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INTRODUCTION: ENTREPRENEURSHIP, INNOVATION, AND PLATFORMS

During the last three decades, innovation and entrepreneurship have been among the most dynamic topics within the field of strategic management. Sparked by the insights of Joseph Schumpeter, strategy scholars have devoted increasing effort to understanding innovation as an engine for firm performance, to understanding the drivers and success factors associated with entrepreneurship, and to understanding the role of each in value creation, value capture, and economic welfare.

The central puzzle of Schumpeterian competition compares the advantages enjoyed by entrepreneurs and those inherent to incumbency. In both formal game theory and natural language theories, interaction between incumbents and entrants has become increasingly rooted in the dynamics of R&D, the incentives for and competence to innovate, and a potential entrant's post-innovation choice between competing and collaborating with an incumbent. Formal models have built on Teece's (1986) insights about complementary assets to examine the circumstances under which an entrant will commercialize its innovation via collaboration with an incumbent (Gans & Stern, 2003). Studies of industry evolution increasingly turn on the competition between extant and entering cohorts of firms endowed with different technologies or innovative propensities (Adner & Snow, 2010). In sum, entrepreneurial innovation has become the dominant motivation for strategy's most enduring question: when and how does market entry dissipate incumbent profits?

The challenges and implications of innovation for incumbents are also core research topics in strategic management. Some of the pioneering work in this area examined how incumbents innovate, evolve, and change over time (Nelson & Winter, 1982), why incumbents sometimes fail in the face of certain types of innovation (Henderson & Clark, 1990), how innovations and innovation capabilities correlate with competitive advantage (e.g., Henderson & Cockburn, 1994; Kogut & Zander, 1992), and under what conditions incumbents are able to protect themselves from innovations from outside their industry (Teece, 1986, 1998; Tripsas, 1997). Related research in corporate strategy has examined the relationships between innovation and diversification (Silverman, 1999), among innovation, acquisitions, and alliances (Sampson, 2005), and between innovation and the vertical boundaries of the firm (Pisano, 1990). Ideas about the value of innovation for competitive advantage have been incorporated into

theoretical research as well, especially in the resource-based view of the firm and also in perspectives based in the disciplines, including work based in economic sociology examining the interaction between network position, innovation, and competitive advantage (e.g., Powell, Koput, & Smith-Doerr, 1996). The insights and approaches of these earlier inquiries have yielded a variety of research lines that continue to be among the most vibrant in strategic management. For example, burgeoning work examines the roles of mental models and cognition in driving innovation and firm performance (Kaplan & Vakili, 2015; Tripsas & Gavetti, 2000), the role of the market for ideas in shaping the boundaries of the firm (Arora, Fosfuri, & Gambardella, 2001; Gans & Stern, 2010), and the role of innovation for value creation and value capture in firms (Lieberman, Garcia-Castro, & Balasubramanian, 2017). Questions about how incumbents can best manage innovation were at the forefront of early inquiry and remain among the central questions today (Nelson, 1962, 1991).

As digital technologies pervaded the economy from the late 1990s through today, increased attention has been paid to network effects (Parker & Van Alstyne, 2005), ecosystems (Adner, 2017; Adner & Kapoor, 2010), and platform strategies (Gawer & Cusumano, 2002, 2014; Hagiu & Wright, 2015). Platforms matter not only because some of the most powerful and innovative digital firms such as Google, Amazon, Apple, and Facebook all develop technological platforms and operate platform business models. These firms are only the most visible elements of a profound economic movement, as platform-owning firms constitute an increasingly larger part of the economy, totaling a market capitalization of platform firms estimated to be greater than $4 trillion (Accenture, 2016; Evans & Gawer, 2016). Platforms-based innovation ecosystems may well be the new dominant organizational form of an increasingly digital economy. For strategy researchers, the academic literature on platforms has gathered momentum, building on the insights of economic Nobel prize winner Jean Tirole (Rochet & Tirole, 2003), as well as earlier work by Bresnahan and Greenstein (1999). Some of the most exciting directions of strategy research in this area are seeking to complement a purely economic understanding of platforms as multi-sided markets with an appreciation of innovation dynamics and organizational dynamics of platform-based ecosystems (Baldwin & Woodard, 2009; Boudreau, 2010; Gawer, 2014).

This volume extends these three branches of strategic management literature in distinctive and mutually reinforcing ways.

Entrepreneurship and Entrant–Incumbent Dynamics

The first module of this volume focuses on entrepreneurship and entrant–incumbent dynamics. Three studies explore competition between entrant and

incumbent, both integrating insights from the extant literature and extending these insights in new, often counter-intuitive directions.

In "Negotiating for the Market," Joshua S. Gans considers a subtle but central question at the intersection between strategy, innovation and entrepreneurship: Beyond the static gains from trade that arise when an entrant develops an innovation that can potentially displace an incumbent technology, how does the possibility for the entrant and incumbent to further their dynamic capabilities facilitate or hinder the prospect of cooperation versus competition? A significant theoretical and empirical literature considers the static gains (and costs) from cooperation versus commercialization. At the same time, there is a more informal argument that entrants who license or sell out at an early stage may overlook the possibility of developing dynamic capabilities that would actually be more valuable than the agreement they achieve with a current incumbent. Although this intuition is often invoked in both academic research and practice, there is little careful examination of when and why such a condition might hold (or be meaningfully important). Given this context, Gans's study is the first to consider start-up commercialization strategy relying upon a formal model of dynamic innovation. The chapter is not simply a model-building exercise, but derives the logic for a new and important insight: the potential for dynamic capabilities can, indeed, undermine the case for cooperation. The case under which this occurs is not simply that the innovative entrant would gain valuable dynamic capabilities under competition, but that this effect is larger than the capabilities that would be earned through some form of integration.

Gans's model is simple and elegant: each period features an innovation "leader" who can be the incumbent or entrant, the technology developed completely displaces the current technology, and both incumbent and entrant have some advantage (over a random new entrant) in becoming the innovation leader the next period. Importantly, the relative size of that advantage for each respective actor depends endogenously on whether, when the entrant is the innovation leader, the entrant and current incumbent choose to cooperate or not. Key findings of the chapter are that: (a) when incumbent and entrant capabilities can be combined, the entrant will be acquired; (b) when innovators can maintain innovation leadership even if they are not producers, the entrant will license to the incumbent; and (c) when innovative leadership requires production and there are diminishing returns to integration, the entrant will compete with and displace the incumbent.

Innovating entrants typically require external financing to fund their early endeavors. Ramana Nanda and Matthew Rhodes-Kropf's chapter, "Innovation Policies," focuses on a central problem in entrepreneurship: what types of projects will be funded, and how do the institutions that surround funding influence the realized value from entrepreneurial investment? The authors take a creative and novel approach for attacking this problem by exploring the idea that a funder might have to choose and commit to an "innovation policy" regarding failure-tolerance prior to selecting an investment. Whereas an

uncommitted investor is free to stop projects after an experiment yields information indicating that the project is NPV-negative, a failure-tolerant investor will commit to fund projects even if an intermediate experiment generates "bad" news. This chapter explores the surprising implications of this commitment for the type of projects that are funded. Specifically, investors who are failure-tolerant must be compensated for their tolerance in the form of more of the upside to projects that are ultimately successful (i.e., in exchange for "fronting" additional money to the entrepreneur independent of outcome, they must be rewarded with a higher fraction of the value when success occurs). This commitment generates a match between failure-tolerant investors and projects that involve less value from experimentation; in contrast, uncommitted investors are willing to fund "high upside" projects but only if they can choose whether to continue based on the value of an informative experiment.

The authors draw out the inevitable consequences of this trade-off: commitment-oriented corporations may end up only funding incremental projects (the value of the upside is low), venture capitalists will be ruthless in shutting down firms after negative information (but will ultimately end up funding more "breakthrough" projects as part of their portfolios), and some projects will ultimately require a funder (such as a government or university endowment) who is willing to commit and also does not need to maximize NPV for its portfolio. A more exploratory section considers the impact of competition among investors for deals in the context of a search model, and derives conditions under which the only funders who exist in equilibrium are high-commitment, low-risk funders.

One of the central issues in the study of entrant–incumbent dynamics regards the competition among firms engaged in technology-based entry. In their chapter, "Nuanced Role of Relevant Prior Experience: Sales Takeoff of Disruptive Products and Product Innovation with Disrupted Technology in Industrial Robotics," Raja Roy and Mazhar Islam focus on an industry that experiences a dramatic change in technology – the shift from mechanical control technology to computer numerical control (CNC) technology in industrial robotics. The authors distinguish between two distinct sets of entrants, those with and without experience in the disrupted technology, and two important time periods, the time before and after the sales takeoff for CNC-based robots. They develop sharp predictions about the relative innovative success of these two sets of entrants in each of the two time periods. Notably, whereas the two sets of firms will be equally adept at producing CNC robots before the sales takeoff, after the takeoff the firms with prior-generation experience will outperform those without such experience.

Empirically, Roy and Islam identify the extent to which nearly 300 firms entering the industrial robotics industry between 1978 and 1983 have experience with the old (disrupted) technology of mechanically controlled robots, relative to their experience with the new (disrupting) technology of CNC robots. Based on a heroic data-gathering effort that involves constructing a dataset from

myriad sources, the authors investigate how experience with the disrupted technology is related to success after entry. They find that, indeed, those firms that had higher levels of experience with the disrupted technology prior to sales takeoff have greater success in the period of time after sales take off. Their results have implications for theories of disruptive industry change and for understanding the history of the industrial robotics industry. They also help to clarify debate over the value of experience (which is generally deemed useful) in technological regimes that appear to face obsolescence (which is often deemed harmful).

The three studies in this part thus highlight strategic interactions involving entrant firms at three different interfaces: with financiers, with established incumbent firms, and with other recent entrants. These studies jointly extend our understanding of the competitive dynamics underlying entrepreneurial innovation.

Management of Innovation in Large Firms

The second module of this volume includes three studies that extend our understanding of innovation and technology adoption within large incumbent firms.

Maya Cara, Julian Birkinshaw, and Suzanne Heywood contribute to the long-standing debate regarding complexity and innovation. Scholars are divided on whether organizational complexity is positively or negatively associated with technological innovation by that organization, and prior empirical research is inconclusive on this point. In their chapter, "Structural versus Experienced Complexity: A New Perspective on the Relationship between Organizational Complexity and Innovation," the authors propose an alternative perspective for disaggregating organizational complexity into aspects that favor innovation and aspects that do not, in some ways paralleling the literature on the slack–innovation relationship. In contrast to research that examines organizational complexity at the organizational level, Cara et al. focus their attention on the level of complexity faced by individual managers on a day-to-day basis. Specifically, the authors draw a distinction between *experienced complexity*, "the extent to which the organizational environment makes it challenging for decision-makers to do their jobs effectively," (Cara et al., 2017, p. 117) and *structural complexity*, "the elements of the organization, such as the number of reporting lines or integrating mechanisms" (Cara et al., 2017, p. 117).

Drawing from research on rugged landscapes (Levinthal, 1997), the authors hypothesize that factors associated with structural complexity will be positively associated with firm innovation output. In contrast, elements associated with the novel construct of experienced complexity – notably, the perception of unclear accountabilities and of inefficient processes – will be negatively associated with a firm's innovation output. They find evidence consistent with these

hypotheses based on the innovation and complexity constructs developed in their large firm survey. By focusing on the complexity experienced by individuals in large organizations, Cara et al. shift attention to the complexity–innovation relationship toward its micro-foundations and invite future work that builds on this basis for understanding innovation in large firms.

Of course, the organizational structures that affect innovation and adoption need not be formal. Informal networks also matter. In her chapter, "Network Stability, Network Externalities, and Technology Adoption," Catherine Tucker addresses an important yet subtle question: When potential network-technology adopters face increased uncertainty about whom they might interact with, how does that affect their adoption of the technology? From a theoretical perspective, a long (and somewhat inconclusive) literature has yielded two conflicting conclusions. On one hand, uncertainty about potential network partners might enhance adoption incentives since uncertainty induces a scope economy across the potential network. On the other hand, uncertainty reduces the value of any particular connection, and so might reduce adoption incentives. To address this question, an empirical approach is required. Tucker tackles this question by exploiting two "natural experiments" that occurred as a videoconferencing technology was adopted at the firm level by a global financial company, but where adoption decisions by individual employees was voluntary.

As in her now-classic *Management Science* chapter (Tucker, 2008), Tucker exploits the fact that the videoconferencing technology also had a "standalone" benefit as a television which led to selective adoption independent of network benefits by those that wanted to watch particular one-off sporting events (e.g., World Cup, Rugby tournament, etc.). In this chapter, she also introduces a second shock – the dislocation of employees from the firm's New York office in the wake of the September 11 attacks (employees were physically moved and somewhat re-organized after the attacks). This combination allows her to evaluate how the adoption behavior of New York employees differed both relative to other offices and pre- versus post-attacks. Her main emphasized result is that, after the attacks, New York employees were much more sensitive to the people they had the "potential" to interact with rather than those to whom they would immediately be connected after their own adoption. At face value, the size of the network effect nearly doubles for those employees facing a more uncertain communication pattern.

Whereas the above two studies focus on mid-level employees, the third chapter focuses on challenges facing top management. In their chapter "Platforms, Open/User Innovation, and Ecosystems: A Strategic Leadership Perspective," Elizabeth J. Altman and Michael L. Tushman focus on the specific managerial and organizational challenges that firms and their senior teams face when they transition from traditionally closed ways of conducting business to externally focused platform, ecosystem, or open innovation strategies. The phenomena covered by the various streams of the strategy literature on platforms, ecosystems, and open innovation are partially overlapping, yet the often disparate

streams of literature have not yet coalesced, nor have they offered a clear view of the distinctions between these concepts and of the extent to which they overlap. Further, while the existing literature focuses mostly on strategic, economic, and management trade-offs of platform, open/user innovation, and ecosystem strategies, there is scant work focusing on implications for firms' leaders.

Altman and Tushman's chapter contributes first by summarizing the main insights of these various streams of literature and by offering a clear comparison between the structures of platforms, ecosystems, and open/user innovation. The authors then turn to the important yet under-researched question of how senior management in mature organizations can successfully face the organizational and managerial challenges posed by transitions to these externally facing strategies. Altman and Tushman use the lens of institutional theory to highlight the cognitive and normative underpinnings of the new externally facing, community- or ecosystem-building strategies. They identify not merely different firms' behaviors, but also the different assumptions and beliefs that underpin the shift from traditionally closed business conduct to the more externally facing platform and ecosystem strategies. The transition from closed to more open strategies is construed as a shift in institutional logics, one that gets instantiated through practices such as (1) increasing external focus, (2) moving to greater openness, (3) focusing on enabling interactions, and (4) adopting interaction-centric metrics. By selecting insights from the strategic leadership literature, the authors identify a number of challenges that senior teams are likely to experience in the context of this transition. They suggest that executive orientation and experiences, especially for senior managers who have operated in either secretive environments or highly competitive technology industry, may hinder them and their organization to adapt to the new behaviors required by the new strategies. They also suggest that the complex and sometimes conflicting nature of decisions associated with the new strategies, as well as finding new metrics and their consequences on executive compensation, can all be problematic for senior management teams.

By focusing on complexity, networks, and top management teams, the three studies in this part span issues central to research on strategy and innovation and highlight decision-making at multiple levels of the organization. Together, the studies provide insights into the challenges of incumbency and innovation, by looking inside the firm, across the firm's internal network, and throughout the firm's ecosystem.

Platform-Based Competition

The third module of this volume focuses on platform-based competition. Four studies explore this subject, with two focusing on strategies of the platform provider, one focusing on the impact of a platform on firms that interact with it,

and one focusing on extension of the platform literature to an industry that is rarely seen as a platform-based industry: biotechnology.

David J. Teece's chapter, "Dynamic Capabilities and (Digital) Platform Lifecycles," develops insights into the phenomenon of platforms, drawing on the strategic management theory of dynamic capabilities. Platforms are particularly relevant in the digital economy, Teece suggests, because, on one hand, in this context firms "see their role less in industries and more in business ecosystems (which are made up of organizations and customers working together to create and sustain markets and products)," and, on the other hand, "the coevolution of such ecosystems is typically reliant on the technological leadership of one or two firms that provide a platform around which other system members, providing inputs and complementary goods, align their investments and strategies" (Teece, 2017, p. 212) The chapter extends Moore's (1993) characterization of ecosystem life cycles to identify distinct phases in what Teece calls a "platform lifecycle." This life cycle has four phases: birth, expansion, leadership, and self-renewal. Teece then identifies how various categories of dynamic capabilities are particularly relevant during each phase of the platform life cycle.

Theoretically, in addition to the useful link between dynamic capabilities and platforms, the chapter advances our understanding of platforms by placing the concept of platform within an evolutionary perspective. Historically, within innovation studies and the technology strategy literature, the related concepts of product life cycle and industry life cycle have proven useful to explore how systematic changes in product or industry characteristics spark variation in environmental technological and economic conditions and also shape strategic opportunities. The corresponding line of research has stimulated a rich vein of empirical as well as conceptual studies, and allowed scholars to better understand the interaction between design changes, firms' behavioral changes, and the evolution of various contextual parameters. In this context, Teece's insight to apply a life-cycle lens to platforms is particularly judicious. Platforms, which are sometimes conceived as product technologies and sometimes conceived as an aggregate of firms, are an intriguing and somewhat natural candidate to benefit from a life-cycle lens. The chapter therefore opens what we believe are fruitful avenues for further development in the platform literature.

In his chapter "Platform Boundary Choices: 'Opening-Up' while Still Coordinating and Orchestrating," Kevin J. Boudreau considers the important but overlooked question of platform boundaries. Within the economics and management literature, most existing models of platforms assume that (1) platform boundaries are given, and (2) that boundaries of the platform are isomorphic with the scope of the platform-owning firm. Boudreau introduces a distinction between the boundaries of the platform (technology) and boundaries of the platform owner (firm), and then extends classic economic theories of firm boundaries to generate predictions for the boundaries of platform-based organizations. In particular, Boudreau examines the extent to which narrowing or widening platform boundaries affects (1) investment incentives for both

platform owner and complementary parties; (2) internalization of coordination problems; and (3) consolidation of control over critical assets.

Employing rich exposition of historical descriptions of several platforms, Boudreau finds significant cross-sectional variation and regular changes over time in boundary choices, indicating that platform boundaries are neither predetermined by industry conditions nor necessarily identical to the platform owner's boundaries. Further insights are broadly consistent with theoretical predictions. Although the shifting of boundaries *per se* does not seem to significantly alter suppliers' incentives to participate or to invest, the addition of mechanisms that protect the rights of outside suppliers significantly increases these suppliers' willingness to participate. Boudreau also finds that in order to solve coordination problems, the platform-owning firm tends to change not only its own scope, but also the platform's technological boundaries. Finally, he finds that while opening-up might connote disintegration and narrowing platforms, in fact opening up was often coupled with efforts to integrate farther into critical assets that acted as control points in the system. Despite opening up, these platform owners thus retained power to control and orchestrate independent suppliers through contracting, price-setting and rule-making in technical frameworks.

Overall, the examples in this chapter indicate that the fundamental trade-off as portrayed in previous literature – framed as a trade-off between openness-versus-control and coordination – is not confirmed by the evidence. Rather, "most successful open platforms were those that carefully chose boundaries to reconcile the interest of opening-up to harness contributions of outside suppliers with the interest of simultaneously maintaining coordination (in the form of orchestration, sponsorship, leadership, regulation) of activity in their ecosystems or sub-economies" (Boudreau, 2017, p. 284). The case studies and theoretical arguments emphasize therefore the possibility (and suggest to some extent the strategic superiority) of implementing boundaries that achieve both openness-and-control, rather than openness-versus-control.

Whereas the above two chapters focus on strategy for a platform owner, platforms also yield rich implications for competition among other firms in the ecosystem. In "Amazon Warrior: How a Platform Can Restructure Industry Power and Ecology," Henrich R. Greve and Seo Yeon Song address an important question regarding platform-based competition: How do third-party consumer reviews influence the sales of products, and how does this differ for products of dominant incumbent producers versus fringe producers or entrants? The authors propose that, by allowing free dissemination of consumer evaluations, information-sharing platforms allow smaller producers to overcome traditional scale-based marketing disadvantages, thus encouraging sales of fringe producers' products more extensively than those of dominant producers. The authors also distinguish between *discovery platforms* such as Twitter, which enhance exposure to new products, and *evaluation platforms* such as Amazon reviews, which provide information for those already interested in a particular

product. The authors then propose that these different types of platforms offer different types of benefits to small producers.

In order to investigate their hypotheses, the authors marshal a substantial amount of data on book sales, the Amazon ratings of each book, and their associated Twitter mentions. They find empirical results that are largely consistent with predictions. There has been substantial prior work on online platforms' ability to reduce search costs and thus generate a "long tail" of sales, which is consistent with this chapter. Yet whereas the bulk of prior research has focused on the ability to search an online retailer's inventory, the novelty of this chapter is its focus on the role of information-providing platforms to influence this process. Building on their theory and findings, the authors speculate about the way in which industry structure and competition may be altered in platform-mediated industries. In particular, the authors suggest that scale advantages may be reduced in industries like book publishing, in which economies of scale had, historically, been important in marketing, advertising, and promotion.

The burgeoning theory on platforms has focused almost exclusively on information and communication technologies (ICT). Joel West's chapter, "Open Source Platforms beyond Software: From ICT to Biotechnology," examines the degree to which platform theory is applicable beyond ICT. It presents an exploratory field study of communities organized around the idea of "open source biology." Interviewees explicitly refer to these collaborations as platforms and acknowledge influence of the ICT open-source model. West first distinguishes between the general attributes of ICT platforms and those of open-source software (OSS) platforms, noting key OSS attributes such as non-exclusive intellectual property, community governance and production models, and modularity. West moves then to characterize the phenomenon of biotechnology platforms, briefly summarizing the evolution of biotech "breakthroughs" and situating them within enduring tensions between "the norms of open science" and "the proprietary goals of strong intellectual property protection."

The chapter's main results, drawn from the analysis of interview data, comprise a description of three types of open-source collaboration within biotechnology – IP commons; Hackerspace; and Crowdsourced patient data–each of which is mapped into the "attributes" of platforms. West finds that these biotech platform models are associated with various subsets of partially overlapping ICT platform attributes. The chapter suggests that the field of biotech has adopted and partially adapted the open-source concept for biomedical products, and that this has been facilitated in part by trends such as the digitalization of biotechnology research processes combined with some participants' explicit desire to emulate the open-source software movement's embrace of open sharing and re-use of knowledge. The chapter also identifies the technical, legal and institutional limits within the biology field which make the pure adoption of open-source software mechanisms impossible or impractical. It

concludes by discussing the similarities and difference between open ICT platforms and biology platforms, and suggests implications for platform theory.

West thus raises intriguing questions about the meaning of platforms once we extract them from a pure ICT setting. Of particular note, his chapter indicates that greater attention to the specifics of the discovery and development process is needed to predict the kinds of platform dynamics that may or may not be present in varied empirical settings. The degree of distribution of skills should also matter to facilitate the growth and development of platforms, as well as the extent to which the underlying architectures of the platform technology allows a decoupling through modular interfaces, which allow some parts of the systemic products to be "proprietary" and others to be "open."

In sum, by analyzing platforms from the varied perspectives of platform-owner, platform user, and community member, the four studies in this part identify key strategic issues concerning organizational boundaries, competition, and complementarity in platform-based activity. The studies provide cumulative insights into the viability of platform strategies separate from the underlying technology and both within and outside the traditional digital setting.

CONCLUSION

We believe that the studies in this volume can provide insights and direction to encourage the next wave of research on entrepreneurship, innovation, and platforms. We hope that you will agree that, collectively, they inspire further exploration into these core topics of strategic management.

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