commerce platforms such as Alibaba and JD.com leverage the emergence of instant messaging communications to enable complementors to obtain customer-related information and respond to customers' requests and needs promptly, while ride-hailing platforms such as Didi and Lyft utilize encryption technology that restrains complementors from offline misbehaviors. Mobile operating systems such as Android deploy a modular architecture granting complementors autonomy in conducting value-creating activities, while online feedback systems have been largely applied on e-commerce platforms to evaluate sellers' performance and incentivize corrective actions. It is with these digital technologies that platforms can better coordinate activities within the organizational boundary and become modern hybrids that combine elements of markets with hierarchies (Makadok & Coff, 2009; Williamson, 1991). Therefore, to further our knowledge about the influence of digital technologies on platform governance, we focus specifically on digital platforms, which are a type of platform that serves as a standardized digital interface and utilizes digital technologies to facilitate interactions between different parties. We believe that, in addition to looking at traditional governance mechanisms—such as pricing, direct integration or contracting—understanding how organizational relationships resort to digital means of coordination will offer a much-needed technological lens for extending the boundaries of organizational governance research.

With this theoretical and technological perspective in mind, we conduct a dedicated review of 189 studies of digital platforms and synthesize prior research along two prominent

dimensions of organizational governance, i.e., incentive and control. According to Williamson (1985), incentive and control are the two main attributes by which each mode of governance is described, while Gibbons (2005) maintains that all major theories of economic organization can be distilled into either incentive alignment or authority allocation (i.e., control). We categorize relevant platform papers into a specific set of governance mechanisms in relation to incentive and control, respectively, and we further map both digital and non-digital design features examined in prior studies onto the corresponding governance mechanisms. In so doing, we reorganize the platform literature into an organizational governance framework that emphasizes the role of formal and informal processes in coordinating co-specialized capabilities and resolving collective action problems in pursuit of joint value creation (Klein, Mahoney, McGahan, & Pitelis, 2019). This allows us to connect platform research with one of the most influential and mainstream bodies of literature in strategy, and we furthermore identify areas in which strategy and organization research can inspire platform studies and vice versa.

Our paper departs from previous related reviews (i.e., McIntyre & Srinivasan, 2017; Rietveld & Schilling, 2021) on four important fronts (see Table 1 for a summary). First, we focus specifically on digital platforms, instead of two-sided markets or networks generally (McIntyre & Srinivasan, 2017). Digital platforms constitute a distinct type of platform organization where a significant part of platform governance is enacted through digital design features (Saadatmand, Lindgren, & Schultze, 2019), such as the sharing of digital resources and provision of analytics-based information. Thus, our paper emphasizes the crucial role of technological capabilities in organizational governance and sheds light on how organizational relationships can resort to digital means of coordination. Second, our paper focuses on integrating the platform literature into an organizational governance framework and on dimensionalizing governance mechanisms related to incentive and control, whereas prior reviews pay only partial attention to platform governance phenomena and have limited implications for classifying different governance mechanisms (Rietveld & Schilling, 2021). The organizational perspective we adopt leads us to take the platform owner's viewpoint that reflects its own agency, instead of the structural features of the multi-sided market or network

per se (McIntyre & Srinivasan, 2017).[2] Third, while prior reviews look at the general relationship among participants in a platform ecosystem, we focus specifically on how platform owners manage relationships with complementors. Complementors are bounded by informal authority from platform owners and comprise one of the critical assets that assist platforms in generating and delivering value to customers. As a result, understanding how relationships with complementors can be managed via various governance mechanisms can direct a path to achieving competitive advantage and enrich the existing account of hybrid governance. Finally, our review and synthesis of the literature allow us to map both digital and non-digital design features examined in prior studies onto the corresponding governance mechanisms, improving existing knowledge about the specific ways in which various design features may be implemented to help platform owners realize specific governance goals. Despite its usefulness in linking governance theory and phenomena, such a mapping was not featured in prior reviews.

We make several contributions to the literature. First, while platform research leveraging new data sources and techniques has greatly advanced our knowledge of the pressing phenomena of digital platforms, the literature needs more, not less, theory in guiding research questions and deriving inferences (Simsek, Vaara, Paruchuri, Nadkarni, & Shaw, 2019). We demonstrate that classic theories can help us reconceive extant platform studies along the incentive and control dimensions of organizational governance, and unveil and encapsulate specific governance mechanisms and design features that have been explored. We show that while studies from different fields seem to address disparate platform phenomena using different terms, they might in fact revolve around the same question of governance or design. Second, we create a framework that presents an organizational foundation for extant research and points to a conceptual link between platform governance and design, highlighting how decisions on particular design features reflect, and are shaped by, governance mandates. The framework and conceptual link provide a basis for navigating idiosyncratic design features across different types of digital platforms and address such

questions as why multilateral relationships between different platform participants are governed as observed. Our framework and the associated review offer a first attempt to integrate issues of governance and design of digital platforms that interest scholars in various fields. Third, we direct attention to several fruitful avenues for future research on organizational governance in new technology contexts characterized by digital innovations. Our discussion yields new insights on how classic governance theories can inform, as well as benefit from, the development of digital platform research.

DIGITAL PLATFORMS AS HYBRID ORGANIZATIONS

Defining Digital Platforms

Industrial organization scholars have generally interpreted a platform as a specific type of marketplace that facilitates interactions between various groups of actors, such as complementors and customers (Boudreau & Hagiu, 2009), and the interdependence within or between these groups generates "network externalities," which describe how a user's utility increases with the number of other users on the same side (i.e., direct network effects) or on a different side (i.e., indirect network effects) of the platform market (Katz & Shapiro, 1985; Rochet & Tirole, 2003). Following this perspective, earlier work on platforms have amply examined how various market mechanisms (e.g., pricing structures) are used by traditional marketplaces (as varied as malls, bazaars, and newspapers) or networked industries to create network effects and shape "winner-take-all" outcomes (McIntyre & Srinivasan, 2017). In contrast, little attention has been paid to various interactions between platform owners and platform complementors or to the influence of platform architectural design on complementors' participation on platforms (Gawer, 2014).

Nonetheless, inspired by the burgeoning of new platform business models, an increasing number of scholars have directed focus on how digital technologies have enabled platform owners to coordinate activities of various parties on the platform. Digital platforms refer to a type of platform that serves as a standardized digital interface and utilizes digital technologies to facilitate interactions between different parties. As an example, Uber is a digital platform that utilizes its big data analytics and matching algorithms to match a rider

with the most suitable driver. Enabled by modular design principles, the functionality of digital platforms can be extended by independent, heterogeneous agents that leverage platforms' standardized interfaces and components upon which those agents can create their own complementary products (Gawer & Cusumano, 2014; Tiwana, Konsynski, & Bush, 2010). In addition, digital platforms go beyond conventional market mechanisms by utilizing digital means to coordinate activities within the organizational boundary. For instance, when coordinating who can use what resources on the platform, in addition to setting market entrance criteria to weed out low-quality complementors, digital platforms (e.g., Github, iOS, Android) can choose to selectively open its interface by placing restrictions on complementors' use of software tools such as APIs and SDKs (Parker & Van Alstyne, 2018; Parker, Van Alstyne & Jiang, 2017; Ye & Kankanhalli, 2018). Such design features reflect the unique ability of digital platforms to organize value-creating activities of complementors without explicitly invoking contracts or hierarchies. Yet this ability has not received systematic investigation in the platform literature.

Organizational Perspective on Digital Platforms

Observing how digital platforms organize complementors' activities to generate profits, recent research has begun to embrace an organizational perspective (Cennamo & Santaló, 2019) and explicitly regard platforms as an organizational form (Saadatmand et al., 2019). Organizations are characterized by "the conscious and deliberate coordination of activities within identifiable boundaries, in which members associate on a regular basis through a set of implicit and explicit agreements, commit themselves to collective actions for the purpose of creating and allocating resources and capabilities by a combination of command and cooperation" (Ménard, 1995: 172). In understanding various forms of noncontractual interorganizational collaboration, Gulati, Puranam, & Tushman (2012) offers one of the pioneering efforts in conceptualizing platforms as a type of meta-organization where legally autonomous actors (firms and individuals) put themselves under informal authority of the platform firm. Kretschmer et al. (2020) represents the latest recognition of this important shift in management scholars' conceptualization of platforms, i.e., from pricing to governance, as they seek to establish a link between platforms and hybrids. Hybrids exist

because markets are perceived to be unable to adequately bundle the relevant resources and capabilities (Teece & Pisano, 1994), while integration may reduce flexibility by creating irreversibility (Tong & Reuer, 2007) and weakened incentives (Makadok & Coff, 2009). Thus, hybrids would be characterized by a specific combination of market incentives and modalities of coordination involving some forms of hierarchical relationship (Williamson, 1991).

There are two salient similarities between digital platforms and our established understanding of hybrids. First, in hybrid organizations, interfirm relationships are only weakly contractualized, and the linkages are rooted in technological complementarities or organizational synergies (Thorelli, 1986). On digital platforms, complementarity between co-specialized producers (e.g., platform owners and complementors) similarly underpins the emergence of the cooperative organization (Jacobides, Cennamo, & Gawer, 2018; Parker et al., 2017). Indeed, the very logic of organizing as a platform is to leverage the generative potential of distributed innovation agency and economies of specialization (Cennamo & Santaló, 2019). Second, hybrids rely on partners who pool strategic resources and share decision rights while simultaneously keeping distinct ownership over key assets (Tong & Li, 2013), such that specific devices are required to coordinate partners' joint activities and arbitrate the allocation of payoffs (Ménard, 2004; Williamson, 1985). Similarly, digital platforms are organized according to a set of relational contracts through which platform owners pass decision rights across boundaries, and complementors in turn relinquish some payoff rights to platform owners (Tiwana et al., 2010).

These linkages between digital platforms and hybrid organizations further facilitate the leverage of classical theories of organizational economics to illuminate how digital platforms secure cooperation to achieve coordination at a low cost without losing the advantage of decentralized decisions. According to conventional theories of the firm, efficient economic organization is achieved through either *ex ante* incentive alignment or *ex post* use of authority (Gibbons, 2005). Property rights theory, for example, suggests that asset ownership determines firms' residual rights to payoffs and rights of control, which in turn shape their *ex ante* incentives to invest (Grossman & Hart, 1986; Hart & Moore, 1990).

Relatedly, Williamson's (1985) seminal work identifies the strengths and weaknesses of alternative polar modes of governance by referring to their incentive intensity, administrative authority and control. While received wisdom tends to focus on governance at the interface of dyadic transactions and resorts to integration as the solution to coordination problems (Zhang & Tong, 2021), owners of digital platforms cannot realistically acquire the population of complementors (oftentimes in millions). Important productive assets tend to be inalienable and must be within the control of heterogeneous complementors to create the most value. Nevertheless, a hybrid organizational structure does not invalidate incentive and control as key attributes for organizational governance; instead, it draws further attention to non-integration mechanisms that define organizational structures, e.g., organizational (non-monetary) incentives at work, property rights involved, and the absence or presence of "fiat" as a mode of coordination (Cuypers, Hennart, Silverman, & Ertug, 2021). By analogy, platform owners can expand their sphere of influence by employing non-integration mechanisms of incentive and control, such as providing (organizational) incentives for participation and for coordinating innovation activities. The theory of hybrids thus helps illuminate the underlying logics for digital platform governance, which, without taking a deep look, might simply be overshadowed by the sheer amount and variety of specific instruments and design features enumerated in prior studies (Thomas, Autio, & Gann, 2014).

Governance and Design of Digital Platforms

Consistent with classic strategy research (Barney, 1991), we view platform governance and design as strategies developed and implemented by platform owner firms to create and appropriate value. Various types of market frictions including externalities (i.e., costs or benefits caused by an agent that inadvertently affects other agents) and information asymmetries (i.e., one transacting party possesses information advantages over another) raise collective-action problems, which not only affect platform adoption but also shape the distributed actions and innovation by autonomous agents already "on board" a platform (Boudreau & Hagiu, 2009). Platform governance therefore can be seen as consisting of a set of overarching rules, constraints, and inducements that platform owners develop and utilize to address market frictions in coordinating and deploying co-specialized capabilities (Boudreau

& Hagiu, 2009; Zhang, Li, & Tong, 2020). The legal, exclusive ownership of the critical productive asset, i.e., the platform interface or architecture, gives platform owners the power to prohibit, compel, and coerce (Boudreau, 2017; Kretschmer et al., 2020). Platform design then refers to specific instruments or design features built and implemented by the platform owner to achieve the desired outcomes of platform governance.

Platform governance and design are crucial to value creation and appropriation because they determine what value-creating activities (e.g., product development, transactions, interactions) are encouraged on the platform, whom to include and when to engage in these activities, to what extent the activities can occur without interference from platform owners, and how platform owners can capture a share of the value jointly created with complementors (Hagiu & Wright, 2019; Wareham, Fox, & Cano Giner, 2014). Particularly, digital platforms constitute a type of platform organization where a significant part of platform governance is enacted through digital design features. In the review below, we systematically search and document a wide range of research on digital platforms, to analyze how platform owners may leverage various governance mechanisms and design features to incentivize and/or control complementors and their activities.

METHODOLOGY

We followed prior *Journal of Management* review articles and used a stepwise approach in conducting a systematic literature review. First, to ensure comprehensive coverage of the relevant literature, we utilized EBSCO's Business Source Complete database to search for academic articles that contained the terms "platform(s)" or "two-sided market(s)" in the title, abstract, or author-supplied keywords. Since digital platforms began to attract academic attention only in more recent years, we narrowed our search to papers published between 2000 and May 2021. Specifically, we first searched for papers published in management, economics, entrepreneurship, innovation, and information systems journals in the FT50 list. To ensure comprehensiveness, we then followed prior reviews on platforms (McIntyre & Srinivasan, 2017; Rietveld & Schiling, 2021) by including other economics and management journals in which researchers interested in platforms often publish their work,

such as *Journal of Economics & Management Strategy*, *International Journal of Industrial Organization*, *Academy of Management Perspectives*, *Academy of Management Discoveries* and *Long Range Planning.* This search returned 609 articles.

After an agreement to ensure the focus on digital platforms' governance and design, we created a coding scheme (Simsek, Fox, & Heavey, 2021) and performed the second, third, and fourth steps to manually screen each paper for relevance. In the second step, to ensure that the identified articles focus on digital platforms instead of general platforms (e.g., McIntyre & Srinivasan, 2017), the authors independently reviewed the abstract and full text of each paper and held regular meetings to exclude those papers that either focus on non-digital platforms (e.g., traditional media, product platforms, supply chain platforms, etc.,), or use the term "platform" as an analogy or for metaphoric reasons. This effort resulted in 514 articles. Third, given that our focus is on how digital platform owners employ governance mechanisms and the associated design features to shape their relationship with complementors, each author analyzed the 514 papers and removed those that 1) focus exclusively on the perspective of customers or end users; 2) pay attention to complementors but do not examine (direct or indirect) interactions between digital platform owners and complementors; or 3) study network effects as a structural feature without linkages to governance mechanisms or design features reflecting the platform owner's agency. After several rounds of discussions, a sample of 303 articles remained. Fourth, we limited our review to empirical papers by only including those that provide empirical evidence using longitudinal data, surveys, or case studies. This process resulted in 162 articles.

Fifth, since it is possible that some papers may contribute substantially to our review focus but do not necessarily provide empirical evidence or contain the term "platform" or "two-sided market" in the title, article abstract, or author-supplied keywords, or are not published in our set of journals, we also applied an ancestry search by screening the reference lists of the 162 papers and included any articles that are relevant to our review. To ensure relevance, we followed similar practices adopted by other literature reviews (e.g., Simsek, Fox, & Heavey, 2015) by only examining papers that were cited by at least five of the articles in our initial sample. We manually reviewed the title, keyword, abstract, and full text of these

papers to determine their relevance. Following this method, 27 articles were added to our sample list, and we arrived at a final dataset of 189 papers for this review.

As our last step, we extracted information from the 189 articles and grouped them into distinct incentive and control mechanisms along with specific design features that emerged from the review. Following an iterative process, we obtained eight incentive–control dimensions that synthesize the main themes from these articles: (a) sharing of resources; (b) provision of information; (c) conferring autonomy; (d) giving rewards; (e) access control; (f) output control; (g) behavioral control; and (h) external relationship control.

TAKING STOCK: REVIEW OF EXTANT RESEARCH ON THE GOVERNANCE AND DESIGN OF DIGITAL PLATFORMS

Table 2 presents a structure of the literature review, enumerating specific governance instruments and design features of digital platforms, and listing illustrative studies of these mechanisms and features.

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Incentive

Barnard (1938: 184) contends that "authority is another name for the willingness and capacity of individuals to submit to the necessity of cooperative systems." Hence, a key question is why asset owners might voluntarily surrender part of their rights and freedom and submit to the direction of a visible hand, i.e., regulatory intervention by management authorities. The answer lies in incentives. Organizational economists maintain that "incentives are a driving force in the decision to organize transactions under hybrid arrangements" (Ménard, 2004: 351), as incentives facilitate decomposition of tasks and division of labor. While organizational incentives are traditionally framed as a structural feature of the organization, in the digital platform context they become "more of an adaptive emergent coordination mechanism" as wielded by the platform owner (Yoo, Boland, Lyytinen & Majchrzak, 2012: 1402). Complementors are willing to surrender some decision rights to a platform owner 1) because the platform owns critical digital assets (i.e., resources, competencies, information) that it can share with complementors to enable joint production,

and 2) because of complementors' expected gains from this cooperative relationship vis-à-vis the costs of entering the market on their own. Our literature review identifies four specific mechanisms by which platform owners incentivize complementors and obtain the latter's cooperation without transferring ownership rights to their assets.

Sharing of resources

Owners of digital platforms commonly share productive resources with complementors that can assist the latter in their value-creating activities on or off the platform interface. Through resource sharing, platform owners can enable or enhance complementors' product development capabilities, which ultimately raise complementors' productivity and returns. Thus, sharing of resources represents an important incentive mechanism by which the platform owner orchestrates complementors' value-creating activities and facilitates the expansion of complementary offerings on the platform (von Hippel & Katz, 2002).

While resource pooling is a distinguishing characteristic of hybrid organizations (Ménard, 2013), a unique type in the digital platform context manifests in boundary resources. Boundary resources have been defined as "the software tools and regulations that serve as the interface for the arm's length relationship between the platform owner and the application developer" (Ghazawneh & Henfridsson, 2013: 174), including application programming interfaces (APIs), software development kits (SDKs), code libraries, reference designs, and technical specifications. They may be created originally by the platform owner or result from its bundling of valuable, third-party-contributed technological artifacts (Parker & Van Alstyne, 2018). For example, Apple provides APIs for developers to interact with its operating system and coordinate the relationship with a distributed network of developers (Eaton, Elaluf-Calderwood, Sorensen, & Yoo, 2015), while Google offers the Android Studio and SDKs to support the design, development, debugging, testing, and publishing of complementary products (Ye & Kankanhalli, 2018). Open-source platforms such as Linux also release reference designs and technical blueprints related to platform technologies to assist developers in creating products.

A growing body of research shows that sharing of resources contributes significantly to value creation by stimulating complementors' participation and enhancing the efficiency

and effectiveness of product innovation (Gawer & Henderson, 2007; Kankanhalli, Ye & Teo, 2015; Parker et al., 2017). For example, Ye and Kankanhalli (2018) study how the provision of innovation toolkits affects third-party participation on mobile phone platforms, and find that such toolkit support does enhance the amount and types of services created by developers. Similarly, Tiwana (2015a) shows that the introduction of APIs enables app developers to swiftly exploit platform functionalities and adapt their products to meet customer needs. On the one hand, the use of a standardized interface streamlines complementors' interactions with the digital platform and reduces coordination costs, and product offerings conforming to the platform's interface can help maintain interoperability (Tiwana, 2015b). On the other hand, such readily available expertise may be specific to a digital platform; inducing complementors to utilize these resources may further result in platform-specific investments (Rolland, Mathiassen, & Rai, 2018; Wulf & Blohm, 2020).

Provision of information

Provision of information refers to the case where digital platform owners provide complementors with interface- or customer-related information to prompt desired behaviors. Without sufficient information about the focal platform and its customers, complementors might be unable to envisage the expected returns from joint production or seize opportunities for productivity gains, because of technological and market uncertainty.

Several studies examining complementors' participation on digital platforms implicitly assume that complementors are familiar with the platform attributes (e.g., installed base, rules and regulations, technical capabilities) before entering the platform market, and make adoption decisions accordingly (Ceccagnoli, Forman, Huang, & Wu, 2012; Kathuria, Karhade, & Konsynski, 2020; Shankar & Bayus, 2003). Others contend that, in many instances, complementors do not possess sufficient information about the potential platforms they could operate on, and the lack of such information will discourage complementors from joining the platform and making specific investments (Dattée, Alexy, & Autio, 2018). To mitigate uncertainty and facilitate participation, platform owners can provide interface-related knowledge as to what types of investments could render complementors high returns and what kinds of offerings are likely to succeed. They do so through direct communication

channels such as conferences and workshops that facilitate knowledge sharing with developers, and among developers themselves in understanding unique or new features of the platform (Foerderer, 2020; Huang, Tafti, & Mithas, 2018). For example, Fang, Wu, and Clough (2021) draw attention to the influence of platform-sponsored hackathons, and they report a significant increase in hackathon attendees' subsequent adoption of focal platforms. While such incentive mechanisms might incur coordination costs, better information and a closer partnership will guide complementors' resource allocation to areas generating synergistic specificity, which can ultimately improve value creation by the platform ecosytem as a whole (Huber, Kude, & Dibbern, 2017; Schilling, 2000).

Besides the provision of interface-specific information to incentivize participation, several studies also find that some digital platform owners offer customer-related information and impose rules regarding what information about customers is disclosed or concealed on the platform (Kuan & Lee, 2020; Rietveld, Ploog, & Nieborg, 2020). A typical case is the displaying of the titles of complementary applications in a vertical ranking, revealing what products are most valued by customers (Boudreau & Hagiu, 2009). More notably, platform owners tend to diffuse customer-related information by facilitating direct communications between complementors and customers (Khurana, Qiu, & Kumar, 2019; Tan, Wang, & Tan, 2019). Doing so helps reduce information asymmetry between complementors and customers, and better coordinates complementors' value-creating activities. For instance, Alibaba, China's largest e-commerce company, has developed a live chat tool called Trade Manager, which allows complementors (suppliers and customers) to communicate instantly. The design of such communication features can help complementors obtain customer-related information useful for exchanges that is not communicated or released publicly (Zhang, Dai, Dong, Wu, Guo, & Liu, 2019). Similarly, design features that enable repeated communications between borrowers and lenders on a P2P platform can mitigate behavioral uncertainty between borrowers and lenders, which would otherwise inhibit online transactions and exchanges (Xu & Chau, 2018). Direct communication also offers complementors an opportunity to build trust with customers by proactively responding to customers' requests and needs. This is especially attractive to nascent complementors, which

usually do not have slack resources to invest in creating strong signals for product quality (Fan, Ju, & Xiao, 2016). To sum up, information provision, as a specific form of incentive, can enable complementors to better understand customers' preferences and take actions to improve their offerings accordingly (Eckhardt, Ciuchta, & Carpenter, 2018), something hard to attain with *ex ante* contracting between platform owners and complementors.

Conferring autonomy

Conferring autonomy refers to the extent to which digital platform owners grant complementors autonomy in conducting value-creating activities, including product development, transactions, and interactions with customers. The decision on the extent of complementor autonomy is among the most critical ones for platform owners to make, as the degree of flexibility and discretion that complementors would have on a digital platform will shape their incentives to adopt the focal platform *ex ante* and willingness to contribute *ex post*. Research in this area is mainly concerned with two aspects of design.

First is decentralization of decision rights. Platform owners typically devolve some decision rights to complementors, including rights to use and modify the platform interface and core components, as well as rights to develop products, set prices, and market and promote (Bauner, 2015; Hagiu & Wright, 2019; Tiwana, 2015a; Tiwana et al., 2010). For instance, the right to set prices, or pricing rights, can be fully controlled by the platform owner (as in Uber), fully delegated to complementors (as in Amazon), or partially determined by a centralized pricing guide (as in Apple App Store). Regarding these design features, platforms depart from hierarchies where decision rights are transferred from the corporate headquarters to business units, but much resemble other hybrid organizations in incentivizing joint production and division of labor (Tong & Li, 2013). Delegation of decision rights allows complementors to better pursue their own interests and utilize local knowledge to optimize their decisions (Boudreau, 2010; Chen, Pereira, & Patel, 2020b; Gnyawali, Fan, & Penner, 2010; Wei & Lin, 2017), in a way that ultimately advances the platform's value creation (Moss, Neubaum, & Meyskens, 2015). With a stronger sense of ownership and a higher degree of freedom, complementors are more motivated to join the digital platform and tend to produce greater amounts of third-party innovations (Ye & Kankanhalli, 2018). Conversely,

limited endowment of decision rights may discourage complementors from adopting a platform and making specific investments (Perrons, 2009), similar to what the organization perspective (e.g., property rights theory) has predicted (Hart & Moore, 1990).

On the other hand, researchers also recognize the potential downside of decision rights decentralization. When delegation of decision rights is enacted through the licensing of the platform's core intellectual property rights (Eisenmann, 2008; Eisenmann, Parker, & Van Alstyne, 2009), it enables various platform providers (e.g., smartphone producers) to manage the interface through which customers consume complementary products and experience the platform (e.g., as is the case of Android). Transforming a proprietary design into a more open design (e.g., open-source licensing of Android) can induce enhanced specialization and provide greater protection of complementors' interests (West, 2003); yet there is a tradeoff between platform openness and complexity, in that an open interface may breed a more complex ecosystem that raises the development cost for complementors and could reduce their platform-specific investment (Chen et al., 2020a). An open design can also impair the platform owner's ability to appropriate value (Karhu, Gustafsson & Lyytinen, 2018). Reallocation of decision rights helps platform owners realign the locus of decision-making and reduce the extent of ecosystem complexity.

The second design aspect of conferring autonomy revolves around modularity, which refers to the intentional decoupling of interoperating subsystems of a larger system, such that the constituent subsystems can be designed independently but will readily combine and work together to support the whole (Baldwin & Clark, 2000; Lindberg, Berente, Gaskin, & Lyytinen, 2016; Teece, 1996; Tiwana, 2008). For example, Microsoft Windows serves as an operating system whose complements are supplied by external complementors with low interdependence and high variety (Shapiro & Varian, 1998). Design modularity has drawn extensive attention, since it lays the architectural foundation for a digital platform ecosystem and enables decomposition of tasks and division of labor in joint production (Jacobides et al., 2018).

As the digital platform architecture becomes increasingly modular, complementors require less investment to understand the detailed workings of other components that their

products might interact with (Saadatmand et al., 2019; Tiwana, 2018). They can remain interoperable (i.e., communicate, exchange data, derive functionality) with the platform and other components, without knowing how they will be *ex post* recombined by customers (Yoo et al., 2012). Specifically, modularity enables a focus on subsystem development, facilitating both innovation and efficiency by allowing different complementors to co-specialize and by motivating them to invest in their own knowledge domains (Brunswicker & Schecter, 2019; Tiwana, 2015a). For instance, in studying Blackberry OS apps, Tiwana (2018) shows that apps with high modularity in their external architectures respond quickly to the emergence of new platform capabilities. Kazan, Tan, Lim, Sørensen, and Damsgaard (2018) similarly find that mobile payment platforms rely on modular architectures to encourage external developers to engage in FinTech innovations.

Meanwhile, it is worth noting that excessive levels of modularity can constrain the platform owner's ability to coordinate interdependent parties, due to loss of control over the interaction between modular components, while an integrated architecture can better reap the benefits of synergistic specificity between the platform and its complements (Schilling, 2000). An integrated platform tends to enjoy decreased cost when coordinating highly co-specialized components, in much the same way as the integration mechanisms of a firm, as illustrated in the case of mobile computing (Bresnahan & Greenstein, 2014). Overall, platform research emphasizes that modularity helps induce complementors' cooperation by granting them greater autonomy in product development and commercialization.

Giving rewards

Rewards are one of the most basic forms of incentives. Giving rewards to complementors is a direct incentive for complementors to join the platform and make value-creating contributions in exchange for some returns. A recent stream of research has examined how various reward mechanisms shape complementors' behaviors. Scholars have investigated how offering pecuniary and promotional rewards can encourage platform adoption and boost complementors' performance (Ceccagnoli et al., 2012; Rietveld, Schilling, & Bellavitis, 2019; Wen, Forman, & Graham, 2013).

To attract complementors' investments which often bear opportunity cost, platform owners need to ensure and signal that complementors can profit from participating in the focal platform (Miric, Boudreau, & Jeppesen, 2019). This is in line with property rights theory in that payoff rights determine the economic agent's *ex ante* investment incentive; yet it remains unique because payoff rights are not transferred with asset ownership but through the platform owner's imposition of technical designs. Specific revenue sharing schemes and intellectual property protection features are designed such that complementors can recoup investment and appropriate value from their provision of offerings on the platform (Nambisan & Sawhney, 2011; Shi, Li, & Chumnumpan, 2020; Simcoe, Graham, & Feldman, 2009). For platforms that rely on non-pecuniary, voluntary activities and interactions, such as knowledge sharing and information content creation, platform owners may nonetheless implement paid features that offer financial incentives to stimulate user participation and high-quality contributions (Kuang, Huang, Hong, & Yan, 2019; Sun & Zhu, 2013). Conventional theory characterizes changes in governance structures by focusing on the occasions "where transactional difficulties are likely to be severe" (Winter, 1988: 172). Transactional difficulties are most severe during the early stage of a platform where market uncertainty for complements is the highest, prompting the platform owner to introduce more supportive instruments and pecuniary rewards (Rietveld et al., 2020). That explains the fact that a platform sometimes acts against its own short-term financial interests to preserve its reputation for long-term benefits.

One might view the financial incentives above as part of a relational contract by which platform owners devolve payoff rights to complementors in exchange for their complementary contributions. However, the "contract" does not stipulate what the complementors will contribute in return, since the effort of complementors and the resulting contributions cannot be specified *ex ante*. Enacting value-creating activities may require continued inducements, and that tends to take the form of promotional rewards (Li & Agarwal, 2017). By implementing platform designs such as recommendation, certification, and featuring (Dinerstein, Einav, Levin, & Sundaresan, 2018; He, Fang, Liu, & Li, 2019; Rietveld et al., 2019; Rietveld, Seamans, & Meggiorin, 2021; Sun, Fan, & Tan, 2020),

platform owners can help selected complementors enhance their reputation, draw customers' attention, drive website traffic, and improve sales growth (Chen, Wei, & Zhu, 2018; Horton, 2019; Huang, Singh, & Srinivasan, 2014; Zhang, Li, Luo, & Wang, 2019). In their study of mobile apps, Liang, Shi, and Raghu (2019) first show that offering editor recommendations has a positive influence on the sales of featured products. They then shift attention to the spillover effect of recommendations on related products that are not featured and find that platform-provided promotions can also boost the sales of apps owned by the same developer as well as sales of apps with similar functionality by other developers. Furthermore, such designs can also incentivize other complementors to align with the platform owner's strategic positioning (Hukal, Henfridsson, Shaikh, & Parker, 2020). For example, Claussen, Kretschmer, and Mayrhofer (2013) examine a rule change by Facebook by which apps with higher user engagement are allowed to engage users by sending out more notifications. They find that this change motivates extant complementors to improve their performance by developing new applications with higher user ratings. Nevertheless, Rietveld et al. (2019) suggest that platform owners should be prudent when choosing which complementors to promote, since selective promotion affects consumers' perception of the product category and the quality of the platform as a whole. General advice is that platform owners should reward complementors that will create the highest value for the platform but will not act opportunistically after being promoted.

Control

Holmström (1999: 76) submits that "… ownership confers contracting rights that allow the firm to decide who should be offered the opportunity to work with particular asset and on what term." In a similar sense, platform owners' authority can be attributed to their ownership of the platform technology and architecture that give them an "architectural leverage" over complementors (Thomas et al., 2014). The relationship between platform owners and complementors is at least based on relational contracts, in which the parties agree to procedures for making production-related decisions and for determining how revenues are shared and disputes are resolved. Relational contracts are necessarily incomplete and subject to unforeseeable revisions since the transactions may involve specific assets and are often

plagued by *ex ante* uncertainty. Conventional theory suggests that, under these circumstances, centralized coordination tends to be more efficient and effective than decentralized adaptation, as the former can economize on bounded rationality and safeguard against opportunism (Williamson, 1991). While "command constitutes the central adaptation mode of firms" (Williamson, 1996: 31), control in the digital platform context often occurs through and is enabled by particular design features. Below, we identify four control mechanisms and the associated design features that platform owners employ to shape the conduct of complementors.

Access control

A key dimension of digital platform control revolves around the extent to which platform owners give prospective complementors access to the platform interface. Access control is defined as the formal and informal governance mechanisms deployed by platform owners to determine who can join the platform and use the digital interface and boundary resources. The ownership of critical assets, i.e., the platform technology, grants platform owners the power of exclusion; this is the key means through which platform owners can coerce complementors' adaptation and contain complementors' opportunistic behaviors (Boudreau & Hagiu, 2009). Typically, platform owners give access to the platform by opening interfaces to complementors, enabling the latter to contribute to and transact on the platform (Boudreau, 2010; Huber et al., 2017; Khanagha, Ansari, Paroutis, & Oviedo, 2020).

Research shows that platform owners can design screening mechanisms that involve application and selection processes to determine who will be allowed on the platform (Casadesus-Masanell & Campbell, 2019; Kwon, Oh, & Kim, 2017; Song, Xue, Rai, & Zhang, 2018; Tiwana, 2015b), and complementors who are not up to the standard will be denied entry. For instance, Uber hires a third-party company to perform background checks on prospective drivers (Garud, Kumaraswamy, Roberts, & Xu, 2020; Karanović, Berends, & Engel, 2021), and individuals who have criminal or particular driving violation histories may be disqualified from driving for Uber. A related line of research focuses on how charging access fees to complementors serves as a filter to weed out low-quality complementors (Dushnitsky, Piva, & Rossi-Lamastra, 2020; Hossain, Minor, & Morgan, 2011; Song, Chen,

& Li, 2021). Furthermore, by creating specific access control features (e.g., selectively restricting the use of boundary resources), digital platform owners also seek to ensure that complementors will act in accordance with the platform's interests after entry into the platform. For example, Facebook prohibited Vine, a short-form video sharing app, from accessing Facebook's friend-finding API after Vine was acquired by Twitter, so as to prevent competitors' exploitation (Gawer, 2020).

Deciding on the degree to which digital platform owners should grant access to complementors is like "balancing on the head of a pin." On the one hand, a stream of research illustrates that granting greater access boosts platform adoption (West, 2003) by lowering the entry barrier and it contributes to value creation through network effects (Boudreau, 2010; Jarvenpaa & Lang, 2011; Parker & Van Alstyne, 2005). Specifically, as the number of complementors increases, the platform will be infused with heterogeneous knowledge and capabilities (Cennamo, 2018; Li & Netessine, 2020; Tanriverdi & Lee, 2008), which can provide an incubator for technological innovation and product variety expansion (Boudreau, 2012). Expanding the scale of complementors and customers is particularly crucial to platform success during the early stages of a platform's lifecycle (Tiwana et al., 2010).

On the other hand, prior studies also show that granting wide access without sufficient control can have negative impacts on the digital platform. First, increasing the number of complementors spurs competition and could crowd out participation (Boudreau, 2012; Boudreau & Jeppesen, 2015; Li, Shen, & Bart, 2018; Parker & Van Alstyne, 2018; Venkatraman & Lee, 2004). Second, overly loosened access control can result in a platform being flooded with low-quality complements, cause opportunistic behaviors such as shirking and free-riding by complementors (Cennamo & Santaló, 2019; Geva, Barzilay, & Oestreicher-Singer, 2019; Wang, Li, & Singh, 2018), result in undesired transactions and activities, and dilute the platform's market identity (Cennamo, 2021; Logue & Grimes, 2019). Finally, as Zhang, Li, and Tong (2020) show, relaxing control over platform access may lead to a decline in the existing complementors' knowledge sharing, as complementors possessing particular knowledge become more concerned about losing such knowledge to new entrants.

Output control

Digital platform owners exercise output control when they undertake measures to evaluate and validate complementors' outputs and outcomes. Platforms create value by facilitating transactions and exchanges between complementors and customers (Lee, Lee, & Oh, 2015); to achieve this goal requires complementors to provide desirable offerings and customers to honor their commitments (Kim, Prince & Qiu, 2014; Zhu & Iansiti, 2012). However, the absence of face-to-face interactions and other common frictions in digital platform markets generate uncertainty around the quality of complementors' product offerings (Chan, Parhankangas, Sahaym & Oo, 2020; Hong, Wang & Pavlou, 2016; Kim & Visawanathan, 2019; Pilehvar, Elmaghraby & Gopal, 2017). These frictions create barriers to deal consummation and obstruct value creation (Burtch, Ghose & Wattal, 2015, 2016).

These considerations emphasize the importance of output control, through which digital platform owners seek to ensure that complementors deliver satisfactory performance, thus alleviating the risk of adverse selection. Several studies focus on the efficacy of effective feedback systems for platform owners to evaluate complementor performance (Bolton, Greiner, & Ockenfels, 2013; Jolivet, Jullien, & Postel-Vinay, 2016; Lin, Zhang, & Tan, 2019; Yi, Jiang, Li, & Lu, 2019). For example, digital platforms ranging from Amazon to Taobao to eBay provide various feedback mechanisms in the form of reputation scores (Fan et al., 2016; Li, Fang, Lim & Wang, 2018), online ratings, and reviews (Choi, Cho, Yim, Moon & Oh, 2019; Li & Wu, 2018; Lu, Ba, Huang & Feng, 2013; Qiu, Gopal & Hann, 2017), wherein customers can share their personal experience and opinions about complementors' product offerings. Complementors receiving a great deal of negative feedback are deemed to be of low quality and may be downplayed by platform owners. For instance, on eBay, buyers can rate sellers based on item description, quality of communication, shipping time, shipping cost, and so forth. Sellers who do not meet certain performance standards may be deprived of the privileges given to top-rated sellers, or banned from selling on eBay altogether (Curchod, Patriotta, Cohen, & Neysen, 2020). Since sellers with poor ratings are viewed negatively by buyers (Huang, Boh, & Goh, 2017), they are likely to take corrective actions (Huang et al., 2019; Siering & Janze, 2019) and undertake a costly effort to produce and send positive

signals to potential buyers (Barlow, Verhaal, & Angus, 2019; Moqri, Mei, Qiu, & Bandyopadhyay, 2018; Xu, Nian, & Cabral, 2020). Therefore, complementors' self-correction constitutes the secondary mechanism by which platform owners utilize output control to improve complement quality, and by extension, value creation.

Behavioral control

Behavioral control is concerned with the types of interactions allowed or deemed appropriate on the platform, thereby restraining complementors from misbehaviors. While extant research has mainly focused on how delegating decision rights motivates complementors to join the platform and to contribute to value creation, a recent stream of literature argues that such devolution of control does not guarantee that complementors will necessarily perform in ways desired by the platform owner (O'Mahony & Karp, 2020). The relational contracting between platform owners and complementors often encounters unforeseen contingencies and opportunism, requiring *ex post* adaptation via hierarchical control. This idea can be traced to the classic governance theory linking control with bounded rationality and behavioral uncertainty (Williamson, 1985).

Given that complementors have diverse incentives and information sets, giving unsupervised freedom to the "wrong" participants may lead to negative externalities and damage the attractiveness of the platform (Chen et al., 2020b; Miric & Jeppesen, 2020; Wareham et al., 2014) for several reasons. First, since customers face high information cost prior to a transaction, complementors of low quality may be motivated to provide false information and manipulate online feedback (Lappas, Sabnis, & Valkanas, 2016; Lin & Heng, 2015), and to engage in opportunistic behaviors by cheating occasionally after building initial trust with customers (Tan et al., 2019). Second, complementors may be involved in cut-throat competition and commit strategic behaviors to undermine the reputation of their competitors (Luca & Zervas, 2016). Third, complementors that have formed strong ties with customers may have the incentive to bypass, or disintermediate, the platform interface and connect directly to their clients to avoid transaction and service fees accruing to the platform owner (Gu & Zhu, 2021; He, Peng, Li, & Xu, 2020).

Therefore, recent research has paid increasing attention to how platform owners can take actions to regulate complementor activities and defend platform interests. Specifically, several studies examine how platform owners design anti-manipulation mechanisms to identify potential fraudulent behaviors of complementors and to implement penalties that would deter such misbehaviors (Siering, Koch, & Deokar, 2016). For instance, Kumar, Venugopal, Qiu, and Kumar (2018) show that digital platforms can apply machine learning techniques to improve their odds to detect review manipulations. Relatedly, Reischauer and Mair (2018) report evidence that online community platforms implement sanction measures such that users who are detected to have attempted to misbehave or constantly receive poor ratings will face suspension of accounts. Kuan and Lee (2020) find that encouraging user interactions with trusted contacts has helped Facebook to minimize negative network effects.

Of particular note are some repercussions of information provision. While we have noted that information provision and enhanced communication between complementors and customers may breed a high level of trust, it could also cause disintermediation, resulting in reduced value appropriation by the platform owner (Gu & Zhu, 2021). Given the hierarchical control possessed, platform owners can reconfigure technical features to discourage users from circumventing the platform interface, e.g., by monitoring and restricting the exchange of contact information between complementors and customers (Bapna, Ramaprasad, Shmueli, & Umyarov, 2016; Zhu & Iansiti, 2019). For instance, when providing the buyer-seller messaging service to enable communications between buyers and sellers, Amazon encrypts email addresses of both parties, and the communication process is fully monitored by the platform. Similarly, Uber and Lyft do not reveal drivers' own contact numbers to customers, who can only contact drivers via the app interface (Rosenblat & Stark, 2016). While these designs serve to also protect privacy, they play an important, and often understated, role in behavioral control, determining what is and is not allowed on the platform.

External relationship control

External relationship control refers to the extent to which digital platform owners allow complementors to interact with other platforms and how they impose restrictions over such interactions. Digital platforms do not operate in a vacuum and face competition from

rival platforms (Kretschmer et al., 2020). Everything else equal, platform owners would prefer complementors to be single-homed to maintain a differentiation-based competitive advantage over other platforms (Cennamo, 2021). However, whether to launch products on multiple platforms is a strategic decision made by the complementors, not the platform owners. On the one hand, complementors will benefit from sponsoring more than one platform, as multihoming helps them reach more customers and avoid the risk of *ex post* holdup by platform owners (Koh & Fichman, 2014; Tavalaei & Cennamo, 2020; Wang & Miller, 2020). On the other hand, complementors may find multihoming less attractive if highly specific technologies and/or non-contractible costs are required to develop products for particular platforms (Cennamo, Ozalp, & Kretschmer, 2018; Chen et al., 2020a). Thus, platform owners must carefully apply governance mechanisms so that complementors have limited incentives to multihome.

One line of the literature finds that digital platform owners may develop exclusive relationships with complementors to discourage them from multihoming (Corts & Lederman, 2009; Doganoglu & Wright, 2010; Lee, 2013). Such exclusivity can take different forms in digital platforms. In some cases, platform owners and complementors reach agreements that require the complementors to only participate and develop products on the focal platform (Eisenmann et al., 2009). As an example, Alibaba requires its sellers to refrain from selling products on rival platforms such as JD.com and commit exclusively to Taobao or Tmall. Similarly, food delivery platform Meituan offers more favorable commission rates to restaurants that commit to exclusivity. In other cases, complementors can multihome, but some of their offerings can be listed only on a particular platform, or only after a specific time has lapsed. By imposing such requirements, the platform owner retains the uniqueness of the complements offered on its platform and thus enhances the relative attractiveness of the focal platform over rivals. Nevertheless, scholars also note that complementors may be reluctant to enter such exclusive relationships if not given sufficient incentives (Cennamo & Santaló, 2013). Exclusivity needs to be designed in a way that benefits both the platform owner and complementors in a win-win situation, rather than a situation in which the platform owner can freely enter complementors' spaces (Kim & Luca, 2019; Zhu, 2019), as

in the case of Amazon's entry into the market of Toys "R" Us (Hagiu & Yoffie, 2009).Another emerging stream of research reveals that the focal platform can adjust its compatibility with competitors to influence the cost of complementor multihoming (Karhu et al., 2018; Karhu & Ritala, 2020). While compatibility provides a conduit for complementors to increase product development efficiency and the consistency of their offerings (Hann, Koh, & Niculescu, 2016; Kretschmer & Claussen, 2016), it could also simplify the process of multihoming since complements can easily port their offerings to other platforms without incurring significant adaptation costs. Research shows that platform owners seek to counter complementors' multihoming attempts by making it costly for complementors to migrate or develop complements for other platform interfaces. For instance, in 2012, Google launched an API package called Google Play Services, which can be used to connect apps to other Google services. This package significantly increases developers' development efficiency, but it can only be applied to official Android apps and is not compatible with other platforms, raising barriers to developers' multihoming (Karhu et al., 2018).

LOOKING AHEAD: AN INTEGRATIVE FRAMEWORK AND FUTURE RESEARCH DIRECTIONS

Our review serves to link together emerging research on digital platforms and classic corporate strategy research, two important streams of work that have hitherto remained largely independent despite the underlying connection between them. We broaden the application of theories of organizational governance that are core to corporate strategy to a new organizational form, digital platforms. We show that core mechanisms such as incentive and control still apply, though the specific means might take a different form in the platform context (e.g., decision rights being allocated between the platform owner and complementors, rather than between the corporate headquarters and business units or between joint venture partners (Tong & Li, 2013)). On the other hand, our review stands to expand existing theories in corporate strategy through a dedicated focus on organization and governance features that are more unique to platforms—such as by studying the orchestrating role of the platform owner (e.g., through access control, the platform owner can restrict or expand

complementors' platform access and shape their value creation activities on and off the platform (Zhang, Li, & Tong, 2020)). In this section, we demonstrate how the organization perspective is poised to inspire future research in two directions. First, we develop an integrative framework to synthesize the review, and to offer novel insights into the interrelations among three research building blocks: governance, design, and value (creation and appropriation). Using this framework as a guide, we discuss specific directions for future research and offer a number of illustrative questions to help advance our knowledge about the governance and design of digital platforms.

Towards an Integrative Framework: Governance, Design, and Value

As discussed in our review and illustrated in the framework in Figure 1, digital platform research has recognized the important role of platform owners in managing relationships with complementors, and studied how platform owners formulate and implement strategies to shape complementors' behaviors. This literature has centered on two elements, platform governance and platform design.

-------Insert Figure 1 about here-------

Platform governance serves as one of the cornerstones of our integrative framework, since it provides the roadmap for orchestrating complementors' activities. In other words, platform governance determines the direction in which the platform owner implements specific instruments or design features to manage relationships with complementors. For instance, platform owners could upgrade their communication systems after deciding to provide more customer-related information to incentivize complementors. They could also consider restricting the exchange of contact information between complementors and customers when they deem it necessary to impose behavioral control to reduce the risk of disintermediation. Formulating governance decisions requires an understanding of what incentive and control mechanisms can be deployed, and it is these governance decisions that guide the creation of specific design features. Building on prior studies, our framework seeks to identify multiple governance mechanisms that could be leveraged to restrict or enable complementors' access to the platform, regulate complementors' behaviors on the platform, shape complementors' interactions with customers, and so forth.

Platform design is another important pillar of our framework, involving specific means to execute platform governance mechanisms. In this stage, the governance mechanisms that have been developed earlier are converted into activities or technical features that coordinate the cooperation between platform owners and complementors. The outcome of platform governance rests on the platform's capability to design functions and features to realize governance decisions efficiently and effectively. Further, platform design also provides feedback to governance decisions, as platform owners can observe and monitor results of specific design features and adjust governance decisions accordingly in an iterative way, often called "strategy-by-doing" (Chen, Wang, Cui, & Li, 2021). Our review shows that digital platform research has focused to a large extent on the role of digital design features in coordinating complementor activities within and across the meta-organizational boundary. Embracing digital design represents a key avenue for coordinating interfirm relationships that is distinct from traditional governance of meta-organizations.

By integrating prior research, our framework highlights that platform governance mechanisms determine the direction in which platform design is implemented, and that platform design plays the role of executing and reshaping relevant governance decisions. However, our review also finds that prior empirical research has given limited attention to the economic objective that platform governance and design serves. We still know little about whether and how governance and design will affect the performance of the platform firm and the platform ecosystem. Absent this analysis, research on platform governance and design could be overwhelmed by idiosyncratic governance instruments that interest individual researchers, yet sheds little light on the strategy–performance linkage. In overcoming this challenge, we stress that platform research, in general, has informed that both value creation and appropriation are the main goals for platform owners.

By resolving collective action problems, organizational governance is typically assumed to fulfill the goal of joint value creation (Klein et al., 2019). In the platform context, the overall value created by the platform depends on its ability to initiate and sustain network effects among participants (McIntyre & Srinivasan, 2017), as well as on the distinctive market or technical identity created based on a unique constellation of complementary

products (Cennamo, 2021). Yet our review shows that platform governance research has rarely investigated how platform governance and design serve to increase platform-wide value. An equally important but understudied aspect concerns the challenges that platform owners face in appropriating value (Cusumano, Gawer, & Yoffie, 2019). Value appropriation refers to the platform owner's ability to profit from the transactions enabled by the platform technology or service (Teece, 1986). Embedded at the nexus of multilateral relationships, platform owners can capture a share of value created by "taxing" each transaction and interaction (Boudreau & Hagiu, 2009). Nonetheless, in a meta-organization like a platform ecosystem, effective governance requires maintaining the balance between value creation and appropriation. A platform capitalizing on users' non-pecuniary motivations to drive growth might be able to foster a collaborative and creative community, but could also fall short on the capacity to appropriate value (Boudreau & Jeppesen, 2015). On the other hand, while platform owners can employ aggressive revenue-sharing schemes to enhance value appropriation, doing so may dampen complementors' incentives to contribute to the platform and have repercussions for value creation. To this end, we submit that the logic of governance decisions and that of design features are co-determined by the coordination problems that platform owners must address, in pursuit of the goals of value creation and appropriation. The intricate balance of these goals shapes the extent to which, and how, platform owners want to offer incentives and exercise control. Overall, our framework offers a roadmap linking together governance, design, and value on which future research on digital platform's governance and design decisions may build.

Directions for Future Research

Our integrative framework also points to several promising yet underexplored directions for future research. Below we highlight four such directions, and Table 3 provides a list of illustrative questions that future work could aspire to address.

-------Insert Table 3 about here-------

Identifying contingency factors affecting optimal governance and design choices

Though many studies have examined how particular governance instruments or design features influence complementors' participation and performance on the digital

platform, research on the comparison between multiple instruments or design features and platform owners' choices among them remains scarce. Little do we know about how to decide on the optimal design features in different platform contexts. For instance, in their study of APIs, Wulf and Blohm (2020) point out that prior research often studies the aggregate incentive effects of the provision of APIs, neglecting the fact that platforms may offer a variety of APIs, and that different design decisions may produce different performance outcomes. Thus, future research will find it valuable to investigate the heterogeneous and complex relationship between governance instruments (design features) and platforms' performance outcomes. For instance, how should digital platform owners choose between multiple types and bundles of resources to provide to complementors? What information should be disclosed at developer conferences or other venues to promote participation in response to major technological or governance policy changes? To what kinds of complementors should the platform owner delegate a specific decision right?

Our framework suggests that future research can apply a contingency perspective when analyzing platform governance and design decisions. The heterogeneous relationships between governance instruments (design features) and platform value creation (appropriation) naturally indicate that it is unlikely for us to see a universally optimal set of strategic choices for all platforms. Such relationships are likely to vary across different types of platforms with different business focuses, across different institutions governing the platforms in different locations, and across different stages of platform development in different time periods (Koo & Eesley, 2020). As an example, Chen, Pereira, and Patel (2020b) evaluate the tradeoffs between centralized and decentralized governance, and suggest that digital platforms striving to become a foundational infrastructure tend to be more decentralized than those designed for a specific application. Thus, our framework calls for future research to identify contingency factors that may affect the effectiveness of various platform governance mechanisms and that may favor the choice of one over another. Researchers may explore how platform owners' governance and design choices interact with the dynamic industry and institutional environments (as shown in Figure 1), while acknowledging that cross-sectional differences in industries, institutions, and geographic

locations can also shape platform owners' decisions differentially (Li, Chen, Yi, Mao & Liao, 2019; Uzunca, Rigtering & Ozcan, 2018).

In particular, we urge future research to study how the complexity of a digital platform may serve as a contingency factor that affects the platform owner's governance and design decisions. The interdependence between unique components and the technical barrier to leveraging platforms' interfaces is often what makes digital platforms a highly complex organization. Such an architectural feature significantly affects complementors' incentives to join the platform as well as their ability to deliver satisfactory performance to customers. More specifically, we define technological complexity as related to the required knowledge or technical capabilities of complementors in customizing product offerings to the platform interface (Cennamo et al., 2018), and we define organizational complexity as the number of unique components that complementors need to interact with to materialize their value proposition (Chen et al., 2020a). Digital platforms with high technological complexity may be able to offer technical advantages compared to rivals, but increase costs for complementors to develop non-fungible products. High organizational complexity of a digital platform enhances the benefits of synergistic specificity between the platform and its complements, but also makes it difficult for complementors to remain interoperable with other components and to respond quickly to the emergence of new platform capabilities. Hence, it is promising for future researchers to examine how digital platform owners may exploit governance mechanisms of incentive and control to leverage the benefits of complexity while minimizing the potential costs. For instance, research on conferring autonomy can elucidate how the modularity of technical design may be shaped by and tackle various degrees of organizational complexity of a platform. Similarly, studies on the sharing of resources can explore the optimal governance and design features according to the specific technological complexity that complementors are confronting.

Deepening our knowledge of the dynamics and evolution of governance and design

There also exist significant opportunities for researchers to improve our knowledge about discrete governance instruments or design features, interactions among them, as well as their changes and dynamics that shape platform owners' incentive and control functions. For

instance, most existing research on output control has focused on the role of online feedback systems, while digital platforms also resort to internal performance metrics in evaluating their complementors. For example, Amazon keeps track of sellers' transaction records (e.g., order defect rate, cancellation rate, late shipment rate) and uses these data to assess sellers' performance and control their output accordingly. With regard to behavioral control, besides restricting the exchange of contact information between complementors and customers, platforms can design other mechanisms to prevent users from circumventing the platform, such as by reducing transaction fees and providing unique value-added complementary services to complementors (Zhu & Iansiti, 2019). Future research studying these mechanisms and designs will be particularly valuable.

In addition, future research on digital platforms could direct more attention to the influence of the recent digital revolution on platform governance and design. Unlike traditional organizations, digital platforms rely heavily on information and communication technologies and related technical components to govern relationships with complementors, and therefore are more adaptive to technological changes in those domains. This direction provides a wide range of opportunities for scholars to study how technological innovation shapes digital platforms' deployment of particular governance mechanisms and design features. For instance, in 2015, Alibaba took advantage of big data techniques and launched a data analytics tool ("Sheng Yi Can Mou") that provides complementors (sellers) with information on their competitors' (other sellers') performance. The widespread use of data analytics by platform owners has led to a growing scholarly interest in data network effects, where users derive more value from a platform as it learns more extensively from the whole set of data it collects on users (Gregory, Henfridsson, Kaganer, & Kyriakou, 2020). While prior research predominantly discusses the demand-side effect of data analytics, future studies could examine whether and how new design features enabled or informed by big data can enrich our understanding of "provision of information" in guiding complementors' specific investment. Such research might also help reveal the interrelationship between capability and governance in regard to platform owners. On the other hand, the rising of blockchain could imply a significant reduction in platform owners' capacities to govern or

render the idea of "platform owners" largely irrelevant (Chen et al., 2020b; Lumineau, Wang & Schilke, 2020). Blockchain can play a significant role in the decentralization of decision rights, as a blockchain-based platform is governed by rules collectively established and enforced by complementors, rather than by a central platform owner as in a traditional digital platform. The need for a central coordinator's involvement in dispute resolution is also much diminished because of the use of smart contracts. That said, theoretical insights from hybrids research (particularly co-operatives) likely remain pertinent and useful. One would expect decentralization to encourage widespread participation based on a sense of identification and freedom from the explicit exercise of authority (hence expropriation) (Gulati et al., 2012); yet it could fall short on adaptiveness in response to environmental changes or competitive threats as compared to centralized coordination (Williamson, 1991), since collective rules are hard to alter once put in place. Future research could explore the performance implications of decentralized governance focusing on the platform ecosystem as the unit of analysis.

Meanwhile, future research might elucidate the interrelation between platform governance and platform design. Existing governance arrangements determine designs of the platform; current designs, however, could also shape future governance choices. To illustrate, Android's open architecture that allows smartphone makers to modify the Android platform has increased the complexity of the ecosystem and enabled strategic exploitation by rivals (Chen et al., 2020a; Karhu et al., 2018). In response, Google demanded higher levels of harmonization among different Android versions from smartphone makers, and also modified Android's boundary resources to reclaim some control of the core technology.

Finally, there is little research on the platform's successive renewal over its lifecycle through governance and design changes (as opposed to contract renegotiations). Future research could begin this work by focusing on longitudinal changes in digital platforms' governance mechanisms and illustrating the motivations and implications of such changes. For example, AliExpress, an online shopping platform that offers products to international buyers, announced an access regulation policy in 2017, stipulating that complementors who sell particular products, such as wedding dresses, electronic components, and synthetic wigs, can only join AliExpress by invitation; sellers who do not receive the invitation are not

allowed to sell on the platform. This restriction was later relaxed in 2020 such that electronic components sellers can register on the platform at will. Future work might explicate why the platform owner chooses to implement such policies and how such changes will affect complementors' value creation activities and the platform's overall performance.

Providing more direct evidence on platform value creation and appropriation

Despite the importance of value creation and appropriation in the platform literature, little systematic analysis has been conducted as to what purposes platform governance serves and how various governance instruments and design features in digital platforms help achieve organizational goals. Prior research generally looks at the influence of specific governance/design mechanisms on complementors' individual behaviors, such as adoption decisions, innovation activities, or product development, while paying limited attention to whether this influence can eventually promote the efficiency of the platform owner (e.g., larger installed user base, more consumer purchases, higher total profits). That indicates a significant gap in the literature, since complementors' changes in behaviors do not necessarily increase ecosystem-wide value or bring extra profits to platform owners. For instance, complementors might be motivated to "game the system" in response to a governance change on the digital platform, while hurting value creation for customers. Although incentivizing complementor innovation improves value creation for customers, complementors obtaining a loyal customer base can impair platform owners' appropriability through disintermediation or other means.

Thus, as suggested by our framework, future studies on platform governance will benefit from a better understanding of the nexus between governance mechanisms (design features) and platform owners' value creation/appropriation, as platform owners' gains from formulating and implementing governance strategies depend largely on the balance between how much value is created and how much value can be captured by the platform owner. As an example, future studies of anti-manipulation mechanisms should go beyond the mere analysis of the so-called detection accuracy (Siering et al., 2016) and examine whether complementors will take corrective actions or instead develop new manipulation techniques in response, and whether such responses will enhance or damage platform owners' ability to

create and capture value. Similarly, research on external relationship control could examine how platform owners might further monitor complementors' behaviors after the latter has entered into some kind of exclusivity arrangement and assess whether platform owners' decisions to reduce their compatibility with competing platforms and limit complementors' outbound multihoming indeed bring economic benefits to the overall platform ecosystem.

Furthermore, future research on platform value creation and appropriation should extend the analysis of governing complementors toward examining how platform owners play an important role in orchestrating the relationships among complementors (Zhang et al., 2020), and between parties on different "sides" of the platform. Given the two-sidedness or multi-sidedness of platforms, platform value could rely heavily on the interdependence between complementors and customers. Such interdependence implies that the platform owner–complementor relationship could have significant spillover effects on customers (Rietveld et al., 2021; Tae, Luo, & Lin 2020). Spillover effects have been primarily subsumed into the analysis of platform performance, as researchers employ customer-related metrics (e.g., ratings, reviews, number of active customers) in assessing the performance impact of specific governance and design features. Therefore, it would be fruitful for future studies to evaluate platform governance mechanisms from the perspective of the overall platform ecosystem and give more attention to the implications of cross-side interactions for platforms' value creation and capture. For instance, future work on access control could study how platform customers (i.e., users) respond to changes in the number and composition of complementors on the platform, and after accounting for this interdependence, what specific ways to govern complementors will lead to net benefits for the platform ecosystem.

Extending organizational governance research (e.g., organizational boundaries)

Much has been discussed as to how organizational governance can provide a much-needed theoretical framework for understanding the governance and design decisions of digital platforms. We submit that various distinctive features of this new organizational form might also help reinvigorate some of the classic questions on organizational governance. One such question drawing platform scholars' particular attention is concerned with the determinants and implications of organizational boundaries (Gulati et al., 2012). Prior

research considering platform boundary has discussed the scope of the platform firm, the inclusion of specific complementors, the platform's horizontal diversification, and the platform's entry into complementors' market space (Gawer, 2020; McIntyre et al., 2020; Rietveld & Schilling, 2021). "Boundary" thus may refer to the platform firm, the product market, the competition between platform owners and complementors, and the platform ecosystem. Instead, our framework gives a sharper focus on the conceptualization of boundary as sitting between platform owners and complementors. For instance, "conferring autonomy" revolves around the partitioning of decision rights between platform owners and complementors. "Sharing of resources" implies the platform firm's proprietary ownership of some critical resources, but not others. We argue that this view of boundary may breathe new life into governance theory.

Received wisdom of firm boundary suggests that the incompleteness of contracts and the complementarity of assets give rise to quasi-appropriable rents; integration, rather than market transactions, can improve *ex ante* investment incentives and reduce *ex post* appropriation and excessive haggling in renegotiations (Argyres, Felin, Foss, & Zenger, 2012; Gibbons, 2005; Zhang & Tong, 2021). This is because internal organization enables managerial fiat and allows for better-aligned incentives through asset ownership (Hart & Moore, 1990; Williamson, 1991). Much of extant governance research follows this traditional view and defines boundary by asset ownership. However, in digital platforms, integration is no longer the default solution to incentive realignment and authority reallocation, and not the only way platform boundary is enacted. Moving beyond the make-or-buy decision, Hagiu and Wright (2019) view boundary as a controlling versus enabling choice, which refers to how rights over decisions that directly affect customer demand are allocated between the platform owner and the complementors. Regardless of whether to buy or to make, traditional firms typically retain full control of customer-facing decisions, and only decide on how to govern the productive assets in fulfilling these decisions. By contrast, complementors are often given substantial control over such decisions as pricing and advertising, while the platform owner facilitates the exchange between complementors and customers, and grants rights to the use of platform resources (Altman & Tushman, 2017). This view is much aligned with Santos

and Eisenhardt (2005), in that boundary can be defined simply by the demarcation between the (platform) firm and the environment (e.g., complementors), instead of asset ownership.

An important implication for governance theory is a reconsideration of what determines boundary. For instance, platform boundary is manifest in the firm's proprietary knowledge of common components or reusable assets that are at the nexus of a system's architecture and available in a single standard format (Baldwin & Woodard, 2009). While the platform owner might not want to have very heavy core components, which might impair the platform's evolvability (Olleros, 2008), when and how the platform firm should develop technological knowledge and competence about noncore components (Brusoni, Prencipe, & Pavitt, 2001; Parmigiani & Mitchell, 2009), such as boundary and complementary resources (Tiwana & Keil, 2007), remains largely unknown. Similarly, little do we know about why and under what circumstances certain activities, such as information disclosure, would be better performed exclusively by the platform owner rather than its complementors (Kuan & Lee, 2020). In these cases, that platform owners seek to reclaim their sphere of influence may not be driven by contractual hazards or incentive misalignment.

Consider the platform owner's decision to enter its complementors' product market as an example. Following received wisdom, one would argue that for some complements that are highly complementary to a multitude of assets in the system (Hannah & Eisenhardt, 2018), there are substantial quasi-appropriable rents available for appropriation and high transaction cost in general, a situation likely only solvable through integration (Klein, Crawford, & Alchian, 1978). Small numbers bargaining that arises from network effects can further exacerbate the holdup risk (Cuypers et al., 2021), leading complementors to show more willingness to invest in generalized rather than specialized resources (Leiblein, 2003). These considerations then could prompt the platform owner to decide to internalize (Eisenmann, Parker, & Van Alstyne, 2011), or supply (Zhu, 2019) those complements by itself. By contrast, our framework would view such boundary-expanding behaviors as platform owners' calculated efforts to control complementors' market access and appropriate more value (Zhu & Liu, 2018), or as an incentive-related approach to inducing the redirection of complementors' innovation resources (Foerderer, Kude, Mithas, & Heinzl, 2018; Gawer &

Henderson, 2007; Wen & Zhu, 2019). There is much scope for future platform research to further theorize about the determinants of boundary decisions in a way that enriches our fundamental understanding of interorganizational collaboration in the absence of asset ownership reallocation.

CONCLUSION

In reviewing the fast-developing research on digital platforms' governance mechanisms and design features, we establish the linkage between platform organization and hybrids, to inform research and practice in an economy in which digital platforms are assuming an increasingly important role in directing resources and business activities. It is our hope that our review will serve as a catalyst for future research on this new organizational form with regard to such classic organizational governance issues as incentive and control, and help bridge this emerging field of study with foundational corporate strategy scholarship from which new insights will accrue.

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FOOTNOTES

1. Scholars have labelled platform owners as leaders (Gawer & Cusumano, 2002), regulators (Boudreau & Hagiu, 2009), integrators (Nambisan & Sawhney, 2011), and orchestrators (Iansiti & Levien, 2004).
2. To be sure, taking this viewpoint does not rule out understanding platform governance from the complementors' or users' vantage points (as in alliances research, argued by Gulati, 1998).

Table 1
Comparison with Recent Reviews of Platform Research

	Rietveld & Schilling (2021)	McIntyre & Srinivasan (2017)	This Review
Type of platform	General platforms	General platforms	Digital platforms
Main review focus	Platform competition	Network effects	Platform governance and design
Main relationships to govern	Among different participants in a platform ecosystem	Between different sides in a platform network	Between platform owners and complementors
Governance mechanisms referred to or reviewed	Access control, selective promotion, integration into complements	Access control, sharing of resources	Sharing of resources, provision of information, conferring autonomy, giving rewards, access control, output control, behavioral control, external relationship control
Mapping design features onto governance mechanisms	No	No	Yes

Table 2
Structure and Summary of Literature Review

	Governance Mechanisms	Definitions	Design Features	Illustrative Studies
Incentive	Sharing of resources	Sharing of resources with complementors that can assist the latter in their value-creating activities	API, SDK, code library, reference design, etc.	• Eaton et al. (2015) • Tiwana (2015a) • Ye & Kankanhalli (2018) • Wulf & Blohm (2020)
	Provision of information	Provide complementors with interface- or customer-related information	Developer conferences, workshops	• Foerderer (2020) • Fang et al. (2020)
			Communication channels with and between complementors and users	• Xu & Chau (2018) • Tan et al. (2019)
	Conferring autonomy	The extent to which digital platform owners confer to complementors autonomy in conducting value-creating activities	Decentralization of decision rights	• Boudreau (2010) • Hagiu & Wright (2019)
			Modularity	• Schilling (2000) • Tiwana (2008, 2018)
	Giving rewards	Giving pecuniary and non-pecuniary rewards to complementors	Revenue sharing schemes	• Miric et al. (2019) • Shi et al. (2020)
			Fee-based features	• Sun & Zhu (2013) • Kuang et al. (2019)
			Recommendation, certification, featuring, etc.	• Claussen et al. (2013) • Rietveld et al. (2019)

Control	Access control	Governance mechanisms determining who is allowed to join the platform and use the digital interface	Screening mechanisms	• Tiwana (2015b) • Song et al. (2018)
			Restriction on the use of boundary resources	• Ghazawneh & Henfridsson (2013) • Gawer (2020)
			Access fees	• Hossain et al. (2011) • Dushnitsky et al. (2020)
	Output control	Evaluation and monitoring of complementors' outputs and outcomes	Reputation scores, online reviews, ratings, etc.	• Bolton et al. (2013) • Fan et al. (2016) • Li et al. (2019)
	Behavioral control	Deciding on the types of interactions allowed or deemed appropriate on the platform	Anti-manipulation techniques	• Kumar et al. (2018) • Reischauer & Mair (2018)
			Restriction on the exchange of contact information	• Gu & Zhu (2021) • Zhu & Iansiti (2019)
	External relationship control	The extent to which digital platform owners allow complementors to interact with other platforms	Exclusive relationships	• Corts & Lederman (2009) • Lee (2013)
			Reduction of compatibility	• Karhu et al. (2018) • Karhu et al. (2020)

Table 3
Future Research Directions and Illustrative Research Questions

Directions	Illustrative Research Questions	Related Governance Mechanisms
Identifying contingency factors affecting optimal governance and design choices	• How do platform owners choose among multiple resources, or configure a resource bundle, to provide to complementors? Under what conditions? • What kinds of information should platform owners disclose at developer conferences or other venues to motivate complementors' participation? • How will platform owners' use of blockchain technology influence complementors' autonomy? Under what conditions? • How does platform owners' provision of competing complementors' information shape a focal complementor's incentives and behaviors? • Under what conditions do platform owners' governance and design choices interact with the external industry, country, and institutional environments? • How might platform owners exploit governance mechanisms of incentive and control to leverage the benefits of complexity while minimizing the potential costs?	• Sharing of resources • Provision of information • Conferring autonomy
Deepening our knowledge of the dynamics and evolution of governance and design	• Why do platform owners implement invitation-only mechanisms regarding certain products provided on the platform—and how will such mechanisms influence value creation and appropriation? • What types of internal performance metrics do platform owners create, and how do they use such metrics, to evaluate complementors' outputs? • How can new design features enabled or informed by big data analytics enrich our understanding of platform owners' "provision of information" in guiding complementors' specific investment? • How much profit, and in what ways, should be shared with complementors, or retained by the platform owner to ensure the platform's long-term prosperity? • What is the interrelationship between platform governance and platform design, and how does the relationship change as the external environment changes?	• Access control • Output control • Provision of information • Giving rewards

Providing more direct evidence on platform value creation and appropriation	• How can platform owners reduce the risk of disintermediation by complementors (e.g., through providing unique complementary resources or services) and capture value? • How do digital platform owners monitor complementors' responses to the anti-manipulation strategies and tactics, and does that affect platform owners' ability to create and capture value? • Will platform owners' decision to reduce their compatibility with competing platforms and limit complementors' outbound multihoming indeed benefit themselves? • Why do platform owners implement or change particular policies—and how do such changes affect complementors' value creation activities and the platform's overall performance?	• Sharing of resources • Behavioral control • External relationship control
Extending organizational governance research and theory (e.g., organizational boundaries)	• How do the distinctive features of platform organizations help extend existing organizational governance research and reinvigorate some of the classic questions (e.g., organizational boundaries)? • Can the boundary of a platform be conceptualized as sitting between the platform owner and complementors? • To what extent can organizational boundaries be defined without resorting to asset ownership? • How should we view platform owners' entry into the complementors' market space—internalizing the market, controlling complementors' market access, or redirecting/orchestrating complementors' innovation effort?	• Sharing of resources • Provision of information • Conferring autonomy • Access control • External relationship control

Figure 1
Platform Governance and Design: An Integrative Framework