Platform and Ecosystem Transitions: Strategic and Organizational Implications

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Platform and Ecosystem Transitions: Strategic and Organizational Implications

A dissertation presented

by

Elizabeth Jane Altman

In partial fulfillment of the requirements

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Platform and Ecosystem Transitions: Strategic and Organizational Implications

Abstract

By most conventional measures of corporate success (revenue, market capitalization, global brand growth, etc.) businesses operating as multi-sided platforms (MSPs) and their associated ecosystems constitute the majority of the fastest growing organizations in the global economy. In the strategy and economics fields there is a burgeoning literature related to MSP-governed businesses and their ecosystems primarily focused on pricing, growth, governance, and competitive considerations. Yet, in organizational studies and innovation there is a dearth of research analyzing characteristics of these businesses and their complementors and the managerial challenges they present. More specifically, an increasing number of mature incumbent organizations in a variety of industries are starting to operate in environments in which they either need to operate as MSP-based businesses, or join ecosystems governed by them to compete successfully and grow. This dissertation consists of two book chapters and one empirical project aligned with one overarching question: As information constraints approach zero and MSP-governed businesses and their complementors become increasingly more prevalent in the global economy, what are the strategic and organizational issues affecting incumbent organizations that choose to become MSPs or compete as complementors to them?

The first chapter, incorporating a forthcoming book chapter (see Altman, Nagle, & Tushman, 2015) is a theoretical study exploring the effects on management research and

organizations when the costs of information processing, storage, and communication approach zero and organizations engage with a wide range of communities. As these information constraints are reduced, one effect is that MSP-based businesses and ecosystems thrive and impact large sectors of the economy. Thus, this chapter sets the context for the dissertation as it outlines the environment in which MSP-governed businesses and their complementors operate and introduces theoretical challenges posed by the growth of these networks.

The second chapter, an empirical paper, focuses on challenges encountered by incumbent organizations joining MSP-governed ecosystems as complementors. This project is a multi-year qualitative inductive field-based research study analyzing the transition of a well-known consumer technology product provider as it joins a powerful MSP-based ecosystem. The accessory organization enters an asymmetric power relationship encountering, and responding to, multiple types of dependencies. I identify three types of dependencies faced by the organization: *technological, information,* and *values-based,* and three response strategies the organization deploys: *compliance*, *influence*, and *innovation*. I suggest that these dependencies and responses are related to, but distinct from, extant work on power and dependencies. I also classify *three phases of complementor maturity* through which the organization passes. I induce a grounded theory model identifying relationships between the concepts and discuss theoretical implications.

The final chapter, also a forthcoming book chapter (see Altman & Tripsas, 2015), addresses organizational identity implications of transitions mature organizations undergo as they shift from product to MSP-based business models in which business considerations include network effects and interdependence. This chapter explains that organizational identity may affect, and may be affected by, product-to-platform transitions. It suggests that an organization must question its identity and modify it to be consistent with its re-defined business model.

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To Mitchell,

in loving memory

Acknowledgements

In April 2009, my world changed. My husband, Mitchell, passed away in a tragic bicycling accident while we were on vacation in Croatia. At the time, I had been at Motorola for almost 17 years. As I began to cope with my new reality, the Motorola management team was amazing. I will be forever grateful for their understanding and kindness as I balanced professional responsibilities while considering my next move. One evening, very soon after Mitchell passed away, a friend asked what I was going to do next. I was standing with Erica, my college-age stepdaughter. Before I could answer, Erica said, "Haven't you always wanted to go to Harvard to be a professor?" I was stunned, and wondered if she saw something I had put aside. It was true I had remained in touch with academia through guest lecturing, serving as a university trustee, and writing projects, but at the time I was fully engaged in an industry career.

A few months later, I was returning from a business trip and Clay Christensen, whom I had known for many years but had not seen recently, coincidentally boarded the plane. He saw me, asked the person next to me to switch seats, promptly sat down, and not knowing what had been happening in my life, started inquiring about how I was. By the end of the flight, we had decided I would come to his office the following Monday to discuss options for me to return to academia. The rest, as one might say, is history. I like to think of the transition this way: For the first half of my career I majored in industry and minored in academia. For the second half, I plan to major in academia and minor in industry. Harvard Business School (HBS) has given me the opportunity to make this switch and for that I am unboundedly grateful. This dissertation reflects the combined advice, feedback, encouragement, and patience of numerous professors, colleagues, friends, and family. With these acknowledgements, I aim to specifically thank a few and recognize that I am indebted to many others.

A great part of being a doctoral student is having the privilege of asking faculty members to serve on your dissertation committee. I am honored and thrilled that four scholars for whom I have the utmost respect agreed to serve on my committee. I think it is fair to say that Michael Tushman is one of the most beloved and respected scholars at HBS and in the broader management and organization theory, innovation, and strategy communities. Now I understand why. I am tremendously grateful he served as chair of my committee and I appreciate all the time and effort he spent with me. From our first discussion, Mike challenged me, pushed my thinking, and encouraged me, always with a strong reminder to have fun. Mike set high standards and asked for precise thinking, which forced me to clarify my assertions. By inviting me to work with him on an executive education program and co-author with him, Mike provided me with wonderful opportunities. I could not have asked for a more thoughtful, caring, and supportive advisor and only hope that someday I am half as effective an advisor for my students.

I sent Andrei Hagiu an email during my first semester at HBS asking if we could meet. Writing a literature review on multi-sided platforms (coincidentally, for Mike Tushman's class), I had seen Andrei's name throughout the literature. Though we approached research from different angles, Andrei agreed we should collaborate. Andrei welcomed me into his classroom as a Teaching Fellow and taught me to prepare case-based lesson plans. He invited me to co-author an HBS teaching case and teaching note. Andrei was working with a Silicon Valley firm and provided a gracious introduction such that they will now be the subject of a forthcoming paper. Throughout our interactions, Andrei has enthusiastically encouraged my interests, and pushed me to crystallize my thinking and consider new perspectives. My interactions with Andrei have been a great link to the HBS strategy group including enabling me to have an office

near his (not incidental for a grad student). Our impromptu discussions have greatly improved my research and brightened my days. (And, whom else could I talk with about the Celtics?)

I was scheduled to take a class with Mary Tripsas during the end of my second year. It was going to be my last class, but then was cancelled. To avoid me needing to take a class during my third year (affecting research travel), Mary agreed to do an independent study with me. That project resulted in Chapter 3 of this dissertation on product-to-platform transitions, and what I hope will be much future collaboration. Most importantly, it enabled me to get to know Mary and realize how much I learn from her and enjoy working with her. Mary spent hours listening to me talk about research, helping me conceptualize what I was seeing, and considering how to frame my work. Her expertise is unendingly valuable. Mary helped me navigate conferences and the job market and has been an ever present source of wisdom, humor, and encouragement.

Kate Kellogg gamely agreed to join my committee relatively late in the process and her contributions have been invaluable. I may not be exaggerating when I say I might not have had a job market paper ready in time for applications if Kate had not stepped in when I needed help most. I think the first draft I sent her was a rambling document containing 90+ pages. At that point, Kate started imposing rules. “No more than two sentences before any quote,” etc. We walked through the draft and Kate explained what I needed to do. The roadmap we developed was the breakthrough that organized the work. Kate is a brilliant scholar. I feel extremely fortunate to be able to work with her and that she has so actively participated on my committee.

Beyond my formal dissertation committee, I have benefitted (and continue to benefit) from the mentorship of numerous current and former professors to whom I am very grateful. Myra Hart has been a friend and mentor since well before I began at HBS and consistently provides sound advice and encouragement. Kathleen McGinn was one of my first HBS

professors and taught me how to read and dissect an academic article. Kathleen served on my field exam committee and spent much time helping me develop my original research agenda. Ranjay Gulati provided excellent guidance when I started the doctoral program. I first went to him with a scribbled drawing trying to explain what interested me about certain types of interactions between organizations. He calmly said, "You care about platforms. Go read about them." I am so glad I took that advice. Rebecca Henderson was my strategy professor at MIT Sloan and the model I envisioned when I considered great business school teachers. Rebecca and I stayed in touch over the years. When I was considering returning to school, Rebecca enthusiastically supported the idea. Since then, we have become great friends and I appreciate all of her advice, encouragement, and academia-related wisdom and humor (or, for Rebecca, humour). Other professors who have been instructive and supportive include: Ron Adner, Jason Davis, Amy Edmondson, Robin Ely, Frances Frei, Marco Iansiti, Rakesh Khurana, Karim Lakhani, Michele Lamont, Geoffrey Parker, Jeff Polzer, Ananth Raman, Marshall Van Alstyne, Dennis Yao, and many others.

The HBS Doctoral Programs Office has been a constant source of support financial, operational, and emotional. Dianne Le (now at Stanford) was the first person I met in Wyss House and was a tremendous help and friendly face early in this process. John Korn, Jennifer Mucciarone, Marais Young, LuAnn Langan, and the rest of the crew could not have been more helpful and accommodating. HBS doctoral students are fortunate for the support we receive in many ways, and one of the best is the role of the Doctoral Programs Office.

HBS is filled with small seminars and groups that offer support for research initiatives. I profited significantly by participating in two in particular. The Digital Initiative is a venue in which I was exposed to much fresh thinking on the frontiers of the digital transformation of

business. Leslie Perlow runs a class we affectionately call “Craft” that functions as an ongoing research group related to the craft of qualitative research methods. I am very thankful to Leslie, the students in Craft, and the visiting guests who joined us over the years. I benefitted greatly from all our discussions and will miss the camaraderie and inspiration of this group. I am also very appreciative for the feedback I received in other workshops, seminars, and conferences including HBS doctoral seminars, the Wharton Mack Institute 2013 Emerging Scholars Workshop, CCC 2014, Academy of Management Annual Meeting 2014, The Open and User Innovation Conference 2014, and SMS Madrid 2014.

Qualitative field-based research only works if a researcher has a willing, cooperative, and interesting field site. I am exceptionally fortunate that Zuni allowed me access to their management team and employees starting in September 2011 through March 2015. I am thankful to everyone there who met with me and shared their views. Two executives in particular had confidence in me and opened the doors. They know who they are and I am eternally grateful for not only the access they provided, but also for the insights and observations they shared. I could never have created this work without their help.

Graduate school is a team sport. During my first semester I was reminded it had been a while since I had done quantitative problem sets; Sean and Bhavya came to my rescue and became great friends. Frank and I realized we shared many academic interests. When Mike Tushman asked if I wanted to work with another student on a bibliography for Oxford Press, I asked Frank to join. Ever since, we have been wonderful collaborators and friends. Chapter 1 of this dissertation regarding innovating without information constraints is a product of that teamwork and I hope the start of much more work together. Officemates are like roommates in that they hear everything and are there as life unfolds. Thanks to Megan and Yo-Jud for sharing

space – you are not far behind. Everett Spain started a year behind me, but in typical Everett fashion, managed to finish a year ahead. We started a tradition sending "Word of the Day" emails to each other sharing the most obscure academic words we could find while reading. Thanks, Everett, for keeping this all in perspective. To Ethan, Matt, Hila, Sen, Luciana, Pat, Ryann, Pinar, Elizabeth and all my HBS friends, I learn from you every day and look forward to staying in touch over the coming years.

I consider myself tremendously fortunate to have an incredible community of friends who support me in life's adventures (and misadventures). Unfortunately, I can't name them all here, and I will probably miss a few, but some deserve special mention. First, I must mention the Garvey Girls (Jessie, Jill, Heidi, Jodi, Sue, and Judy). I neglected to include them in the acknowledgements to *The Innovator's Guide to Growth*, the book I co-authored in 2008, and have never lived it down. Thus, to the Garvey Girls: Consider yourselves well documented. As I was applying to HBS, Pam and I became friends. She too lost her husband at a very early age and together, playing a lot of pool, we worked to figure out life's mysteries. Pam continued to work full-time and started a master's degree in the Harvard Extension School. We will graduate together, and I could not be prouder to share the day with her. I met Jeff about halfway through this program. He has heard more about Harvard, conferences, papers, the job market, platforms, and ecosystems than I am sure he ever wanted to hear. And, he has handled it all with grace, kindness, and humor. I feel extremely fortunate that he is part of my world and he has welcomed me into his. To Tim, Tai, Jodi, Gene, Sue, Marc, Blaze, Ross, Kristen, John, Anne, Amy, Rico, Nancy, Marianne, and everyone else who provided assistance, distractions, entertainment, dinners, and continued to remind me that this was a good idea: Thank you from the bottom of my heart.

I am graced with an extended family that has provided endless support throughout this dissertation process. In our weekly calls, my mother-in-law, Toby, never fails to ask how school is going. My brother, Michael, calls to check-in and make sure all is stable. My father and I speak almost daily and he probably could defend this dissertation by now. Marlene has stepped into my father's life, and by extension mine, and been a great source of encouragement. My stepson, Adam, is about to graduate from law school and has accompanied me on two amazing adventures over the past few years (in South Africa and Vietnam) as we have taken breaks from our respective studies. It has been great fun to be in school at the same time as Adam. He is smart, thoughtful, and caring; I thank him for commiserating with me as we have both surmounted new challenges. My stepdaughter, Erica, is wrapping up a very successful first stint in corporate America and preparing to start business school in the fall. As Erica has progressed in her career, I have loved sharing business and strategy experiences, and running ideas by her. As I mentioned at the start of these acknowledgements, I am grateful to Erica for reminding me what I really wanted to do. Erica is insightful, smart, and frequently wise beyond her years. Both Adam and Erica are the true legacies of their father and he would be beamingly proud of them both, as am I.

There were times when I was unhappy with work in the corporate world and Mitchell would say that if I wanted to go back to school, I should go ahead and he would be fully supportive. He never wanted to stand in my way. Truth be told, I probably never would have returned to school if Mitch had not passed away; we were just having too much fun. When I was writing the acknowledgements and dedication for *The Innovator's Guide to Growth*, I told Mitch I was dedicating my work on it to my mother and father, but that the next book would be for him. This dissertation is for Mitch.

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Introduction

To survive, compete, and thrive, organizations need to process, store, and communicate information. The easier it is for them to do so, the more flexibility they have in the business models they can employ. Today, information processing, storage, and communication costs are approaching zero. As a result, forms of business models that reach beyond traditional organizational boundaries and engage external communities are becoming increasingly prevalent. One such form is the multi-sided platform (MSP) business and its associated complementor ecosystems. Firms that deploy MSP businesses constitute the majority of the fastest growing organizations in the global economy (e.g., Amazon, Google, Apple, etc.). Each of these organizations enables extensive networks of suppliers, partners, and complementors. How the MSPs interact with complementors, and how these complementors respond to challenges imposed by MSPs, is the focus of this dissertation.

Strategy and economics scholars have studied platforms and ecosystems for some time with increasingly more attention being paid to them across the literature. Researchers generally focus on pricing, growth, governance, and competition. However, we have very little research exploring the strategic and organizational implications of firms either transitioning to become platform-based, or joining ecosystems governed by MSPs. This dissertation consists of three chapters all aligned with one overarching question: As information constraints approach zero and MSP-governed businesses and their complementors become increasingly more prevalent in the global economy, what are strategic and organizational issues affecting incumbent organizations that choose to become MSPs or compete as complementors to them?

The first chapter, incorporating a forthcoming book chapter (see Altman, Nagle, & Tushman, 2015) explores the effects on management research and organizations when the costs

of information processing, storage, and communication approach zero and organizations engage with a range of communities. One type of community with which organizations engage is complementors, such as application developers and accessory providers. Facilitating engagement with complementors is a characteristic of MSP business models. Thus, this first chapter sets the context for the remainder of the dissertation by outlining environmental conditions that foster the growth of MSP-governed businesses and introduces theoretical challenges raised as these systems become more prevalent.

The second chapter focuses on challenges and responses by incumbent organizations joining MSP-governed ecosystems as complementors. This chapter introduces the notion of phases of complementor maturity, which capture the strategies a complementor employs as it gains experience in a particular ecosystem. This chapter is based on a multi-year qualitative inductive field-based research study analyzing the transition of a consumer smartphone and tablet accessory provider as it becomes a complementor in an ecosystem governed by a very powerful MSP. The organization enters an asymmetric power relationship encountering, and responding to, multiple types of dependencies. I identify three types of dependencies faced by the organization: *technological, information,* and *values-based,* and three response strategies the organization deploys: *compliance*, *influence*, and *innovation*. The study findings suggest that these dependencies and responses are related to, but quite distinct from, extant work on power and dependencies and interfirm relationships. In particular, I find that these dependencies and responses are impacted by the fact that they derive from an asymmetric complementor relationship, which is different from more traditional buyer-seller, alliance, or other interfirm relationships. I induce a grounded theory model identifying relationships between the concepts and discuss theoretical implications.

The final section, also a forthcoming book chapter (see Altman & Tripsas, 2015), focuses on challenges mature incumbent organizations face as they transition from product-based to MSP-based business models. The chapter addresses organizational identity implications of transitions mature organizations undergo as they undergo such product-to-platform transitions. In most cases, these business model shifts include considerations of network effects and increased interdependence. The chapter explains that organizational identity may affect, and may be affected by, product-to-platform transitions. It suggests that an organization must question its identity and modify it to be consistent with its re-defined business model.

Chapter 1: Innovating Without Information Constraints: Organizations, Communities, and Innovation When Information Costs Approach Zero

Elizabeth J. Altman, Frank Nagle, and Michael L. Tushman

ABSTRACT

Innovation traditionally takes place within an organization's boundaries and with selected partners. This Chandlerian approach is rooted in transaction costs, organizational boundaries, and information challenges. Information processing, storage, and communication costs have been an important constraint on innovation and a reason why innovation takes place inside the organization. However, exponential technological progress is dramatically decreasing information constraints, and in many contexts, information costs are approaching zero. This chapter discusses how reduced information costs enable organizations to engage communities of developers, professionals, and users for core innovative activities, frequently through platforms, ecosystems, and incorporating user innovation. When information constraints drop dramatically and the locus of innovation shifts to the larger community, there are profound challenges to the received theory of the firm and to theories of organization and innovation. Specifically, this chapter considers how shifts in information costs affect organizational boundaries, business models, interdependence, leadership, identity, search, and intellectual property.

Keywords: *managing innovation, information costs, information constraints, communities, organization boundaries, technological progress, platforms and ecosystems, user innovation*

> *Modern business enterprise is easily defined . . . it has two specific characteristics: it contains many distinct operating units and it is managed by a hierarchy of salaried executives.*
>
> (Chandler, 1977, p. 1)

> *What characterizes the networked information economy is that decentralized individual action—specifically, new and important cooperative and coordinate action . . . — plays a much greater role than it did. . . . The declining price of computation, communication, and storage have, as a practical matter, placed the material means of information and cultural production in the hands of a significant fraction of the world's population.*
>
> (Benkler, 2006, p. 3)

INTRODUCTION

Information is expensive to process, store, and communicate—at least, that has been the prevailing assumption upon which most of our organizational theories rely. Because information has been hard to gather and process, firms have emerged as hierarchical and control-based organizations (Chandler, 1962). Leaders have developed strategies to compensate for the difficulties of obtaining and processing data. Business models have been built with the underlying assumption that information costs are high (e.g., Tushman & Nadler, 1978). However, with the exponential growth in information processing, storage, and communication abilities, this is all changing. Information costs are rapidly approaching zero, and the constraints associated with information processing are disappearing. Organizations now have the ability to engage with external communities in unprecedented ways. This decrease in information processing costs is having a decentralizing impact on the locus of innovation and, in turn, on how organizations manage their innovation processes.

In this new information context, institutional logics (Friedland & Alford, 1991; Thornton & Ocasio, 1999; Thornton, Ocasio, & Lounsbury, 2012) revolving around Chandler's (1962) hierarchy and control-centric management, which have prevailed in firms such as General

Electric (GE), are being challenged by new logics centered on openness, sharing, and external engagement (Benkler, 2006).[1] Recognizing that new doors are opening as information flows more freely than ever before, incumbent organizations are grappling with how and when to address these new logics. For example, in the summer of 2013, GE launched two online three-dimensional (3D) printing contests, which they referred to as quests, inviting entrepreneurs and organizations to submit new designs for aircraft engine brackets and advanced materials production capabilities (General Electric Company, 2013).

Adopting these new logics, and engaging more deeply with communities, has substantive implications for how firms organize and innovate. As we see with GE's call for inputs related to design and production capabilities, the locus of innovation for incumbent firms has begun to move from within the firm to communities beyond its full control. Evidence of this shift and the tension it is creating can also be seen as firms engage with labor/task marketplaces (e.g., oDesk, eLance, TopCoder), developer ecosystems (e.g., Apple's App Store), and user-generated contributions (e.g., open source software, user review websites). All three of these community engagements allow for reductions and blurring of firm boundaries and call into question what the firm does and what resources it owns. As we discuss throughout this chapter, this tension between a Chandlerian logic and a more open and community-centric logic challenges many of the assumptions underlying the strategic and organizational research that has been treated as foundational wisdom in management scholarship.

To explore the implications of these phenomena, we start by discussing information processing, storage, and communication and note dramatic increases in capabilities coupled with

[1]Throughout this chapter, we adopt the definition of institutional logics put forth by Thornton and Ocasio (1999, p. 804) as the "socially constructed, historical pattern of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality." This definition embraces both the material and the symbolic and encompasses both formal and informal rules for decision makers.

substantial decreases in costs. Recognizing that cost reductions have enabled wide engagement with external communities, we present a typology of communities, emphasizing those enabled by information cost reduction: labor marketplaces, developer ecosystems, and user-generated contributions. Engagement with these communities involves parties outside the firm heavily participating in, or influencing, innovative processes and product offerings managed by the firm.

We then consider how information costs approaching zero and engagement with external communities affect firm organization and strategy. We investigate what happens with respect to organization boundaries, business models, interdependence, leadership, identity, search, and intellectual property (IP) when organizations engage with communities for capabilities core to their innovative processes. Before concluding, we explore the impact of these organizational and strategic shifts on innovative processes. Utilizing the classic evolutionary process model of variation, selection, and retention, we identify ways in which engagement with communities shapes the path of innovation at each step of the process. We suggest that when information constraints drop dramatically and the locus of innovation shifts to the larger community, there are profound challenges to the received theory of the firm and to theories of organizations and innovation. We conclude with thoughts for how these changes present opportunities for research on innovation and organizations.

INFORMATION CONSTRAINTS REDUCTION

Just over 50 years ago, in 1961, the IBM 1301 disk drive, which could store 28 MB of information, cost $115,500 (almost $900,000 in 2013 dollars).[2] In late 2013, Hewlett-Packard's cloud service offered 500 GB (500,000 MB) of storage, almost 18,000 times the capacity, for

[2]IBM archives. Retrieved http://www-03.ibm.com/ibm/history/exhibits/storage/storage_1301.html on December 15, 2014.

free.[3] This massive drop in price for information storage costs is representative of the reduction in information costs in general.

Together, information processing, storage, and communication represent the three primary components of information usage. Costs for these three components represent important constraints on how information can be used to drive innovation (Maskell, 2000). As engineers, scientists, and others involved in technology development continue to push the boundaries of their craft, and thus increase technological efficiency, they generate exponential growth rates and price decreases for all three of these components. Recent assessments estimate that information processing capabilities grow at an annual rate of 58%, information storage capabilities at 23%, and capacity for information communication at 28% (Hilbert & López, 2011).

Although the costs for information usage are dropping, not everyone is able to take full advantage of this reduction. First, use of many free services is predicated on access to computing devices and infrastructure. In many parts of the United States and the world, disadvantaged populations have limited access to such devices and infrastructure due to the so-called digital divide (Greenstein & Prince, 2007; Norris, 2001; Warschauer, 2003). Second, although we present examples in which information costs have dropped to zero, these frequently occur at scales useful only for individuals or very small firms (e.g., Google Drive's free storage is only 15 GB; larger capacities are offered for a fee to larger enterprises). Although costs for larger firms have also dropped dramatically, large-scale information operations can still be expensive.

Third, whereas the costs of the three primary components of information usage may be approaching zero, there are many complementary assets that are required to fully capture the business value of the information. For example, as firms gather more data from their customers,

[3]The 500 GB of free storage is valid for 90 days. Retrieved from https://www.hpcloud.com/free-trial on June 5, 2013 .

they require more data scientists to manage the data and extract useful insights from it. Likewise, electricity costs for running and cooling massive data warehouses have started to affect firms' bottom lines (Koomey, 2008). We keep these three caveats in mind as we explore how the capacity for information processing, storage, and communication has been increasing exponentially leading to declining prices that are rapidly approaching (and in some cases have already reached) zero.

Information Processing

Information processing refers to the ability of a device to take information and perform calculations using it. In the computerized world, this is frequently measured by the speed of a central processing unit (CPU), which is correlated with the number of transistors that can fit in a given space on a computer chip. Moore's Law (Moore, 1965) predicts that the number of transistors that can be placed on a chip will double every 18 to 24 months. This leads to exponential growth and an associated reduction in cost per calculation, a pattern that has continued from 1971 to the present. Although some have predicted that Moore's Law is not sustainable in the long run due to the size of transistors, which are approaching the molecular level (Latif, 2013; Merritt, 2013), new computing methods including multicore chips, DNA computing, and quantum computing should allow for Moore's Law to hold from the perspective of how many calculations can be done per second.[4]

The impact of such sustained growth is often underestimated because it is exponential. Many estimate that information processing power is passing an inflection point in its exponential

[4]Multicore chips contain two or more CPUs that run in parallel. DNA computing utilizes the self-assembling nature of DNA to craft problems as half-strands of DNA, which are solved by the matching pieces of DNA. Quantum computing takes advantage of qubits, which are bits of information that can exist as both a 0 and a 1 at the same time.

growth, described by Ray Kurzweil (1999) as entering "the second half of the chessboard."[5] We are entering a period in which the increases in processing speeds will occur in a manner never imagined before (Brynjolfsson & McAfee, 2011). The effects of this exponential growth can already be seen: A modern cell phone has more processing power than all of NASA had in 1969 when humans landed on the moon (Kaku, 2012). Likewise, the processing power of a multimillion-dollar military supercomputer in 1997 could be found, less than 10 years later, in the Sony PlayStation 3 gaming console, released in 2006 for $500 (Kaku, 2012).

With this exponential growth in processing power has come a dramatic drop in price for a set amount of power (Figure 1.1). For example, in 1996, the best personal computers could obtain about 1 million instructions per second for each US dollar of cost (1 MIPS/$) (Koh & Magee, 2006), whereas today, the best personal computers can obtain about 176 MIPS/$.[6] Further, although these prices reflect the cost for cutting-edge performance, it is possible to obtain lower levels of performance for free when utilizing cloud computing services.[7] For example, Amazon Web Services EC2 provides free processing power for 1 year that runs at approximately 1,933 MIPS and HP Cloud provides free processing power for 90 days that runs at

[5]East Indian lore tells the story of an Indian king who loved chess so much that he offered the inventor of the game any prize he desired. The inventor asked for one grain of rice on the first square of the board, two on the second, four on the third, and so on, doubling the amount for each of the 64 squares on the board. While the amount of rice on the first half of the chessboard was large, it was within the realm of the feasible. However, the amount of rice on the second half of the board was more than all the rice in the world.

[6]The calculation was based on the Intel Core i7-3960X, which runs at 177,730 MIPS and could be purchased from TigerDirect.com for $1,009 in 2013.

[7]Although there are many definitions of cloud computing, we use a fairly broad definition and consider cloud computing to be the use of computer servers and services that are hosted by a third party and are accessed via the Internet. One key feature of most commonly used cloud computing platforms, including Amazon Web Services and Google Drive, is the ability for a firm to utilize more computing power, storage, and bandwidth on demand, without needing to buy and install servers within the firm.

approximately 4,545 MIPS.[8] Although today's cutting-edge processing power is by no means free, the processing power that was cutting-edge for a personal computer approximately 10 years ago is now offered for free via cloud computing.

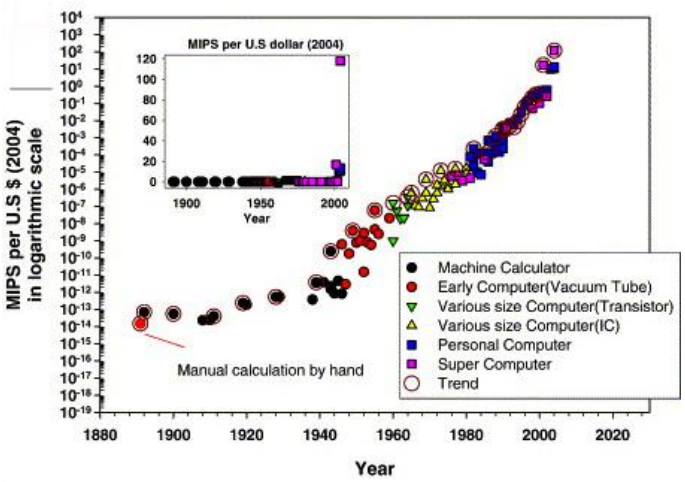

Figure 1.1 MIPS per US Dollar over time (Source: Koh & Magee, 2006) [9]

Information Storage

The costs of information storage have also dropped dramatically. For many years, disk drives have been a common object of study for management scholars due to constant technological disruptions in this industry (e.g., Chesbrough, 2003a; Christensen, 1993, 2006). These disruptions drove an exponential growth pattern similar to that of Moore's Law for transistors. Although each generation of users frequently wonders, "How will I possibly use up all that disk space?," they always do, as technologies evolve and enable people to create increasing amounts of information that needs to be stored. Indeed, industry approximations estimate that by 2010,

[8]Amazon Web Services free package information, retrieved from http://aws.amazon.com/free/ on June 5, 2013. HP Cloud free package information retrieved from https://www.hpcloud.com/free-trial on June 5, 2013. MIPS calculations for both were retrieved from http://insights.wired.com/profiles/blogs/all-clouds-are-not-created-equal-2x-cpu-performance-at-nearly-the#axzz3LuAiExLF on June 5, 2013.

[9] We gratefully acknowledge permission from the authors to use figures 1.1, 1.2, and 1.3.

the amount of information created between the beginning of civilization and 2003 (5 exabytes[10]) was being created every 2 days.[11] This rapid increase of information storage allowed for the progression from text as the only practically digitizable information to pictures and eventually video becoming storable at a reasonable cost. This increased storage has led to websites such as YouTube, to which users upload 100 hours of video per minute.[12]

Not only has information storage space increased, but the portability of this storage has also grown. Magnetic tapes were followed by magnetic disks, optical disks, and flash memory. The latter now allows for up to 1 terabyte[13] of information to be carried on a device the size of a person's thumb. Flash memory was an important innovation that enabled the portable device revolution, which has led to the large-scale production and adoption of smartphones and tablets. Such massive amounts of storage have led to a "save everything" mentality at both individual and firm levels.

Combined with increases in processing power, the ability, and thus the propensity, to save everything has led to the "big data" or data analytics phenomenon that is revolutionizing the way companies do business as they gain the ability to better understand their consumers.[14] Although basic data analytic capabilities have existed for many years, it is only through the emergence of cheap information storage that organizations can now save and analyze enough

[10]An exabyte is 10^{18} bytes, or 1 billion gigabytes.

[11]Google CEO Eric Schmidt addressing the Techonomy 2010 conference, Lake Tahoe, California, August 6, 2010.

[12]YouTube upload statistic. Retrieved from http://www.youtube.com/yt/press/statistics.html on December 15, 2014.

[13]A terabyte is 1,000 gigabytes or 10^{12} bytes.

[14]Although there are many definitions of big data and data analytics, Gartner (2013) defines big data as "high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making."

data to produce deeper and more nuanced analyses of customer behavior for use in prediction, market segmentation, and so on.

As with information processing power, the growth in information storage space has also led to a decline in the cost of storage (Figure 1.2). For example, in 2000, the cost of hard disk storage was about 140 MB/$ (Koh & Magee, 2006); today, storage on an external hard drive costs about 22,073 MB/$.[15] Further, although the largest storage devices are not free, there are a number of storage options that are free. Thumb drives holding 1 GB have become so cheap that they are regularly given out for free.

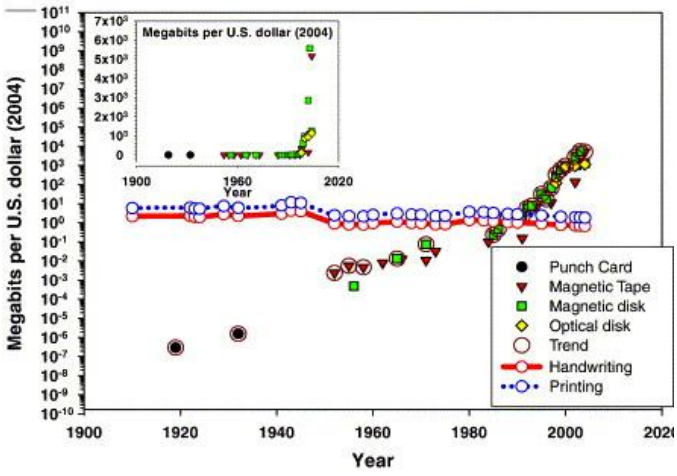

Figure 1.2 Megabits per US Dollar over time (Source: Koh & Magee, 2006)

More impressively, coupling gains in storage capacity with increases in information communication power has allowed for extremely cheap, and even free, storage via the Internet. For example, Google Drive offers 15 GB of free storage, Box offers 50 GB, and HP Cloud offers 500 GB for 90 days. A 500-GB disk drive that cost $150 five years ago is $50 today. Further, the

[15]This calculation was based on the Seagate Backup Plus 4TB External Desktop Drive, which could be purchased from TigerDirect.com for $190 in 2013.

same storage space can now be obtained through the cloud for free. These impacts on processing and storage bring down information constraints for large incumbent firms and similarly reduce information costs to essentially zero for new entrants.

Information Communication

Information communication is the ability to move bits of data from one place to another, often from storage to processing and back. We consider this to encompass both machines communicating with each other and people communicating with each other via these machines. Although communication costs within a computer system are certainly one aspect of information communication, we focus primarily on the communication channels that move information from one device to another, namely bandwidth. The ability to move digital bits from one system to another has long relied on existing telecommunications channels, starting with phone lines and moving to cable lines and, more recently, fiber optic lines. Wireless data communication has also relied on existing channels, namely radio and cellular. In both wired and wireless domains, bandwidth has grown exponentially since the invention of the telegraph and radio in the 1800s (Koh & Magee, 2006). This increase in communication capabilities is what allowed for the creation of the Internet and its growth into a communication channel accounting for 8% of all retail products sold in the United States (Anderson, Reitsma, Evans, & Jaddou, 2011). Ever since the invention of the precursors to the Internet in the 1960s, bandwidth has increased rapidly. For example, in 1984, the fastest modem available to a home user had a speed of 300 bits per second (bps), whereas in 2010 it was 31 Mbps, an increase of 100,000 times in just over 25 years (Nielsen, 2010).

As with information processing and storage, the exponential growth of information communication has been accompanied by a rapid decline in price (Figure 1.3). Industry assessments estimate that the price per Mbps for Internet transit dropped from $1,200 in 1998 to $5 in 2010 (Norton, 2010). However, since the mid-1990s when America Online (AOL) mailed floppy discs to consumers providing free access to the Internet for a limited time, there have been avenues for free access to the Internet. Today, Google Fiber, which boasts maximum speeds of 1 Gbps, offers a free connection to the Internet with download speeds limited to 5 Mbps.[16]

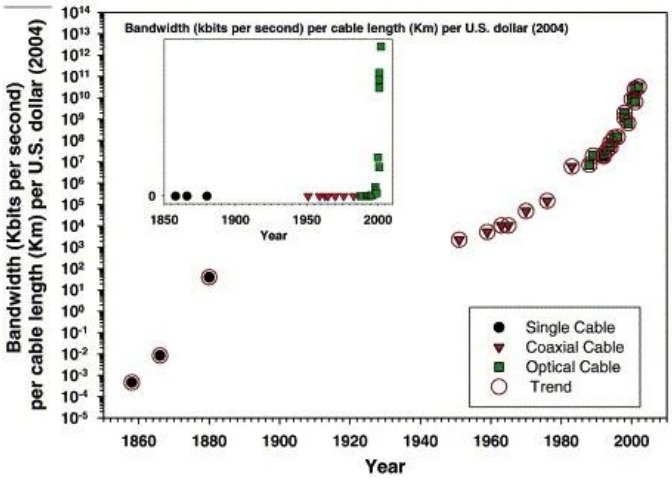

Figure 1.3 Bandwidth per cable length per US Dollar (Source: Koh & Magee 2006)

It is important to note that while such cheap bandwidth is readily available in many areas of the United States, in many other areas it is very difficult to get access to high-speed Internet service, creating what many have called the "digital divide" (Greenstein & Prince, 2007; Norris, 2001; Warschauer, 2003). However, even in areas where the decreases in cost have not yet produced wider accessibility for broadband service, cheaper communications allow for

[16]Although the monthly fee is $0, there is a one-time installation fee of $300. Information retrieved from https://support.google.com/fiber/answer/2476912 on June 6, 2013.

innovations such as the delivery of agricultural market prices via text message to farmers in developing nations (Aker, 2010; Jensen, 2007). Around the world, this reduction in information communication costs has had an impact, allowing skilled workers from emerging economies to have access to developed markets via platforms such as oDesk, eLance, and TopCoder. Further, through the rise of massive open online courses (MOOCs), the reduction in information communication costs has allowed anyone with an Internet connection to gain access to high quality education in a vast array of fields. Finally, although some bandwidth may be free, 5 Mbps is not nearly enough to allow a large business to operate effectively, and therefore they must still pay for access, even if the fees are much less than only a few years ago.

Together, the reduction in costs of information processing, storage, and communication have led to more products that leverage modular technologies and standardized interfaces, greater engagement by consumers and other end users, and wide-scale availability of enormous computing power and comprehensive databases. This, coupled with the increased ability to collaborate and coordinate across large distances, has produced wide-ranging effects on the way organizations create and leverage innovations and on fundamental organizational processes.

ENGAGING COMMUNITIES

Organizations engage with many types of communities including customers, suppliers, partners, and complementors. One way to visualize the scale of these engagements is through the triangle shown in Figure 1.4. At the top are a small number of strategic alliances. For large technology firms, these may be multidimensional technology, service, and licensing relationships with other large firms. This type of alliance is custom-negotiated, and usually involves senior members of the executive team, possibly including the CEO. A firm will likely not have more than ten to

twenty relationships of this kind that are strategic in nature. Microsoft's interaction with Intel is one example of this type of relationship (Casadesus-Masanell & Yoffie, 2007).

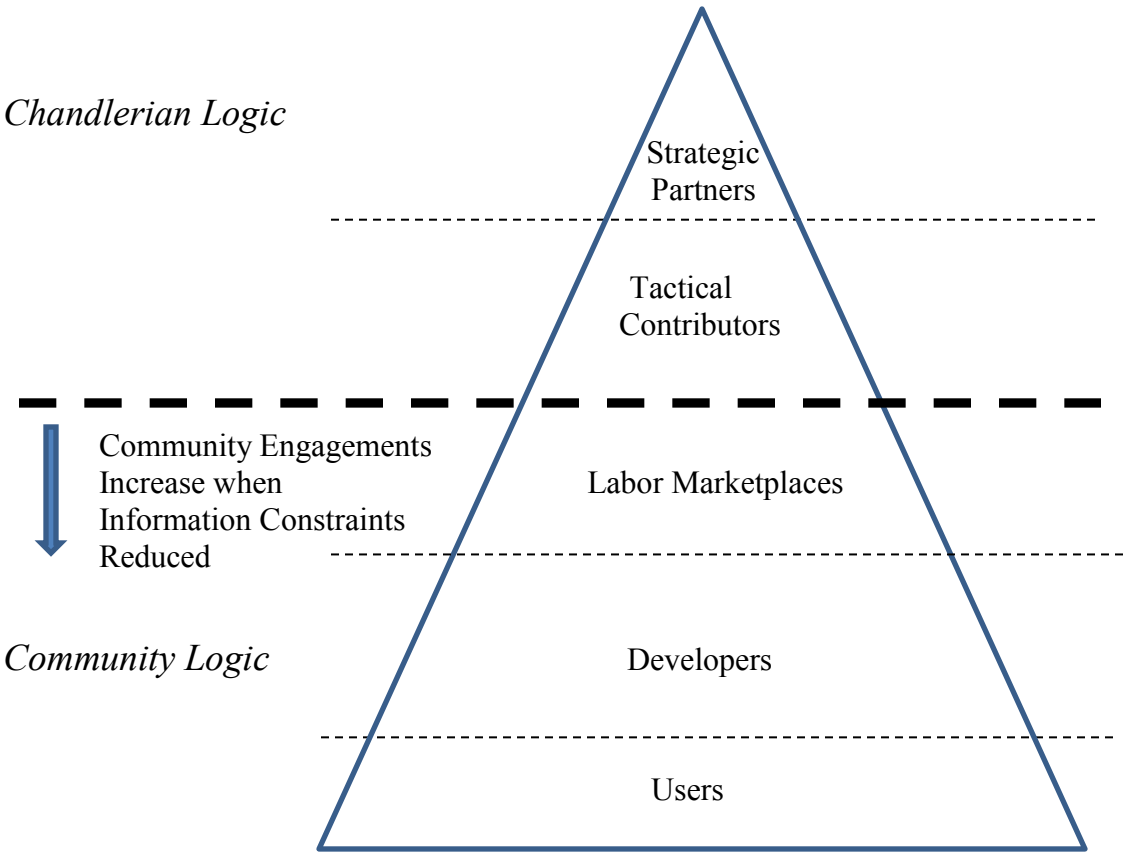

Figure 1.4 Typology of communities

The next set of relationships is more tactical but still involves custom negotiations on a case-by-case basis. A relationship in this category is one in which a firm licenses a technology that it integrates into a product. A large firm might have tens of these tactical contributors but probably will not have hundreds. These relationships are usually managed by business development professionals trained to work with interfirm relationships (see the alliance literature; e.g., Gulati, 1998, 2007; Rothaermel, 2001). A mobile phone provider's relationship

with a speech recognition technology provider such as Nuance is an example of this type of alliance (Nuance Communications, 2013).

Beyond these custom-negotiated relationships are community engagements enabled by reductions in information costs. In this chapter, we focus on the bottom three sections of the triangle because they include the types of engagements that are accelerating as a result of the increase in information processing capabilities and the decrease in information costs. These categories of engagement are (1) the advent of external labor and task markets, (2) the rise of developer ecosystems, and (3) the growing prevalence of user-generated contributions. Considering labor marketplaces, we examine how firms engage with parties beyond their legal control to accomplish tasks they previously would have performed internally. With developer ecosystems, we look at how complementary firms provide value to end-users. With user-generated contributions, we consider how firms engage users to contribute value. Organizations that use labor marketplaces might have many interactions with individual external workers contributing to a project. Organizations with developer ecosystems may have hundreds, thousands, or potentially more than a million developer relationships. Organizations that interact with users could have millions of contact points. In Table 1.1, we summarize how engaging external labor, developers, and users changes with and without information constraints.

Reductions in information processing, storage, and communication costs make these relationships not only feasible but also attractive, though they need to be managed in an entirely different way from those in the top two sections of the triangle. Institutional logics that revolve around openness and sharing become essential, but they differ from the prevailing logics of hierarchy and control. Firms need to grapple with how to manage these multiple logics as they cope with an array of complex community engagements. These interactions create challenges

(e.g., contrasting logics, more user input than a firm can easily process) and opportunities (e.g., introducing benefits from entities beyond those directly controlled by the firm). Studying these phenomena may prompt us to think differently about innovation, organizations, and our classic theories that explain them. Innovation is no longer occurring primarily within a firm; rather, organizations now engage with others who also innovate in ways that improve the organization's products, experiences, and value. These interactions result in new behaviors to create, capture, and select innovations while also introducing fundamentally new managerial challenges.

Labor Marketplaces

Labor marketplaces, also known as task marketplaces, are multi-sided platform-based businesses that allow firms and individuals that have specific tasks to find people to accomplish those tasks. Tasks posted on the most popular of these platforms (e.g., oDesk, eLance, TopCoder) include everything from website design to language translation and marketing. Sometimes also referred to as "the human cloud" and considered the next generation of outsourcing after information technology (IT) and offshore outsourcing, these marketplaces comprise an ecosystem of platforms linking virtual workers with employers who hire them on an as-needed basis.

The recent rise of these platforms is substantial, with growth in global revenue amounting to 53% for 2010 and 74% for 2011 (Kaganer, Carmel, Hirscheim, & Olsen, 2013). Addressing some original concerns about transparency, quality control, and coordination in these labor relationships, these marketplaces now have mechanisms to allow hiring managers to monitor contractors' work as well as standardized contracts and dispute resolution services (Needleman, 2010). Task platforms allow a firm to rely on external parties for much of its labor supply in a way that was previously not possible before information technologies enabled the collaboration

and communication feasible today. As we discuss in the next section, this reliance on external labor has important implications for organizational and strategic decisions.

Developer Ecosystems

Technology developments enable firms to deploy goods that are increasingly modular, with open interfaces allowing independent entities to contribute to end-products (Baldwin & Clark, 2000). Although many firms design and develop self-contained products that provide a complete user experience, increasingly more products require after-market applications or accessories to deliver full value (Adner, 2012). In using labor marketplaces, organizations engage external parties directly and hire resources to further their missions. In contrast, when they build developer ecosystems, organizations enable external parties (developers) to create complementary products (apps or accessories) that customers acquire either directly from the external parties or through a marketplace.

Prevalent examples of firms with developer ecosystems are those that offer smartphones, tablets, and other devices that users customize with apps and accessories. Beyond consumer products, this same phenomenon exists in other industries, such as medical diagnostic devices. Welch Allyn traditionally provided integrated systems to doctors' offices and hospitals allowing medical practitioners to measure blood pressure, temperature, and so on. Today, it offers a platform system to which doctors and hospitals can add modules and apps provided by other firms (Welch Allyn, 2011, 2013).

The widespread availability of apps is driven by underlying reductions in information costs. Firms are able to leverage today's ease of processing and communication to open interfaces to their products, providing application programming interfaces (APIs) and software

development kits (SDKs) and encouraging other firms to contribute to their products. Consumers are able to easily download apps to improve products they purchase, and market evidence indicates that they are doing so in large numbers. In May 2013, Apple announced that 50 billion apps had been downloaded from its App Store, which offers more than 850,000 apps in 155 countries for a suite of iPhone, iPad, and iPod Touch products (Apple Inc., 2013). In Facebook's second quarter 2013 earnings release, to benefit its 1.15 billion monthly active users, it announced that more than 100,000 apps had been built (Facebook, 2013). Complementary firms (such as app developers) are able and incentivized to develop these apps because they have easy access to product information through developer websites and ease of distribution through app stores and other means. Enticed by the prospects of serving enormous markets, and equipped with enabling technologies and documentation, developers invest in creating apps and accessories for other firms' products. Firms and their complementary developers and accessory providers need to employ institutional logics consistent with operating in a world that is highly open and decentralized with significant sharing and interdependence.

User-Generated Contributions

As the drastic reduction in information costs has made it easier to engage an ecosystem of developers, it has also made it easier for organizations to connect with the users of their products and services (Von Hippel, 2009). In explaining this phenomenon, Benkler (2006, p. 5) highlights "the rise of effective, large-scale cooperative efforts—peer production of information, knowledge, and culture." Indeed, in some cases, such as open source software, users have become the entirety of the organization developing the product. In these cases, the creative contributors no longer reside inside an organization. Rather, they exist in a loosely affiliated

community with its own set of operating procedures and norms that have developed to govern behaviors (O'Mahony & Ferraro, 2007; Shah, 2006).

Many open source software projects started within an organization and then were taken over by a group of users after the code base was opened. For example, Apache began as a federally funded research project and is now a fully open source project that runs more than 50% of websites on the Internet (Greenstein & Nagle, 2014). In a survey of large organizations, 50% of respondents said they use open source software in their business, and another 28% said they are considering using it (Trapasso & Vujanic, 2010).

Although these types of open source software projects exist in an entirely community-based self-governing organizational form (Benkler, 2006), in more traditional firms there are increasing examples in which user-generated contributions provide firms with free inputs. For example, user-generated product and service reviews on Amazon, TripAdvisor, and Yelp help drive sales and profits of reviewed firms and products (Duan, Gu, & Whinston, 2008; Liu, 2006; Luca, 2011). Further, companies such as Threadless rely on users for idea generation and selection (designing products and determining which products are most likely to be successful in the market) (Lakhani & Kanji, 2008). All of these activities (open source software, user-generated reviews, and user idea generation and selection) are enabled by reductions in information costs.

As information costs drop sharply and all three types of community engagement increase, sharply inconsistent logics emerge within incumbent firms. Incumbents need to balance operating in their traditional internally focused mode with an approach that is more externally oriented and inclusive. They need to manage competing logics that will be more pervasive than ever before (Lounsbury, 2007). Table 1.1 summarizes how these three types of communities

(labor, developers, and users) change as the environments in which they operate move from a world where information is constrained to one in which information constraints are essentially nonexistent.

Table 1.1 Engaging With Communities With and Without Information Constraints

	With Information Constraints	Without Information Constraints
Labor	• All internal to the firm, or specialized contracting through temp agencies and contractors • Long-term engagements and large-scale projects • Difficult performance quality control and monitoring	• Labor marketplaces • Micro-jobs enabled • Community rating schemes and digital monitoring
Developers	• Organization-to-developer contracting • Select few high-maintenance relationships between organizations and developers • Significant case-by-case IP considerations and negotiations • Embedded applications ("pre-loads") executed by engineering teams	• User-to-developer contracting • Many arm's length developer relationships governed by simple click-through licenses • IP licensing tailored for engagement with high volume of organizations (e.g., automated websites for contracts) • App store applications ("post-loads") by third-party developers
Users	• Users engage almost exclusively through customer service representatives • Inputs are primarily customer complaints or repair requests • External inputs are avoided	• Users provide inputs across functional organizations (e.g., to engineering and marketing) contributing to full design process • Inputs include product design suggestions, manufacturing ideas, and so on • External inputs are embraced as a valuable part of product design and delivery

ORGANIZATIONAL AND STRATEGIC IMPLICATIONS

Organizations that flourished during the industrial age focused their energy on managing physical assets. The constraints they battled related to physical goods, production challenges, and

employment issues. In contrast, organizations during the information age leverage sophisticated information technologies to manage their resources and pursue product development. Incumbent firms reach beyond traditional organizations and interact with individuals, firms, and communities to create offerings integrating contributions from a variety of sources. They undergo structural transitions to operate in a networked information economy characterized by decentralized action by individuals cooperating and coordinating through distributed nonproprietary, non-market strategies (Benkler, 2006).

The effects of this new economy span organizational and institutional levels. As these firms engage beyond their boundaries, they outgrow the strategies, business models, and organizational processes theorists have been studying for decades and challenge their institutional logics. Whereas previously they managed based on a Chandlerian logic that emphasized hierarchy and control (Chandler, 1977; Thornton & Ocasio, 1999), firms today balance multiple logics that incorporate peer production, information sharing, data access, and free goods. As they modify their institutional logics in response to new strategies and organizational transitions (Gawer & Phillips, 2013), they undergo institutional work, which Lawrence and Suddaby (2006, p. 215) defined as "the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions."

Take, for example, research and development (R&D), an institutionalized category with well-understood meaning and value in society beyond the work it encompasses (Meyer & Rowan, 1977). As information constraints decrease, categories of activities change in terms of work processes, symbols, and myths that surround them, creating challenges for institutionalized rules. For example, whereas R&D used to be performed almost entirely by professionals

employed within a firm, it can now be a joint activity spanning internal experts and external contributors.

In the context of increased community engagement and enhanced roles for user contributions, institutional entrepreneurs (Battilana, Leca, & Boxenbaum, 2009; Greenwood & Suddaby, 2006; Maguire, Hardy, & Lawrence, 2004) are increasingly found outside traditional boundaries of firms. One example is social networks, which were originally a means for students to connect with each other and now have evolved to become, among other things, a primary venue for sharing photographs as well as a useful setting for firms to garner insights into consumer sentiment (Nagle, 2013). This change was largely driven by user innovators rather than members of existing firms.

Another example is the evolving role of quality assurance (QA) departments. In the days of mainframe computing, a QA department would be responsible for extensive testing of mainframe software before release. Today, users provide immediate feedback to software firms, so the role of QA professionals includes developing and managing mechanisms to collect and manage quality-related feedback from users. At the extreme, in community-centric peer production contexts such as Wikipedia, the QA role has been entirely shifted to the community (Piskorski & Gorbatai, 2013), further challenging institutionalized norms.

These community-based innovation processes affect a range of topics associated with strategy, innovation, and organization theory. These topics include organizational openness (Boudreau, 2010; Chesbrough, 2003b), community engagement (Lakhani, Lifshitz-Assaf, & Tushman, 2013; O'Mahony & Lakhani, 2011), user innovation (Lakhani & Von Hippel, 2003; von Hippel, 2009), networked economies (Benkler, 2006; Castells, 1996), and other related topics such as multi-sided markets (Hagiu & Spulber, 2013; Parker & Van Alstyne, 2005), and

social media (Piskorski, 2013).[17] Regardless of where one falls on the spectrum of views related to these topics, or to which version of openness or community engagement one subscribes, they all clearly have organizational implications. These include the effects on firm boundaries, strategy and new business models, interdependence and community engagement, leadership, identity, search, and IP. Table 1.2 shows how these organizational and strategic characteristics vary as information processing, storage, and communication become virtually free.

[17] For a broad overview of the technology and innovation management literature, see Altman, Nagle, & Tushman, 2013.

Table 1.2 Organizational and strategic characteristics with and without information constraints

	With Information Constraints	Without Information Constraints
Boundaries	• More employees inside organization because it is less expensive to include them within the organization than to contract externally • Difficult to find appropriate person for job • Hold-up problems exist because individuals with specific skills have power over the organization • Organizations contract with firms providing services, rather than with individuals, thus difficult to fire underperforming individuals outside organization boundaries • Vertical and horizontal integration attractive strategic alternatives because market costs tend to be expensive • Organizations incur costs and risks associated with internal computing assets for innovation	• Fewer employees within organization because it is easy to contract with external employees when organization needs more human resources • Easy to find appropriate person in the community, so coordination costs decrease with matching efficiencies • Hold-up problems reduced because there is efficient marketplace with large supply of highly skilled people • Organization-to-individual contracts are the norm, so it is easy to fire a temporary individual • Vertical and horizontal integration less attractive strategic alternatives because market transactions are less expensive • Organizations can pool risk and costs associated with computing by using cloud computing
Strategy and New Business Models	• Organizations own or tightly contract for the assets they need • Digital goods (e.g., software) are expensive to produce, and user inputs are virtually impossible to capture • Differentiation is straightforward when resources are unique to the organization • Strength of organization resides in owned resources and skills • Difficult to conduct corporate entrepreneurship because of shared resources • Entrepreneurial organizations need to build capabilities internally to compete	• Assets are free and open; organizations leverage what they need • Free digital goods (e.g., open source software, user reviews, and ideas) are widely available for the organization to leverage • Differentiation is hard when leveraging widely available common public goods • Organization strength resides in skills and knowledge processing, not in owned resources • Corporate entrepreneurs can leverage labor markets, cloud computing, and so on, to create their own space inside the organization • Entrepreneurial organizations, including solopreneurs, can cost effectively engage external resources allowing them to highly specialize

Table 1.2 (Continued) Organizational and strategic characteristics with and without information constraints

Interdependence and Community Engagement	• Organization owns and controls computing resources for innovation • Organization internally owns resources critical to accomplishing its mission • Outputs created by the organization and/or partners with whom it is tightly contractually bound, so organization controls own destiny • Developers contract case-by-case with individual organizations and engage in strategic relationships • Accessories and applications created using resources owned by the organization	• Organization does not control, and is reliant upon, cloud computing partner to provide innovation resources • Organization contracts externally for resources critical to accomplishing its mission • Outputs created by partners with loose affiliations, so organization has high interdependence with many entities • Developers join ecosystems, must comply with ecosystem rules, and become reliant upon success of the platform • Accessories and applications created by resources residing outside the organization
Leadership	• Hierarchy and control are primary means of managing external parties (agents) through contracts • Organization must incur expenses to monitor all agents (partners) • Administrators must satisfice because they are choosing from bounded options • Leaders operate in a hierarchy • Engagement with outside communities restricted to particular staff members engaging with limited communities (e.g., disgruntled customers)	• Adopt community logic and incorporate behavioral incentives, influence, and persuasion as primary means of managing external parties (agents) • Communities via review mechanisms provide monitoring and quality control role at drastically reduced costs • Administrators satisfice less because they have more and broader options • Leaders must manage in communities • Engagement with outside communities to harness external creativity becomes central element across functions (e.g., R&D, marketing)
Identity	• Dimensions of internal organizational identity focus on internal development (e.g., R&D excellence) • External organizational identity is associated with the organization • Professional identity is associated with internal development and creativity	• Dimensions of internal organizational identity shift to emphasize engaging communities (e.g., developer evangelism) • External organizational identity (image) encompasses both the organization and related communities • Professional identity is associated with engaging external communities, sourcing, and selecting creative outputs

Table 1.2 (Continued) Organizational and strategic characteristics with and without information

Search	• Local search is predominant • Search is expensive and thus there is limited rational choice in decision making • A challenge for exploitation is that gathering user feedback to incrementally improve products is hard • Exploration is hard because it is difficult to engage in distant search (hard to cast a wide net)	• Distant search, particularly leveraging communities, is predominant • Search is cheap, so decision making can be more rational • Exploitation is easier due to enhanced user feedback (e.g., localization) • Exploration is easier because distant search is cheaper
Intellectual Property (IP)	• Organizations protect IP with various legal mechanisms such as patents, trademarks, copyrights, and trade secrets • When organizations engage in interorganization collaborations, they execute traditional cross-licensing IP contracts • Without access to free digital goods, organizations need to either create or buy resources, both of which have well-defined ownership and IP implications	• IP considerations become very tricky, and organizations need to consider who owns inputs as well as outputs • Licensing involves various types of open source and public goods licenses • Availability of free digital goods provides opportunities for organizations to source resources without cost but introduces challenges related to ownership and IP

Boundaries

The concept of firm boundaries and what is considered inside versus outside the control of a firm (March & Simon, 1958; Pfeffer & Salancik, 1978; Thompson, 1967) is challenged as information constraints decrease and firms become more community-centric (Gulati, Puranam, & Tushman, 2012; Lakhani et al., 2013). Gulati et al. (2012, p. 573) introduced the notion of meta-organizations comprised of "networks of firms or individuals not bound by authority based on employment relationships, but characterized by a system-level goal." They developed a typology based on degrees of stratification and permeability of boundaries. These organization types, all of which bring together autonomous entities into an interconnected system, are largely enabled because information costs are so modest. Researchers have also explored the porosity of boundaries under various circumstances (Santos & Eisenhardt, 2005), and alliance researchers such as Dyer and Singh (1998) have considered the strategic value of relationships between alliance partners and networks. Yet, there remains substantial opportunity for research that considers the effects on organization boundaries as information constraints approach zero and community engagement becomes more prevalent.

A reliance on external labor leads to a weakening of firm boundaries. Task marketplaces reduce an organization's need to hire internal employees by providing a marketplace with standardized contract terms and efficient matching of tasks to task performers. The matching mechanisms allow task performers to very clearly showcase their skills and portfolios of past projects, while also allowing organizations to concretely define tasks they need completed (Kaganer et al., 2013). Standardized contracts are designed to let two parties negotiate price, time for completion, and task details while covering issues such as IP and task monitoring in a consistent way. Traditionally, hierarchies are utilized to limit coordination and contracting costs

(Coase, 1937; Jensen & Meckling, 1976; Thompson, 1967; Williamson, 1975). However, task platforms allow organizations to limit these costs by using markets instead of hierarchies to execute tasks.

For organizations engaging with task marketplaces, the two primary risks are projects not being completed and IP leaks (Kaganer et al., 2013). However, the scale of these marketplaces makes it possible for organizations to engage in redundant projects, which decreases failure risk. Further, task performer reputations are publicly available, incentivizing performers to complete projects that garner good feedback from their employers. To manage IP concerns, organizations employ multiple strategies such as breaking tasks into small subunits such that any individual contributor does not have enough information to make a leak valuable. Further, the high volume of individual task performers participating in labor marketplaces results in competition, which allows organizations to seek qualified individuals, test their services, and easily contract with a different person if the first is unsatisfactory. This reduces the importance of hold-up problems (Klein, Crawford, & Alchian, 1978) because organizations contract with individual contractor employees rather than hiring an outsourcing organization. Hart and Moore (1990) noted a distinct difference between firms hiring employees directly and those contracting with outsourcing firms. When hiring employees, firms can fire individuals who underperform. In contrast, when outsourcing with third-party contractors, firms cannot address problems with individual workers. Task marketplaces eliminate this problem because individuals are contracted on a discrete basis, and thus contracts can be managed individually.

Activities enabled by reductions in information constraints and broader engagement with communities of complementors and developers also allow for a reduction in the need for vertical and horizontal integration, and thus organization size. Transaction cost economics (TCE)

maintains that firms come into existence when the costs of a transaction in the market are higher than the costs of performing the same transaction within a firm (Coase 1937; Williamson 1981). However, when user-generated contributions are freely supplied, the costs of transactions are essentially zero, and therefore it is no longer logical to have these activities located within a firm. For example, because the creative agency Victors and Spoils relies on crowdsourcing to develop advertising campaigns, it does not need to employ as many creative designers as a traditional firm. Although it has long been known that firm boundaries shrink as IT (Malone, Yates, & Benjamin, 1987; Brynjolfsson, Malone, Gurbaxani, & Kambil, 1994; Hitt, 1999) and the Internet (Afuah, 2003) reduce information costs and associated transaction costs, few studies have considered what happens to organizations when information costs, and thus transaction costs, essentially vanish.

Cloud computing similarly leads to potential reductions in firm boundaries by decreasing information costs and allowing organizations to rely on external parties for critical needs (e.g., a powerful set of IT tools for innovation). Traditionally, risk reduction has been an important reason for firms to conduct activities internally (Chandler, 1962). However, by allowing organizations to rapidly scale their computing needs, cloud computing greatly reduces the risks associated with purchasing large and expensive servers. Cloud computing allows an organization to offload the risk of overbuilding computing capacity by contracting a third party who pools capacity demand with other organizations (Simchi-Levi, Kaminsky, & Simchi-Levi, 1999).

Strategy and New Business Models

As organizations leverage more free and open assets (e.g., open source software, user reviews and ideas), it becomes less clear what assets an organization needs to own and how it

differentiates itself from competitors. When information constraints were high, these assets were expensive to produce, and user inputs were essentially impossible to capture. Now, these goods are widely available, and organizations can leverage them to accomplish their goals. However, organizations also need to re-think their basis of competitive differentiation. Perhaps the knowledge and strategies for utilizing such free and open assets will become the most important assets of an organization, and perhaps the only assets it truly owns (Teece, 2007). Consequently, an organization's most valuable assets, the knowledge and information within the organization (Arrow, 1975; Teece, 1982) and the mechanisms through which this knowledge is processed (Tushman & Nadler, 1978), will become the largest avenues for sustainable competitive advantage.

Taking advantage of these new assets and modes of competition requires the adoption of new strategies and business models and/or the modification of more traditional ones (Chesbrough & Appleyard, 2007; Dahlander & Gann, 2010). With information costs decreasing, community engagement increasing, and new opportunities related to opening and expanding boundaries, organizations need to supplement existing business models with new approaches that capture the creativity and inventiveness of external innovators, such as those related to developer ecosystems, labor marketplaces, and user contributions. Crowdfunding, in which organizations search for funding by engaging with a wide community of potential investors, is an example of an emerging business practice in which organizations can also capture resources from external parties through taking advantage of dramatically reduced information constraints. Entrepreneurship provides a business approach that by its nature leverages scarce resources and thus thrives as information costs decrease and more resources become available with much less investment. Within large organizations, the entrepreneurial model can be mimicked through

corporate entrepreneurship, in which small groups within organizations can enable mature incumbent organizations to explore new and innovative areas while continuing to exploit existing capabilities (Bresnahan, Greenstein, & Henderson, 2011).

Another business model enabled by inexpensive information capabilities is the rise of "solopreneurs," individual entrepreneurs who can build entire companies without ever hiring internal employees. Solopreneurs, such as AllergyEats and SociallyActive, no longer need to acquire large amounts of capital to buy servers and IT support, formerly an important barrier to entry; rather, they rely on cloud computing. Further, solopreneurs can utilize labor marketplaces to perform functions that previously would have required entire departments. Website design, marketing, and even sales can all be contracted out to external parties via task marketplaces. Additionally, these types of organizations can engage their users as sources of content and direction. Although solopreneurs have existed throughout history, drastic reductions in information costs are allowing them to have a broader impact that helps them compete with larger, established organizations by focusing on their core competencies (Prahalad & Hamel, 1990) in highly specialized entrepreneurial ventures.

Interdependence and Community Engagement

The Internet and peer production processes function as effectively as they do because of adoption of new technical and organizational architectures combining contributions from diverse providers (Benkler, 2006). These architectures have as a defining characteristic their ability to deal with interdependencies among modular components. As Internet-based technologies become more pervasive throughout core business processes, incumbent organizations and institutions will continue to adopt new institutional logics consistent with the new processes

(Thornton et al., 2012). As these organizations participate more broadly in peer-production processes, contribute to sharing communities, and generally engage in more modern forms of community interaction, they will need to develop organizational processes that embrace interdependence and community engagement.

Coordination and integration are challenges organizations face as a result of this increased interdependence and more complex logics. Okhuysen and Bechky (2009) addressed these topics and considered the creation of integrative conditions for coordination, such as accountability, predictability, and common understanding. In ecosystems incorporating community engagement, the conditions for accountability are sometimes unclear. For example, when a platform owner decides to upgrade technologies it is unclear whether the platform owner is responsible for maintaining backward compatibility to protect all developers and for how long it would need to do so. The extent to which platform owners need to provide predictable technology roadmaps is also debatable. To leverage reduced information constraints and build and maintain a developer ecosystem, an organization needs to focus on the questions associated with these coordination mechanisms (Adner, 2012).

Interdependencies vary depending on the type of entity with which the focal organization is engaging. Organizations have interdependencies with suppliers with whom they contract directly (e.g., cloud computing, IT service providers). They also have interdependencies with complementors. Both types of interdependencies have significant implications for organizations related to how they consider and manage firm boundaries (March & Simon, 1958; Pfeffer & Salancik, 1978; Santos & Eisenhardt, 2005; Thompson, 1967). And, both increase as information constraints decrease and organizations engage with communities more broadly.

Complementor interdependencies are becoming more frequent and complex as product design, development, and deployment are evolving, particularly as more modularized products are introduced into the world with open interfaces ready for additions by other organizations (Baldwin & Clark, 2000). Formerly, product development efforts were primarily internal or occurred through a network of closely affiliated suppliers and strategic alliance partners, but when organizations build and engage with communities, the product experience is developed in conjunction with organizations operating outside the central organization's legal and economic boundaries. The central organization may exert control in terms of regulating distribution of products through app store requirements or branding programs (such as Apple's "Made for iPhone" logo), but complementors act and innovate independently.

An example of complementors' actions influencing a central organization is privacy breaches by Facebook application developers (Steel & Fowler, 2010). Developers disclosed users' personally identifiable information (PII). Users were infuriated with Facebook. In fact, Facebook was not releasing data; app developers were releasing information after users opted in to using the apps. However, the perception was that Facebook was releasing user information. Facebook was harmed by actions of complementors they did not control.

With lower information constraints, organizations are enabled to develop and grow ecosystems and encourage communities, consisting of either organizations or individuals, to invest on their behalf. An example is a smartphone maker that encourages app developers and accessory providers to create products that work with its particular smartphones. This creates interdependencies between the phone maker and the app and accessory providers in which both become dependent on each other for business success. The smartphone provider needs apps and accessories to be available so that its product is attractive to consumers. The app and accessory

providers need the smartphone provider to make available sufficient advance information so they can create compelling complementary products. Additionally, app and accessory providers must address the risk that smartphone providers might introduce new models rendering existing apps and accessories obsolete. The app or accessory organization has no control over a situation that could potentially lead to a significant negative impact such as high inventory scrap costs.

Interdependence among various members of an ecosystem also leads to risks being shared. From the perspective of the focal organization, there is a diversification of risk to developers or accessory providers. From the vantage point of an app developer or accessory provider participating in an ecosystem, there is risk associated with decisions the focal organization might make to the detriment of the accessory provider. However, these risks are usually justified by the great benefits that also exist from potential growth of the overall market.

Leadership

As information costs dramatically decrease and organizations engage more actively and comprehensively with communities of all types, leaders are faced with new challenges, and new leadership styles emerge. Roles transition from directing work in a traditional hierarchy (Chandler, 1977) to sourcing and organizing contributions in a more interdependent loose affiliation of communities. This is true for interactions within incumbent organizations (managing employees), outside the organization (managing suppliers and complementors), and in the newer community-based organizational forms. As Benkler (2006, p. 67) explained regarding the large-scale Linux operating system development process, “a certain kind of meritocratic hierarchy is clearly present. However, it is a hierarchy that is very different in style, practical implementation, and organizational role than that of the manager in the firm.”

Because of increased access to information, leaders no longer can use asymmetries of information as a significant source of control. Herbert Simon (1945/1997) outlined considerations related to the creation of an administrative organization and highlighted the notion of influencing staff members (beyond just directing them). This is even more relevant when staff members have the same or better access to information and information processing than managers. Similarly, in a context where user-generated contributions play a significant role in product development and brand management, leaders need to influence not only staff members but also those in the community who contribute work, reviews, and other resources to projects.

Leaders also need to manage and orchestrate interactions with ecosystem members, and the form of management cannot be one of traditional hierarchy and control because the members are independent entities outside the organization. Instead, leaders need to use incentives and persuasion, frequently referred to as "developer evangelism" by practitioners in this arena, to convince developers to invest in their products. Developer conferences, websites, tools, and cross-promotions are all means that leaders can use to influence developers to invest valuable resources on behalf of their organization as they expand their search for innovative solutions beyond their boundaries (Rosenkopf & Nerkar, 2001).

Illustrating the importance of engaging individuals, Samsung has long had a developer program through which developers can obtain product information online and attend local conferences. Expanding this activity, Samsung hosted a worldwide developer conference in October 2013. The conference website invited participants to "Engage with industry leaders; Collaborate with fellow developers; Learn about new Samsung tools and SDKs; Create what's next" (http://samsungdevcon.com/sdc13/). This highlights the importance that Samsung's

leadership is placing both on building relationships with ecosystem members worldwide and also on the role they need to play in fostering community interactions among members.

Beyond considering influence and persuasion, Simon's (1945/1997, p. 199) notion of an administrator as one who satisfices, choosing actions that are satisfactory or "good enough," is worth reconsidering when inputs are from large external communities. To what extent do administrators need to satisfice when the solutions from which they are choosing come from external communities widely diverse in functional expertise, geography, motivations, and experiences? No longer are managers bound by inputs from their employees and close partners; rather, they may be able to get closer to the economic model of maximizing decision making when search extends beyond the boundaries of their organization to large-scale communities.

Furthermore, top management team operations and roles (Finkelstein & Hambrick, 1996) may be affected by changes as a result of decreasing information constraints. Just as individuals might be affected by shifts in the relative importance of roles when firm boundaries shift and interdependence increases, so too might dynamics within top management teams change. For example, as developer communities become increasingly important, the roles of team members who create and nurture these communities might also increase in importance. However, in a management team where product development professionals have traditionally held sway, shifting power to business development staff might be a difficult transition for a leadership team. Additionally, the openness associated with more community engagement may introduce top management team challenges related to managing paradoxes and contradictions as leaders aim to protect traditional proprietary advantages while embracing creative innovative inputs from external parties (Smith & Tushman, 2005).

Moreover, across the organization, shifts to broader external community engagement, sharing, and openness may introduce challenges related to roles and functional responsibilities. In the past, primary engagement with external communities was largely restricted to particular staff members, such as customer service personnel. Now, in cases where sharing with external parties becomes important and more pervasive, other functional areas (such as product development) might need to interact directly with external parties and process their inputs (e.g., suggestions from users).

Monitoring costs, a central topic in the TCE discourse (Williamson, 1981), vary in the context of interdependent communities. One might initially think that monitoring costs would increase as the number of developers in an app store increases. In fact, through network effects, the more popular an app store becomes, with an increasing number of apps, the larger the community of users it develops, and that community then contributes reviews to the marketplace, which serve as a form of monitoring. In practice, a conglomeration of developers monitors all the individual developers. Therefore, not only does lack of information constraints allow for production of complementary goods by parties outside the organization, it also allows for monitoring and quality control of these goods for free by users. Leaders may no longer need to manage organizations of individuals monitoring outputs but rather organizations of individuals nurturing and managing the community that monitors outputs.

Identity

Organizational identity research encompasses both an internal perception of organizational identity (Albert & Whetten, 1985) and an external conception, which is sometimes referred to as an organization's image (Dutton & Dukerich, 1991). As information constraints decrease and the

locus of innovation moves outside the organization, both internal and external conceptions of organizational identity may be challenged. With respect to internal organizational identity, as an organization transitions from creating innovations entirely internally to sourcing and selecting innovations externally, it may change from considering itself as primarily a research-based organization to being one that delivers innovative product experiences regardless of where they are sourced. This may lead to changes in which functions have the most power in an organization, potentially shifting the power base from engineers to business development professionals or vice versa, depending on the nature of the organization.

Relative to external identity, an organization may change from presenting itself as primarily a technology-led product organization to a services-based one. It may move from having an organizational identity centered on the organization alone to one that encompasses both the organization and its related communities (e.g., its developer ecosystem). In both cases, the organization's identity may be threatened and undergo a transition as a result of transitions prompted by technological changes (Tripsas, 2009).

Identity spans levels of analysis considering both individuals and organizations (Gioia, 1998). Both of these identity types may shift as organizations transform, and the two may influence each other (Fiol, 2002). How employees identify with their organization and with their professions is likely to be challenged as the locus of innovation moves outside the organization. When much of the innovation included in an organization's product offering is being sourced externally, do employees have the same level of pride in their organization? As engineers transition from considering themselves creators of innovations to evaluators of others' innovations, is there also a potential threat to their professional identities (Ibarra, 1999; Lifshitz-Assaf, 2013)? Must organizations hire people with different profiles when the roles of people

within R&D include much greater levels of interaction with external communities? Professional identities are increasingly associated with engaging external communities, sourcing, and selecting creative outputs rather than with internal development and creativity when an organization is more focused on external engagement. Both individual and organizational identities provide powerful lenses through which we can study these changes. Further, organizational identity research could likely benefit from examples that link changes associated with information constraints reduction, such as product-to-platform transitions, with identity transitions (Altman & Tripsas, 2015).

Search

Search and decision making (Cyert & March, 1963) are relevant topics to reconsider with respect to organizations and communities in the context of minimal information constraints. A fundamental underpinning of rational choice theory is that there is a cost associated with gathering better information. In his behavioral model of limited rational choice, Simon (1955, p. 112) tied these costs to aspiration levels of individuals and then built his argument on the idea that a "behaving organism does not in general know these costs" and thus cannot be fully rational in its decision making. In the world of social media, users employ tags, "like" buttons, and hashtags to signify their approval (or disapproval) of content.[18] Through these mechanisms, they self-organize into communities supporting particular ideas. These freely created groups exist and are searchable by entities looking for trends and insights into popular culture. When we have free contributions (e.g., user reviews), costs associated with searching for better information are

[18]Tags are keywords included in the metadata of text that make it easier to search. Like buttons are a small button that allows a user to indicate that they approve or agree with an action or statement by another user. Hashtags are the # symbol followed by a keyword or phrase within a block of text to allow for easier searching and grouping.

greatly reduced.[19] This reduction in constraints enables individuals to meaningfully operate in less boundedly rational ways and thereby adopt a classic welfare-maximizing approach to decision making.[20]

At an organizational level, absorptive capacity is understood to characterize an organization's ability to exploit external knowledge as a function of its prior related knowledge and is dependent on the structure of communication between the organization and its environment (Cohen & Levinthal, 1990). In a world of free contributions from individuals and self-organized groups, it is not clear whether the gatekeeper and boundary-spanning roles in traditional R&D organizations (Allen, 1977; Tushman, 1977), which are important for absorptive capacity, maintain the same functions or possibly morph into more of a curatorial or distributor role, managing inputs from the community at large. Although community contributions increase alternatives available to managers and introduce new complexity into the search process, on balance these changes present an enormous opportunity for leaders to make better decisions from better alternatives.

At an organizational level related to search, innovative organizations continually strive to balance the challenges and trade-offs of exploiting existing knowledge while also exploring new opportunities (March, 1991). Within product development particularly, search behavior varies in terms of both how organizations re-use existing knowledge and how widely they look for new knowledge (Katila & Ahuja, 2002). User-generated contributions can apply in modes of both exploitation and exploration. In the exploitation mode, user-generated contributions can extend

[19]We recognize that these reviews can potentially be manipulated by the organization or individual of focus and thus must be monitored. Nevertheless, these reviews are having sizable impacts across business models and industries and thus are relevant to this discussion.

[20]We acknowledge also that we are assuming individuals can easily process information without bias, but we believe this is a reasonable enough assumption to make this point.

the reach of an existing product through localization efforts. A specific example is when organizations enable users to localize products for particular markets and then capture these localizations for the benefits of other users, as Facebook does when it relies on users to translate its site into non-English languages. User-generated contributions and developer interactions offer even greater opportunities in an exploration mode because they dramatically increase the available search area. When an organization casts a wide net for user contributions and developer applications, it dramatically increases its ability to explore new alternatives. If managed properly, these contributions allow the organization to gain important insights into how products are used. Further, engaging with users and developers leads to products that better satisfy the needs of users and are therefore more widely adopted.

Intellectual Property

Decreased information constraints, greater engagement with communities, and a shifting locus of innovation lead to strategic considerations regarding how organizations manage IP. When innovation and the accompanying invention were conducted entirely within the boundaries of an organization, the situation was relatively straightforward. Organizations protected IP through legal mechanisms such as patents, trademarks, copyrights, and trade secrets. When they engaged in interorganization collaboration, they executed appropriate licensing contracts to document ownership and usage rights of the IP created during that relationship.

Organizations, individuals, and groups of users all need to understand IP considerations in a world where organizations regularly solicit inputs and then incorporate these contributions into product offerings (Harhoff, Henkel, & von Hippel, 2003). Beyond determining who owns outputs (which is a challenge in itself), organizations need to be concerned about verifying

ownership of inputs. When a user leaves a suggestion on a feedback forum and the organization integrates that suggestion into the next version of a product, does the user have any ownership rights? And, how can the organization be certain that the user did not steal that idea and its implementation from someone else and thus whether the user has the rights to contribute it in the first place? Similarly, when open source software is used to develop proprietary software (e.g., Mac OS X is based on the open source BSD Unix kernel), one must carefully consider how that particular open source license is framed (O'Mahony, 2003). Further, when cloud computing resources are used to develop important innovations, clear ownership agreements with the cloud provider must be in place. The full scope of strategic implications and considerations related to IP in a world of external resources, app developers, and user-generated contributions are well beyond the purview of this chapter. However, it is clear that increases in processing capabilities and reduction in information constraints create novel and complex challenges for IP attorneys and the leaders and individuals with whom they work. They may even call into question the utility of IP laws for spurring innovation (Benkler, 2006; Jaffe & Lerner, 2004).

In summary, while many of the traditional organizational and strategic theories do not necessarily fail as information costs approach zero, several of the assumptions that underlie these theories may no longer apply. Therefore, in all of the areas discussed (boundaries, strategy and new business models, interdependence and community engagement, leadership, identity, search, and IP), research is required to understand how organizations shift strategic visions to account for the reduction in information constraints. However these shifts occur, it is clear that the process of innovation will be significantly altered.

IMPACT ON INNOVATION

Scholars often use evolutionary process models, incorporating variation, selection, and retention as lenses through which to view innovation (Campbell, 1960; O'Reilly & Tushman, 2008; Staw, 1990; Tushman & O'Reilly, 1996). We employ this framework to help better understand how the reduction of information constraints affects innovation. Variation is the process through which individuals, organizations, communities, and institutions take existing problems and explore potential solutions through a process of experimentation. In a world without information constraints, the locus of this innovative process shifts from being centered within an organization to more broadly encompassing organizations, individuals, and communities. Selection is the process through which competing alternatives are evaluated and the dominant solution is chosen and brought to market. Finally, although the classic evolutionary view of retention is that of a hereditary process of distributing the selected attributes to the next generation, we instead use the term to mean retention and adoption by the community of users (or potential users). In all three of these stages, dramatic reductions in information processing, storage, and communication costs allow individuals and communities to be more engaged in the innovation process than previously was possible. In Table 1.3, we compare these three innovation stages in contexts with and without information constraints.

Table 1.3 Innovating with and without information constraints

	With Information Constraints	Without Information Constraints
Variation	• R&D conducted internally and with select partners • Long prototype and pilot cycles • Inputs from internal domain-specific experts • Reseller models do not encourage complementary innovation • Computing tools are expensive and inaccessible	• Organization defines the problem, uses community to help generate possible solutions • Faster experimentation (lean) • Inputs from diverse disciplines (e.g., biologists answering physics problems) • Multi-sided platforms (marketplaces) create opportunities for a large variety of offerings from a community of sources • High-performance tools are available for innovators
Selection	• Management hierarchy decision making • Homogenous perspectives during evaluation • Traditional market research techniques (e.g., focus groups)	• Community-based decision making (or at least input) • Heterogeneous perspectives during evaluation • Online and field-based rapid experimentation
Retention (by Communities)	• Limited and costly communication to potential customers (e.g., traditional advertising) • Complexity in segmenting and targeting customers • Organization/customer relationship ends with product purchase (e.g., brick and mortar checkout) • Slower diffusion and difficult distribution of product offerings	• Easy and inexpensive communication to potential customers (e.g., social media) • Big data enables specific customer targeting • Organization/customer relationship starts with product purchase (e.g., account signup) • Leverage platforms and ecosystems for wide diffusion of new products (e.g., apps)

Variation

In settings both with and without information constraints, the process of variation is a key driver of innovation. Whereas the first movers create the variation via new innovations, all other organizations must react to the variation. Both must manage the variation as it inevitably affects the status quo. During the variation stage, organizations conduct research and development by

searching the existing solution space for a problem, use innovation tools to experiment with possible new solutions, and are open to complementary innovations that add value to the original innovation. However, as we move toward a world without information constraints, all of these activities require more engagement with communities and in some cases may be conducted by communities. Individuals are capable of performing many of these activities on their own when they are armed with the tools enabled by reductions in information constraints.

Previously, most R&D was conducted within an organization that perhaps engaged a few select partners in their innovative efforts. Now, platforms such as TopCoder and InnoCentive allow organizations, and even complex government agencies such as NASA, to focus their efforts on defining problems that are then opened to the community to help generate possible solutions (Lifshitz-Assaf, 2013). This allows organizations to seek inputs from individuals based in diverse disciplines who can engage in out-of-the-box thinking (e.g., a biologist may have the solution to a physics problem).

Powerful new tools, such as cloud computing, allow individual innovators to create solutions that previously could have been developed only within an organization with vast resources. These same tools allow all innovators (organizations, individuals, and communities) to conduct faster experimentation whenever fully detailed prototypes are not necessary to gain accurate measurements of how a product will function or be adopted. Web-based communication tools, including email, mobile phones, and sharing sites (all sometimes gathered under the term "social media"), are also making it much easier for groups to quickly form and grow and for new types of groups to gather. As Shirky (2008, p. 20) explained in his popular book on self-organization, "We are living in the middle of a remarkable increase in our ability to share, to cooperate with one another, and to take collective action, all outside the framework of traditional

institutions and organizations," all of which leads to production of knowledge that organizations can employ in their innovation efforts.

With information constraints dramatically reduced, organizations are changing how they leverage creativity of entities outside their organizations and engender ever greater levels of variation. Open and distributed innovation research provides insights into how organizations manage some of these engagements (Baldwin & von Hippel, 2011; von Hippel, 2009). In related work, the burgeoning literature on multi-sided platform-based businesses and ecosystems provides guidance for how organizations leverage complementors to increase the value of their offerings (Adner & Kapoor, 2010; Eisenmann, Parker, & Van Alstyne, 2011; Zhu & Iansiti, 2012). Although there are numerous types of multi-sided platform business models, they all enable interactions between two or more types of customers (e.g., buyers and sellers) interacting in a market (Hagiu & Wright, 2013). Transitioning to this business model may enable increased variation and better innovative outcomes, yet may also create new challenges for organizations.

Selection

After going through the variation process, in which firms either create or react to a new innovation, an innovating entity must select which version of an innovative solution it wants to bring to market (Lakhani et al., 2013). However, without information constraints, the organization can engage with external communities to gain important feedback regarding what is most likely to be successful. For example, when a traditional clothing retailer, such as The Gap, must decide which designs to mass manufacture and release to the public, the decision is frequently made by the management hierarchy, with input from consumers, if any exists, filtered via a marketing or market research organization using tools such as focus groups. However,

when a firm such as Threadless desires to launch a new product, it has the user community vote directly on competing designs. In this manner, Threadless already has a good sense of a product's potential consumer acceptance and demand before it manufactures the product. Organizations no longer need to rely primarily on traditional market research techniques like focus groups; they can directly engage a large subset of the user community to experiment with reactions to products before making final selections.

Similar to the variation process, engaging communities outside an organization during the selection process allows for heterogeneous perspectives to be sampled before a decision is made. This gives experts in fields outside an organization's core competencies the ability to identify potential challenges the organization might not have considered. These contributors can be professional experts, as when a biologist answers a physics-based problem on a competition website, but they can also be amateurs who have become "experts" with particular products. This often occurs with user-generated reviews: End-user customers contribute to e-commerce websites by posting product reviews, and then other customers vote on the level of helpfulness of the comment. In one recent instance, one of us received a catalog from a mail-order firm highlighting the top ten rated products on the firm's website and offering discounts on those goods. The firm was engaging users to select products on which the firm then offered a promotional discount through its catalog, which blended the traditionally unidirectional world of mail order catalog merchandising with the digital world of customer ranking and ratings.

Retention (by Communities)

For an innovation to survive, the innovator must ensure that it is retained, diffused, and adopted by the community. The reduction of information constraints has important implications for the

diffusion of innovations, which has been an important topic of economic inquiry for many years (see Griliches, 1957, and Rogers, 1962, for early examples and Geroski, 2000, for an overview). The reduction of information constraints speeds communication about new innovations, but this means that organizations have less room for error in early versions of products. Big data and data analytics, enabled by major information cost reductions, allow organizations to mine their existing customers' behaviors to better identify potential early adopters of new products; this can greatly improve the speed with which an innovation diffuses. However, it also causes an organization to increase its engagement with customers after they purchase the product. In many instances with today's online products, the first thing users do when they start to engage with a product is create an account with the organization selling the product. This establishes a link between the organization and the user that represents an ongoing relationship, enabling the user to provide feedback to the organization that can be integrated into the innovation process.

Further, application marketplaces (e.g., Apple's App Store, the Facebook App Center) have large captive audiences that developers want to reach. By using cloud hosting services (e.g., Heroku, Amazon Web Services), which integrate seamlessly with the marketplaces, developers are able to quickly and widely distribute applications to an audience well beyond what they could reach without such services. Additionally, utilizing cloud computing to host innovative applications allows organizations to experiment and update software-based products without requiring users to download a new version to their desktop after every update.

Importantly, the world without information constraints not only allows for more rapid diffusion of information and physical goods but also allows for some physical goods to diffuse as rapidly as information goods via the invention of 3D printing. 3D printing enables individuals to send digital files of goods rather than sending actual physical goods. Receivers can then print

their own versions of a physical good from files they have received. Sending digital information that represents a physical good is much easier (and less expensive) than sending actual goods.

FUTURE DIRECTIONS AND RESEARCH OPPORTUNITIES

During the time we were writing this chapter, we frequently encountered situations in which we found ourselves thinking, "This is it! This is what we are writing about! This is innovating in a world without information constraints. This is an organization acting differently because information is essentially free." An example occurred while we were researching incumbent organizations engaging with communities. One of us found GE's open innovation call for participation, thought it was well executed, and tweeted the link with reference to the source.[21] Within 15 minutes, much to our surprise, GE tweeted back. That interchange represents exactly the type of organizational change examined herein. A decade ago, this type of interchange could never have happened. In addition to the technological constraints, there were organizational ones, particularly for large, hierarchical control–centric organizations. Before GE, or any large organization, distributed text publicly, it would need to go through an onerous approval loop. Today, embracing new tools and approaches enabled by reduced information constraints, GE has changed how it engages with the world and is publicly posting multiple tweets per hour, chatting with consumers and potential innovators.

In this chapter, we explored the implications of information processing, storage, and communication costs approaching zero. We showed that the reduction of these costs allows organizations to engage with communities of laborers, developers, and users, and that this engagement leads to shifts in fundamental assumptions of traditional organizational theory. In

[21]"Tweeted" in this context refers to posting an update on the twitter.com website to a community of followers.

turn, these organizational shifts lead to new innovation methods. What we see with the simple social media interchange just described, and the phenomena from which it derived, is the instantiation of these shifts.

The changes described herein lead to opportunities for theoretical and empirical research. From a theoretical standpoint, the existing assumptions that many fundamental organizational theories are built upon may no longer be accurate portrayals of a world without information constraints. Although the theories may still be valid, there are open questions as to which of them remain relevant in the modern world. From an empirical standpoint, it is logical to focus on changes to existing business models and development of entirely new ones. Mature organizations are struggling with new levels of interdependency and complexity as they share and engage more broadly and attempt to manage multiple logics simultaneously. Entrepreneurial organizations are emerging with entirely new approaches to managing innovation. These organizations and institutions are undergoing significant transitions, at multiple levels of analysis, which neither practitioners nor scholars fully understand.

Quantitative and qualitative research methods should be employed to improve our knowledge of these phenomena and their theoretical implications. We see a wealth of research questions related to these studies. In particular, the value of free contributions by users also deserves further research. Is this value accounted for in productivity and growth measurements? Do organizations that utilize such free inputs have higher rates of return than their competitors? What drives users to contribute such free labor? Further, when traditionally product-centric organizations transition to platform-based marketplaces leveraging today's environment with de minimis information constraints, what are the organizational and strategic ramifications? To what extent is organizational identity involved in these types of transitions? Can it help with the

transition, or is it always a hindrance? How do organizations that participate in another organization's ecosystem balance their need to differentiate with the requirements of compliance when they are part of a community? These questions stem from the observation that we are living in a world where information is no longer expensive to process, store, or communicate, and this opens a world of innovation opportunities for individuals, organizations, and institutions.

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Chapter 2: Dependency Challenges, Response Strategies, and Complementor Maturity: Joining a Multi-Sided Platform Ecosystem

Elizabeth J. Altman

ABSTRACT

Complementors gain market opportunities by joining ecosystems; they also face challenges from relationships with multi-sided platform ecosystems. Prior research provides insights on emergence, growth, and competition between platforms and ecosystems. This research focuses on managerial challenges and strategic and organizational responses of complementors joining ecosystems. Asymmetries lead to dependencies, which I categorize into three types: 1) technological, 2) information, and 3) values-based. Based on a three and a half year qualitative inductive field-based study, this research finds the organization responds with combinations of three strategies: *compliance*, *influence*, and *innovation*. Over time, the organization passes through three phases of complementor maturity changing the relative emphasis on each strategy. This chapter contributes to platform, ecosystem, and organizational theory research by: 1) exploring relationships between complementors and dependencies, 2) articulating complementor response strategies, and 3) introducing phases of complementor maturity and outlining how, when, and why an organization moves through these phases.

Keywords: *Managing Innovation, Multi-Sided Platform, Ecosystem, Dependence, Complementors, Asymmetric Inter-organizational Relationships, Complementor Maturity*

"You know how in America we never dip our flag to anybody? At the Olympic Games, you know... We never dip our flag, period. Well, I feel like we kind of dipped our flag."

- Zuni manager, 2-8-12

"So, dipping our flag? I'll dip…I'll dip… because I know that I'm still in the end delivering a better experience than anybody else can."

- The same Zuni manager, 8-26-14

INTRODUCTION

Some products work better when they are combined with others; a baseball glove is not useful unless one also has a baseball. A computer, smartphone or tablet becomes more valuable when a user downloads and uses software applications (also known as "apps") or adds accessories. With the growing prevalence of products that include open interfaces, products are becoming increasingly more interdependent such that users purchase accessory products, or complements, which they use to realize the full potential of their purchases (Brandenburger & Nalebuff, 1996; Adner & Kapoor, 2010). Accessories exist in the form of software apps and as hardware products such as cases, keyboards, headphones, speakers, memory sticks, trackballs, etc. To access large markets, organizations that create these complementary products join ecosystems and become dependent upon other firms to provide interface specifications, guidelines, requirements, technological components, and so on. In many cases, firms that produce products that benefit from accessories operate multi-sided platform (MSP) businesses that facilitate interactions between buyers of their core products (e.g., smartphones) and producers of complementary products (e.g., smartphone accessories). As an increasing percentage of the world's most valuable and influential firms operate platform-based business models (Gawer &

Cusumano, 2002; Regalado, 2014; The Economist, 2014), there is growing interest in the effects of these businesses on the complementors dependent upon them.

Examples of multi-sided platform-based businesses include: Google Play (formerly Android Market), which enables developers to sell apps to Android phone consumers; Amazon Marketplace, which facilitates third party vendors to sell used and new goods to consumers; and Internet dating sites, which allow individuals to interact with others looking for relationships. Research on platform-based businesses continues to increase with recent articles organizing platform literature and providing definitions and typologies (e.g., Baldwin & Woodard, 2009; Gawer, 2014; Thomas, Autio, & Gann, 2014). Much of the research in this area focuses on the emergence of platforms and competition between them finding that network effects generally play a role in their success (Rochet & Tirole, 2003; Eisenmann, Parker, & Van Alstyne, 2006; Zhu & Iansiti, 2012). A burgeoning area of research emphasizes strategic decision-making related to platform governance and differentiation and its impact on competition outcomes finding there are trade-offs to governance structures, including a platform's hierarchy (Bresnahan & Greenstein, 2014). Throughout this work, platform-based businesses are the focal unit of analysis and implications for complementors remain either secondary or left un-addressed.

Ecosystem research has focused on challenges and opportunities of ecosystem creation (Moore, 1993, 1996), competition (Iyer, Lee, Venkatraman, 2006; Adner, Oxley, & Silverman, 2013), and technology emergence and substitution (Christensen & Rosenbloom, 1995; Adner & Kapoor, 2015).[22] Ecosystem-focused scholars commonly find that creating and successfully

[22] Research relevant to the study of ecosystems also sometimes refers to systems of producers and markets as value networks such as in Christensen & Rosenbloom (1995). The definition of a value network, however, does not imply the existence of complementors; though, the study of these inter-related interdependent systems are valuable to understanding the broader phenomena of ecosystems that include complementors.

managing a strong ecosystem of complementors is beneficial to a focal firm (Adner, 2012; Iansiti & Levien, 2004), though governance of these ecosystems may also create tensions through the emergence of contradictory logics and paradoxical tensions (Wareham, Fox, & Giner, 2014). Further, in the emerging management-centered ecosystem literature, researchers have been studying trade-offs associated with ecosystem management decisions such as opening participation to all actors versus limiting involvement via compliance criteria finding that the number of participants on a platform is linked to innovation and investment (Boudreau, 2012). Scholars are also applying the complementary asset framework (Teece, 1986) in the context of entrants into new industries exploring how complementarities and competition affect strategies of these new entrants (Kapoor & Furr, 2014). Still, with few exceptions, this work mostly centers on platform owners and managers and stops short of extending findings to managerial implications for complementor organizations. These under-studied firms constitute a multi-billion dollar worldwide industry and increasingly face challenges associated with interfacing with large powerful platform managers (such as Apple, Samsung, and Facebook).[23]

To study challenges and response strategies of complementors operating in multi-sided platform-based ecosystems, I explored the research question: What are the strategic and organizational issues associated with mature, independent organizations joining established ecosystems? In particular, what challenges does an organization face as it enters into asymmetric relationships, and how does the organization respond to these challenges? Are these challenges and responses different in the context of MSP-based businesses and their complementors, or are they similar to those present in other asymmetric interfirm relationships (e.g., buyer-supplier, alliances, etc.). Because of the limited existing research related to this topic, I utilized an

[23] For example, Strategy Analytics, a reputable industry analyst firm, recently forecast global total apps revenues of $33.7B (MacQueen, 2014).

inductive theory-building approach with a longitudinal single case study design that spanned three and a half years and included semi-structured interviews, observation, and archival research. I studied this question from the perspective of an incumbent organization joining ecosystems as a complementor and investigated challenges experienced by a division of an accessory provider as it strived to balance maintaining its own independence and growth aspirations with an emerging need to operate as a member of ecosystems managed by large and powerful central firms.[24]

My analysis shows we can use theories related to dependency, power, influence, and organizational identity to better understand challenges complementor organizations face as they join ecosystems, particularly when these organizations are mature incumbents entering asymmetric relationships. I have identified three types of dependencies prevalent in such situations: 1) *technological*, 2) *information*, and 3) *values-based*. Analyzing data from this study, I am able to identify three response strategies the organization invoked to manage these dependencies: 1) *compliance*, 2) *influence*, and 3) *innovation*. Further, I propose that over time the complementor organization followed multi-pronged strategies that employed a combination of these responses, and the composition of these strategies shifted as the complementor gained experience operating in the ecosystem. The research findings suggest that as the complementor became more mature in its approach to participating in ecosystems, it changed the relative emphasis it placed on each of the response strategies. I outline three phases of complementor maturity and the variation in response strategies. The findings also suggest that the proportional emphasis the organization placed on response strategies during maturity phases may be

[24] Although the focal division at Zuni was exploring options to offer complementor products in multiple ecosystems, during the time of this study, its primary focus was on providing products to work with Apple products. Thus, the vast majority of my data relates to Zuni's interactions with, and challenges related to, offering products to work with Apple products.

associated with dimensions of the organization's existing and evolving identity. In support of this finding, I have induced a model illustrating the relationships between theoretical concepts identified in this study. Taken together, this analysis of response strategy and complementor maturity provides a new way to understand how complementor organizations manage when they are engaged in relationships with powerful platform managers. It also adds new insights to our understanding of dependencies in interfirm relationships.

THEORETICAL BACKGROUND

Multi-sided platforms, ecosystems, and complementors

Across platform-related research, the term *platform* is used with varying definitions. Hagiu and Wright (2015a) present a definition for multi-sided platforms (MSPs) (also sometimes referred to as multi-sided markets or multi-sided networks) suggesting MSPs are organizations that enable or facilitate direct interactions between two or more groups of participants. This is the definition I adopt since my research is focused on platform-based businesses in the context of relationships with complementors, or firms that independently offer complementary products or services to mutual customers (Brandenburger & Nalebuff, 1996; Yoffie & Kwak, 2006).[25,26,27] This definition envisions MSPs as enabling a triangular set of relationships in which the MSP and

[25] Though firms investigated in this paper are technology-related, this research does not address computer platforms (Bresnahan & Greenstein, 1999), nor general technology platforms (Kim & Kogut, 1996; Meyer & Seliger, 1998; Economides & Katsamakas, 2006), nor specific decisions related to technology platform choices (Boudreau, 2010).

[26] MSPs at the center of systems of complementors are also sometimes referred to as "platform managers" (Eisenmann, Parker, & Van Alstyne, 2006), which is terminology I also use here. The term "platform manager" is particularly appropriate when an MSP, such as a smartphone provider, does not create its own platform technology in its entirety, but rather adopts and modifies a technology (e.g., Android software), and then manages an ecosystem associated with that MSPs version of the technology integrated with their products (e.g., smartphones).

[27] When I refer to a complementor in this paper, I mean complementors to MSP-based businesses. At the extreme, any business model that includes a complementor can be considered to be an MSP.

complementor maintain independent relationships with a customer. This definition contrasts with a supplier-buyer-customer (or reseller) business model characterized by linear relationships in which a supplier sells to a buyer (or reseller), which sells to a customer. (See Figure 2.1 for schematic diagrams contrasting linear with triangular business models.) Complementors, taken together with the MSP they complement, are sometimes referred to as an MSP's ecosystem.[28]

Linear Business Model

Multi-Sided Platform Business Model

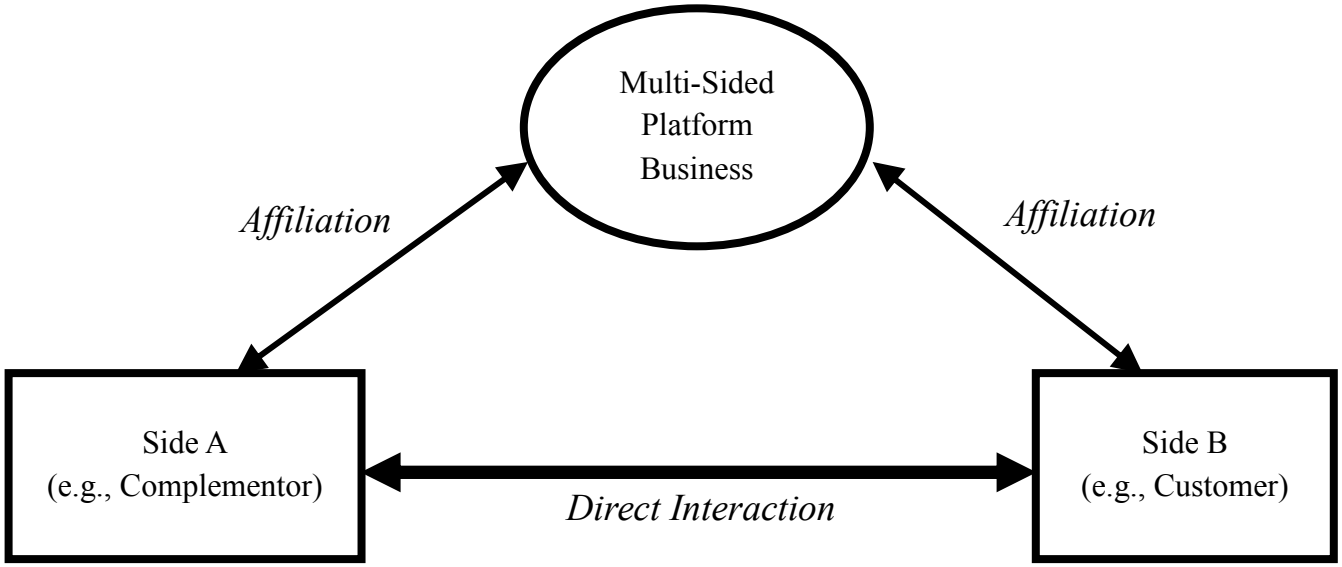

Figure 2.1 Business model schematics

[28] While the term "business ecosystem" often also encompasses suppliers and customers of a focal firm, for this paper though suppliers and customers are not explicitly excluded from the definition, the primary emphasis is on the complementors that are part of an MSP's ecosystem. Additionally, when I refer to an ecosystem, I generally mean MSP-governed ecosystems in which an MSP is enabling interactions between complementors and customers.

Whereas not strictly true of all MSPs, for ones most relevant to this research, indirect network effects generally play a role in the success of these platforms as the increasing presence of apps or complements on one side brings value to users on the other side (Rochet & Tirole, 2003; Eisenmann, Parker, & Van Alstyne, 2006; Zhu & Iansiti, 2012). Research has shown this to have been true in the Personal Digital Assistant market in which a dearth of third party software applications negatively impacted the evolution of the hardware market (Nair, Chintagunta, & Dubé, 2004) and in the video game industry in which both pricing and game variety affected market growth (Clements & Ohashi, 2005). This is also true for ecosystems around smartphones and tablets, the setting for this study: the more third-party developed apps and accessories become available for products, the more value a user can derive from a smartphone or tablet. However, these network effects are not necessarily beneficial for any given complementor because they encourage increased market entry for competing complementors and thus enable less power versus an MSP to accrue to any individual complementor. This dynamic is one of the primary reasons why this research focuses primarily on dependencies rather than interdependencies between complementors and MSPs. As more complementors join an MSP's ecosystem, the MSP's power to dictate terms of engagement increases. Complementors remain dependent on MSPs along multiple dimensions, but MSPs become less dependent on any particular complementor (Boudreau, 2012).

Research related to complementors generally addresses strategic decisions platform firms face relative to complementors, such as first-mover advantages and standardization (Cusumano, Mylonadis, & Rosenbloom, 1992), whether or not to treat complementors as complementors or suppliers (Hagiu & Wright, 2015a and b), pricing structure decisions (Armstrong, 2006), implications of modularity on ecosystem relationships (Baldwin & Clark, 2000), strategies on

whether or not MSPs should compete against complementors (Gawer & Henderson, 2007), or more recently organizational challenges MSPs face as the locus of value creation moves to networks of complementors (Kapoor, 2013). In this research, rather than keeping MSPs as the center of inquiry, I focus on challenges faced by complementors of MSP-based organizations.

There is scant work investigating the effects of core firm behaviors on complementors (Pierce, 2009) and taking the perspective of complementors. An exception to this is Venkatraman and Lee's (2004) study of the U.S. video game sector, which provides an excellent explanation of the important role of complementors as it examines video game console manufacturers and their complementors (game developers) and relationships between complementors. This research utilized network theory to analyze game developers' choices regarding platform linkages. They found that game developers' choices are affected by macro network characteristics (e.g., density) as well as platform attributes (e.g., newness) and that a combination of these characteristics must be considered for each case. Whereas these researchers consider dependencies arising in complementor networks, they do not delve into types of dependencies nor address response strategies to them as the research in this chapter does.

Another exception is emerging work related to mobile applications. Researchers have found that the great volume of app entry creates difficulties related to marketing and commercialization, specifically matching products and consumers and particularly causing challenges for entrepreneurs (Bresnahan, Davis, & Yin, 2014). Though this work is one of the few studies specifically exploring challenges from the perspective of complementors, in this case app suppliers, it still focuses on market-related challenges of product competition. This chapter complements that work by centering on management challenges associated with these organizations becoming complementors.

Within related research streams there is also growing interest in the role of complementors. For example, within engineering management literature, Kude, Dibbern, and Heinzl (2012) study the enterprise software industry and explore complementor firm's motivation to partner with large platforms or what they refer to has "hubs." They find that the reputation of the hub and its ability to provide integrated systems play a role in complementor motivation, and more importantly that the level of product complementarity with the hub explains variation in how much a hub's innovativeness drives participation. Although this study is one of the few to explore complementor motivations, it doesn't consider the nature of the dependencies between the complementors and hubs and how this drives responses. Additionally, marketing scholars are recognizing the importance of MSPs, especially as they relate to sales of software and hardware. Binken & Stremersch (2009) study the effect of superstar software games in the video game console industry finding that the introduction of a superstar game (e.g., Super Mario 64) has a sizable effect on hardware console sales. This research brings a marketing perspective to the study of MSPs and ecosystems, and emphasizes the role of complementors, but again does not focus on organization-level challenges and responses of these complementors.

Information science and software engineering scholars are starting to address challenges of building and governing platform-based businesses and software ecosystems (Costa, Silva, Santos, Werner, & Oliveira, 2013). Jansen, Finkelstein, Brinkkemper (2009: 187) defined software ecosystems as: "a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them." They present a research agenda encompassing technical and business elements and highlighting a range of challenges including establishing ecosystem relationships, managing release timing and quality, portfolio and product planning, and knowledge management.

Open innovation, or the movement towards firms soliciting innovative contributions from external parties, is being recognized by information science and management scholars as being related to MSPs and their ecosystems with research addressing ecosystem management and governance. Among others, some research questions address levels of openness versus proprietary approaches (Selander, Henfridsson, & Svahn, 2010; West, 2003). Additionally, since organizations in MSP-governed ecosystems create value through networks of co-specialized firms, this work is also related to burgeoning work on market and industry architecture (Jacobides, Knudsen, & Augier, 2006; Ferraro & Gurses, 2009; Ozcan & Santos, 2014). Still, in general this research remains focused on ecosystem conveners and managers rather than on participants or complementors and the challenges associated with dependencies they face.

Dependency

Within organizational research, scholars have long noted that organizational structure and associated relationships often echo relationships between technological products and/or services (Barley, 1986; Tushman & Anderson, 1986). In the context of interfirm relationships, we see a similar pattern with MSP businesses and their ecosystems of complementors. Complementor products enhance MSP products and have connections to them (in some cases physically through hardware and software interfaces; in others only virtually). This is true also of complementor organizations that develop and maintain affiliations with one or more MSP-based organizations.

Dependency between organizations has been the subject of much research related to interfirm relationships and resulting strategic and managerial challenges (Pfeffer & Salancik, 1978). Dependence (and specifically resource dependence), interdependency, and relationships associated with these concepts have been studied by scholars in a range of fields including

sociology (Emerson, 1962; Blau, 1964/1986), organizational theory (Pfeffer & Salancik, 1978), strategy (Zaheer & Venkatraman, 1995; Holm, Eriksson, & Johanson, 1999; Kim, Hoskisson, & Wan, 2004), and management (Bode, Wagner, Petersen, & Ellram, 2011; Buchanan, 1992).

Scholars have used resource dependence theory to consider organizations as entities that rely on an exchange of resources with external organizations such as suppliers, competitors, regulators, and so on (Pfeffer & Salancik, 1978; Katila, Rosenberger, & Eisenhardt, 2008; Ozcan & Santos, 2014). These external entities are similar in some respects to complementors in that they impact the performance of the focal entity. More specifically, products and services offered by complementors to customers of MSPs (e.g., accessories) depend on products and technologies of MSPs to function appropriately. Thus, it is useful to consider organization-level dependencies between MSPs and their complementors. Put another way, referring back to the triangle diagram in Figure 2.1, not only do complementors have an affiliation with an MSP, but they also experience dependencies from the MSP since they rely on the MSP for certain critical resources. In the literature on dependency, power imbalance, and interfirm relationships, there is minimal research on effective strategies for organizations that are in the less powerful position such as is the case with complementors joining ecosystems of MSPs more powerful than they are.

When an incumbent organization joins an ecosystem managed by a larger platform manager, an asymmetric relationship (Casciaro & Piskorski, 2005; Gulati & Sytch, 2007; Katila, Rosenberger, & Eisenhardt, 2008) is created between the two. Scholars have studied asymmetric inter-organizational relationships and found they exhibit dependencies (Uzzi, 1997; Doz, 1988; Staudenmayer, Tripsas, & Tucci, 2005). The platform manager may exert power (Pfeffer & Salancik, 1978; Nye, 2011) over the ecosystem joiner in the form of imposing constraints, such as technological specifications and branding guidelines. Gulati & Sytch (2007) studied

procurement relationships and found that joint dependence improved the performance of such relationships, yet this effect was partially mediated by factors such as joint activities and the quality of communication between partners. With complementors, there also can be joint dependence, particularly early in an MSP's development when MSPs need complementors to gain traction, and there may be shared activities (e.g., marketing) and communication between entities. Accordingly, these theories are pertinent to complementor relationships, and this chapter extends the existing work by distinguishing more finely the types of dependencies evident between complementors and MSPs and complementor response strategies to address them.

Customer and supplier relationships have been the subject of considerable research exploring the influence of dependencies on inter-organizational learning, value creation, and performance (Helper, MacDuffie, & Sabel, 2000; Gulati & Sytch; 2007). Alliance researchers have noted that risks and dependencies may be accompanied by behavior monitoring that may generate tension between firms (Das & Teng, 2001). This is similar to that seen with complementors such as with auditing requirements and compliance testing. However, the existing research does not articulate the nature and type of these tensions, nor responses to them. Further, it does not articulate how dependencies and responses in the contexts of MSPs are similar in some respects, but quite distinct in others, due to the nature of MSP-based relationships particularly vis a vis customer interactions.

Beyond alliances and supplier relationships, Casciaro and Piskorski (2005) considered resource dependence in the context of mergers and acquisitions in which power imbalance and mutual dependence affected organizations in opposing ways, reducing dependency. These dependencies may be related to those seen in complementor relationships because they include power imbalance and mutual dependence, but the context of acquisitions is quite different than

complementors in that the outcome is the dissolution of the original studied organization. Though dependencies may be similar as the M&A process begins, as relationships mature, those in an M&A environment eventually resolve through the creation of a singular entity. Those in complementor relationships, in contrast, evolve with organizations working to maintain independence. Additionally, even within the M&A context, the evolution over time of organizational responses to dependencies seems yet to have been fully addressed.

Since the data in this study spans a multi-year time period, I am able to examine how power imbalances and dependencies in MSP complementor ecosystems affect an organization as it becomes a more sophisticated complementor and how this variation affects its responses to dependencies. My research suggests that in relationships between complementors and MSPs, dependencies emerge and therefore theories that consider dependencies between organizations are a useful lens through which to further explore these relationships. For this study, I adopt a broad definition of dependency as situations in which an organization relies upon or needs important or critical resources from another organization and for which there are limited or no alternatives (Emerson, 1962; Pfeffer & Salancik, 1978; Buchanan, 1992).

METHODOLOGY

Research design and setting

This chapter is based on a qualitative inductive field-based research study spanning three and a half years starting in the fall of 2011 and continuing through the spring of 2015 with Zuni (a disguised name), a large well-established global technology-based accessory provider. Zuni participates as a complementor to multi-sided platform businesses. Other consumer electronics firms, both large and small, from Japan, Korea, China, Europe, and the US participate in these

markets as well. For the MSP-based markets in which Zuni competes, one side of the MSP market is accessory providers like Zuni and the other is users of smartphones, tablets, etc. The MSP is a firm like Apple or Samsung, which by selling smartphones that are customizable from both hardware and software perspectives enables interactions between accessory providers and end users. It is important to note that Zuni retains its relationships with its customers, selling accessories directly and through retailers.[29]

The selection of this setting was appropriate for this research inquiry because during the time of this fieldwork the business was in the process of joining powerful ecosystems in which the division needed to abide by policies determined and enforced by firms that had more market influence than it did. It was actively starting to provide products compatible with one large platform manager's products (Apple's). It was also considering joining other ecosystems during the course of the study (initially for Microsoft, Blackberry, and various providers of Android products, and later in the study specifically for Samsung as it emerged as a market leader). Whereas the dynamics of MSP businesses and their related ecosystems are characterized by interdependencies (Thompson, 1967) between entities, this chapter focuses on dependencies and less on interdependencies because there is large asymmetry between Zuni and the platform managers running the ecosystems in which Zuni operated as a complementor. Consequently, the relationship was dominated by dependencies more than by interdependencies.

Competitors to Zuni were starting to provide products for these ecosystems, so Zuni recognized the opportunity and need to do so. Environmental factors forced the division to make strategic decisions that it might not have otherwise chosen to pursue. This is important because

[29] Though Zuni also supplies accessories directly to Apple as a small part of its business, the supply relationship with Zuni is not the focus of this inquiry. This is reasonable from a research design standpoint because the vast majority of Zuni's products that work with Apple products are not sold through Apple, but rather through other retailers such as Best Buy or wholesale clubs in the United States.

in much of the platform and ecosystem literature there are implicit assumptions that firms join platform-based ecosystems due to growth aspirations. Whereas there were clearly economic motivations in this case, there was also a sense of unwillingness and inevitability. If it had been possible for this division to maintain its growth trajectory without having to become compliant with a powerful ecosystem manager's constraints, it probably would have done so. Hence, this site provides an interesting window into a very successful incumbent organization facing a new competitive reality in which growth is via joining an ecosystem, even if reluctantly.

The field study site is the headquarters for a division that designs and sells products that work with other electronics devices. Zuni has a long history as an independent company with a strong brand name. It had to modify its competitive strategy (Barney, 1986) and operations in a few divisions because technology evolved such that to develop and sell new innovative products it needed to establish relationships with firms providing products with which its products worked. The focal division at Zuni became very successful during this study, and that success in large measure resulted from devices that worked with (and connected to) Apple products. Sales and profit numbers for this division are unpublished, so cannot be included here. However, based on confidential interview data there is evidence they have grown steadily from an economic standpoint, and also in organizational size and market influence. Revenue and profitability have increased substantially. The number of people in the division has grown dramatically. Internally, managers of this division have taken leadership roles for initiatives that span the parent corporation. And, although this study includes primarily Zuni's activities related to the Apple ecosystem, by the end of the study they were actively starting to participate in other similar ecosystems such as Microsoft's, Samsung's, and others.

The qualitative case study research approach is an empirical inquiry applicable when investigating phenomena within a real-life context, and contributes to appropriate methodological fit when the phenomena lends itself to nascent theory building (Eisenhardt, 1989; Edmondson & McManus, 2007; Yin, 2009). This research employs a single holistic case study design in which the unit of analysis is a product division (Ragin & Becker, 1992). The division is a reasonable unit of analysis rather than the entire firm because the division is a self-contained business unit undergoing a specific business transition (see Galunic & Eisenhardt, 1996 for a thorough review of division-centric research). The relationship the division has with the platform manager is managed primarily at the division level. The division is a fast growing part of the business that contributes a significant share of profits to the parent firm. The study is a revelatory case (Yin, 2009) since researchers have not had prior access to this type of field site over a prolonged period of time to observe and analyze the phenomenon of a complementor's evolving relationship with a more powerful platform manager.

Finally, this study is an extreme case where the phenomena can be very clearly seen. This is true because both the primary platform manager (Apple) and the complementor (Zuni) have characteristics that are extreme compared to peer organizations. Apple is known to be exceptionally strict and challenging in its relationships with complementors, thus providing a case of a highly demanding platform manager. Further, this division of Zuni is a very well-known, highly respected, technology-driven, profitable organization. During this study, Zuni became highly dependent upon Apple for continued commercial success and growth.

Data collection

This study follows rigorous qualitative field-based research methods. The data include 60 longitudinal cross-functional and cross-level semi-structured field interviews and archival

research. I conducted 56 semi-structured field interviews with all members of the senior management team of the division in the fall and spring of 2011-2012, in the spring of 2013, in the spring and summer of 2014, and a few confirmatory interviews in the winter and spring of 2015 providing a rich set of longitudinal data. (See Table 1 for interview details).

Table 2.1 Data Collection: Interview Timing and Distribution

Interview Block	Start Date	End Date	Approximate Timespan	Interview Numbers
First Interview Block	September 2011	March 2012	7 months	# 1 - #16
Second Interview Block	March 2013	June 2013	4 months	#17 - #32
Third Interview Block	March 2014	August 2014	6 months	#33 - #54
Confirmatory Interviews	February 2015	March 2015	1 month	#55 - #56
Expert Additions	January 2012	March 2015	4 years	#57 - #60

Interviews of the management team included the division general manager, direct reports, and those who do not have direct reporting responsibility but served on the senior leadership team, for example human resources and finance leaders. An interesting feature of this data set is that the focal division experienced essentially no turnover at the management level during the time of this study. Thus, I was able to conduct repeat interviews with individual members of the management team over consecutive years. The data also include a sample of non-senior leadership team members ranging from product managers to analysts. During interviews, once respondents became comfortable with the interview format, they were willing to tell stories and explain situations that did not always cast the division in a positive light, and which were very useful during data analysis. This was particularly true in later interview rounds, by which time respondents had known me for a few years and had developed a trust and understanding that seemed to lead to disclosure of candid observations and organizational insights.

I also conducted formal interviews with industry experts familiar with MSPs and ecosystem-based businesses to test concepts and support development of interview questions. A formal interview with a former Zuni employee provided cultural and identity related insights. More informal conversations with other members of this and related industries informed the research questions as well. The average interview lasted approximately 60 minutes, and length ranged from approximately 30 to 90 minutes. Interviews involved cross-functional staff members, including employees from marketing, research, product development, etc. This eliminated bias that might result from interviewing only employees from specific functional organizations. Informants had a range of tenures in the organization, though most had been there a relatively long time, which is typical of the management team. The interviews spanned organizational levels from the general manager of the division to a business analyst. This ensured impressions related to organizational change were held across levels of management. By spanning functions and organizational levels, this study includes a rich set of data that captures observations from a multitude of perspectives.

A sister division within Zuni had also joined the Apple ecosystem. This division developed different products but sold them through similar channels to similar customers. Particularly during the earlier part of the study, the sister division had an independent relationship with Apple. As time progressed, the two divisions became more coordinated in their communications with Apple. Still, they maintained separate liaisons and had separate processes to manage compliance requirements for their respective products. Interviews were conducted with members of this sister division in each round of interviews (starting in early 2012 through 2014). These employees had been actively involved with the relationship between Zuni and Apple representing their division, and were very aware of the relationship between Apple and the

focal division. Thus, they were able to provide observations from outside the focal division that were extremely useful for triangulating data and corroborating stories from members of the focal division. Table 2.2 includes a list of formal interview participants and dates of interviews.

Table 2.2 Data collection: Semi-structured interview list

No.	Title/Role	Date
1	Marketing, Prod. Management, Sales	9-15-11
2	Marketing, Prod. Management, Sales	10-7-11
3	Product Development Engr.	10-25-11
4	Business Operations, Strategy	10-25-11
5	Marketing, Prod. Management, Sales	10-28-11
6	General Manager	10-28-11
7	Controller, Finance	11-8-11
8	Engineering	11-8-11
9	Human Resources	11-8-11
10	Business Analyst	11-15-11
11	Market Research	11-15-11
12	General Manager	2-8-12
13	Marketing, Prod. Management, Sales	2-15-12
14	Strategy	2-28-12
15	Product Manager	3-15-12
16	New Product Planning	3-29-12
17	Marketing, Prod. Mgmt., Sales	3-21-13
18	General Manager	4-11-13
19	Marketing, Prod. Management, Sales	4-15-13
20	Product Development Engr.	4-22-13
21	Controller, Finance	4-24-13
22	Business Operations, Strategy	4-24-13
23	Human Resources	4-24-13
24	Strategy	4-29-13
25	Engineering	5-1-13
26	Product Manager	5-21-13
27	Market Research	5-21-13
28	New Product Planning	5-22-13
29	Business Analyst	5-22-13
30	Marketing, Prod. Mgmt., Sales	5-22-13
31	Category Business Manager	6-14-13
32	Category Business Manager	6-10-13
33	Marketing, Prod. Management, Sales	3-10-14
34	Marketing, Prod. Management, Sales	3-11-14
35	Marketing, Prod. Management, Sales	4-22-14
36	Controller, Finance	4-22-14

Table 2.2 (Continued) Data collection: Semi-structured interview list

37	Product Development Engr.	4-25-14
38	Engineering	4-25-14
39	Human Resources	4-29-14
40	Business Operations, Strategy	4-29-14
41	Strategy	4-30-14
42	Marketing	5-9-14
43	Product Manager	5-9-14
44	Product Manager	5-9-14
45	New Product Management	5-9-14
46	Engineering	5-12-14
47	Strategy	6-2-14
48	New Product Management	6-3-14
49	Market Research	6-24-14
50	Marketing	6-27-14
51	Business Analyst (Strategy) & Sales	6-27-14
52	Category Business Manager	7-1-14
53	Category Business Manager	7-1-14
54	General Manager	8-26-14
55	Marketing	2-13-15
56	General Manager	3-24-15
57	Non-Zuni: Trademark Attorney	1-13-12
58	Non-Zuni: Accessory Business Manager	1-13-12
59	Non-Zuni: Former BD Director	3-16-12
60	Non-Zuni: Former Zuni Employee	3-21-15

The interviews were generally conducted in employee's offices, though some were in the company cafeteria when employees did not have closed door offices or preferred to meet in the cafeteria. The interview protocol included an introductory explanation of the nature and purpose of the study, a reminder that data were covered under a confidentiality agreement and that the company would be disguised, and a request for permission to audio record the interview.

Semi-structured interviews were based on an interview guide that included questions related to a number of topic areas (see Appendix for an example interview guide). The first topic area included questions about products that might work with other firms' products. This led

quickly to discussions of relationships with other firms and interdependencies and dependencies, including benefits and challenges of these relationships, changes to relationships, and speculation regarding future potential changes to relationships. The second set of questions pertained to organizational considerations such as whether the division had to change business processes as a result of working more closely with other firms and how these changes might have been perceived. The next questions were more open-ended and asked about greatest challenges in the organization. In the final interview phase, I asked (relative to their work) what kept informants up at night, which frequently led to enlightening discussions about organizational happenings.

Interviewing multiple employees across the organization allowed confirmation of the data from several sources and eliminated potential biases of individual sources (Golden, 1992; Miller, Cardinal, and Glick, 1997). In many instances, organization members provided confirming commentary validating a position previously relayed by another respondent. I used initial interviews to validate preliminary assumptions and then adapted the interview protocol for later interview rounds. For example, dependency challenges were not originally a central component of this research, but as fieldwork progressed and I analyzed data, they emerged inductively as an important theme. Additionally, themes related to organizational identity also started to emerge as salient. Accordingly, the interview guide evolved to include questions more specifically aimed at understanding dependencies and identity-related challenges. Similarly, themes of compliance, innovation, and influence emerged during early and middle round interviews, so later interviews included more questions related to these and other topics associated with asymmetries, dependence, response strategies, and complementor maturity.

In later interviews, as research questions became clearer and theoretical framings developed, the final sections included more questions related to Zuni's relationships with

platform managers and particularly with Apple. A section was added related to organizational identity encompassing inquiries such as: "What are you most proud of related to Zuni?", "What are you most frustrated by at Zuni?", and "What do you think Zuni stands for?" These were followed by questions asking if these items had changed, and if so, how might they have done so.

In addition to collecting interview data, over the course of the study I gathered significant archival data related to Zuni. These data included press releases, advertisements, website clippings, media articles, product packaging samples, and retail display photographs from locations around the world. These data were instrumental in triangulating findings across sources and over time and contributed to ongoing revisions of the interview protocols as iteration continued between data collection, data analysis, and theoretical development.

DATA ANALYSIS

Interviews were audio recorded with hand-written notes keyed to the audio via a LiveScribe pen. Interviews were transcribed resulting in over 1,000 pages of text. I coded the interviews with Atlas.ti qualitative data analysis software. Coding and theory development progressed iteratively throughout data collection to inform data gathering. As themes emerged and data analysis progressed, all interview transcripts were included in the analysis software enabling searches for key coding terms. This enabled comparison of interviews across respondents over time to capture variability of perspectives by individual as well as variability across individuals.

Iterative code development

Code development followed a three-stage process of qualitative analysis: 1) data reduction (organizing, coding, and summarizing data), 2) data display (creating tables, network views, and

diagrams to view data from various perspectives), and 3) conclusion drawing/verification (Miles and Huberman, 1994). This process was iterative requiring frequent re-examination of the original transcript data while cycling between developing displays, generating initial conclusions, continued coding and re-coding, conceptual development and thematic identification (Gioia, Corley, & Hamilton, 2013). To avoid confirmation bias, data that both confirmed and contradicted findings were included in the coding process.

The transcript data were coded by "deriving and developing relevant concepts from the data" (Corbin & Strauss, 2008: 65). The first coding round stayed close to the respondents' words and meanings, sometimes employing in-vivo coding (Corbin & Strauss, 2008), and developing first-order codes and concepts (Gioia, Corley, & Hamilton, 2013). Through use of Atlas.ti software to manage the significant amount of data, these codes were grouped into code families. Comparative analysis (Corbin & Strauss, 2008) was useful to compare incidents across interviews and timeframes. For example, multiple respondents used the same examples of Apple interactions to illustrate points; these were all coded together. Similarly, because the data are longitudinal, perceptions of concepts across time could be captured via coding. An example is the two quotes that open this chapter from the same person separated by two and a half years.

Code relationships

Network views were developed as part of the second stage analysis. For code families that emerged as most important, these network views enabled visualization of relationships between codes and assisted in later abstraction to higher level categories, concepts, and themes. In the tradition of grounded theory research and building on more modern qualitative inductive research techniques (Glaser & Strauss, 1999; Corbin & Strauss, 2008; Gioia, Corley, &

Hamilton, 2013), from first-order code families, concepts emerged and then second-order themes were induced. These then mapped to three aggregate strategies Zuni used to address dependencies. See Figure 2.2 for a diagram showing this data structure and the relationships between elements (Gioia, Price, Hamilton, & Thomas, 2010; Gioia, Corley, & Hamilton, 2013). The process of building network views, and iterating between data coding, concept development, and thematic analysis led to insights related to asymmetries, power relationships, dependencies, response strategies, and complementor maturity that developed as Zuni joined MSP ecosystems.

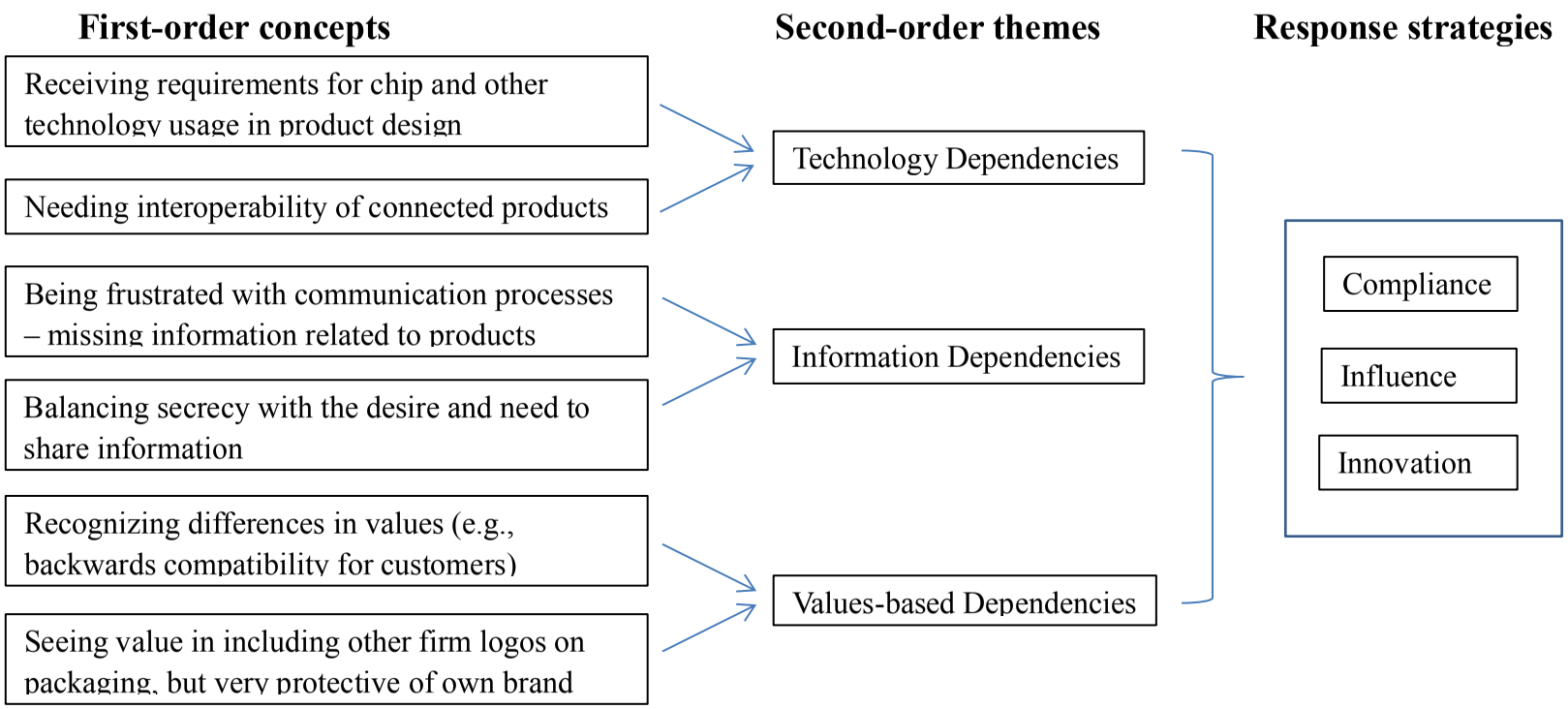

Figure 2.2 Data structure
(Figure adapted from Gioia, Corley, & Hamilton, 2013)

A MODEL OF COMPLEMENTOR MATURITY

As a result of the data analysis, I have developed a grounded theory model identifying relationships between ecosystem joining, ecosystem-related dependencies, and complementor maturity response strategies. Figure 2.3 provides a diagram of this model. The following sections explain the elements of the model and the relationships between them.

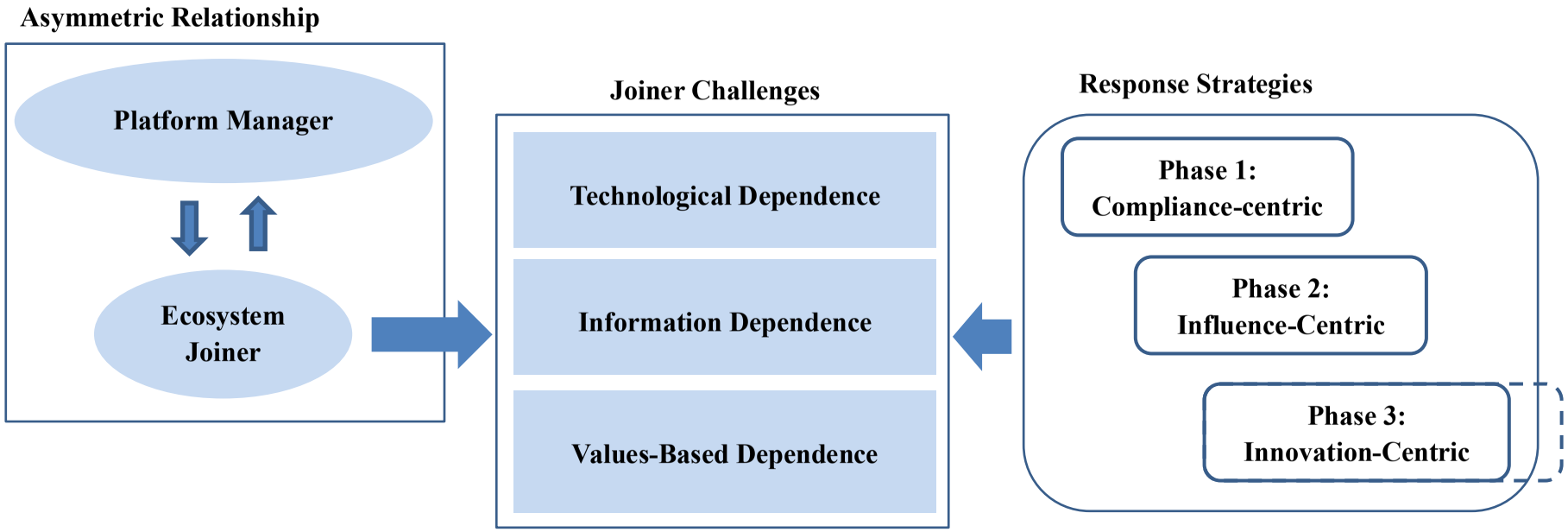

Figure 2.3 Grounded theoretical model of challenges, response strategies, and phases of complementor maturity associated with joining an MSP-governed ecosystem

With powerful platform providers such as Apple, Microsoft, Samsung and others developing huge markets for smartphones, tablets, and other mobile devices, in 2011 a large market had been developed for accessory products. Zuni recognized the market opportunity to design products that were optimized to work with particular MSPs' products, and in particular to enter Apple's ecosystem by developing products that would be approved by Apple and marketed with Apple's "Made for iPhone" or "Made for iPad" certification logos. These decisions to create products that required Apple certification, and to move the product portfolio mix substantially in the direction of creating complementor products for powerful MSPs, led to Zuni entering into an asymmetric relationship with Apple as a developer of complementary products.

DEPENDENCIES OF ECOSYSTEM JOINING

As Zuni joined ecosystems of powerful platform-based businesses Zuni experienced three types of dependencies: 1) technological, 2) information, and 3) values-based[30]. I define and outline each category below with evidence of dependencies associated with each.

Technological Dependency

When Zuni started making products to interoperate with Apple products, it experienced technological dependency. Consistent with the definition adopted above of dependency as encompassing the need for important or critical resources, I define technological dependency to capture situations in which Zuni needed resources and requirements from an MSP to create and deliver products and services as part of that MSP's ecosystem (i.e., complementary products).

[30] A fourth type of dependency could also be articulated as economic dependency. However, through the data analysis, it became clear that this dependency was really a product of the other dependencies. Thus, I have not called out economic dependency as a separate type, but it is essentially captured as a result of the other three types.

Frequently, and most obviously, these resources and requirements were technology related, however, this dependency encompasses all situations in which an MSP prescribed a particular way to do something, or a performance level that needed to be achieved. Thus, also included under the umbrella of technological dependency are all occasions in which an MSP provided packaging or business process requirements as well. Essentially, whenever Zuni was being told what to do or how to do it, I consider it a technological dependency.

The data analysis showed that the concept of technological dependency also included sub-types of dependencies. These sub-types can be envisioned along a spectrum varying by level of resources need by Zuni. An alternate way to conceptualize the spectrum is by considering variation in restrictiveness imposed on Zuni by an MSP. For example, the extreme (worst case) was when specific technologies and their implementations were prescribed by an MSP (e.g., when Apple required accessory providers to use a specific component chip only available from one vendor). A less restrictive example was when an MSP provided technological requirements or standards that a complementor must achieve. These situations imposed different dependencies on Zuni, yet both related to decision-making and resource needs so are captured in the notion of technological dependency.

As it experienced the first type of technological dependency, Zuni had to choose whether to use the required technology. For example, Zuni had to choose whether to incorporate the chip into its design and buy it from the specified vendor. Once Zuni agreed, there was little latitude in how it implemented the requirement to use this technology. Additionally, there were intellectual property (IP) considerations because Zuni was forced to use (license via the chip fee) another firm's IP. This felt to Zuni like a very strong and restrictive requirement. An engineering manager explained,

"So, we had to license a chip. We had to actually utilize the [component from the supplier] that they recommended... And, we had to use their specifications for reference designs in order for it to work with all the varied devices: iPod Nano, iPod Touch, iPhone, iPad. It was a little awkward and what's really interesting is we had trouble making them work."(10-25-11)

In addition to feeling like this was a strong requirement, Zuni perceived that Apple included technologies that did not add value to the accessory product, but added value only for the MSP. For example, one was a technology that enabled Apple to maintain proprietary limitations across the ecosystem. A product manager explained,

"They then put these certain requirements and one of them is this [component] that is just super expensive and, from our perspective, adds no value." (5-9-14)

Not only did Apple dictate technologies Zuni needed to use, but some of those technologies required Zuni to make performance trade-offs because it believed its own internal designs would result in better products. An informant outlined the problem:

"I think one of the key things about the Apple problem is… Apple really did want to influence the design of the product. So, if you remember back, we were of the opinion at the time that our designs for the [product attributes] were better than what Apple was forcing us to use. That, I think, was at the heart of one of my problems here." (2-8-12)

For decades, Zuni had been developing products to industry standards, but those standards were relatively straightforward technologically and provided Zuni with significant flexibility in how to implement them. When Zuni decided to create products to interface with Apple products that would need to be approved by Apple, Zuni had to adhere to stringent and constraining requirements. In instances when a chip was not specified but Zuni was required to meet requirements, Zuni had flexibility in how to achieve required performance levels, so this dependency was weaker and allowed more flexibility. Still, because required performance dimensions were prescribed, the organization's decision-making capabilities were affected as it

had to design products in certain ways (potentially contrary to how the organization would have preferred to design them), and therefore a technological dependency existed. One manager noted:

"...this whole design is because of them. We used to have it [this way], but when you [interfaced it with] an iPhone or whatever, [there would be a problem] ... So, we had to completely change the design… But at the end of the day, it was all driven by them, by their products, and how people use their products." (10-25-11)

In 2014, even as Zuni had matured as a complementor and accepted the need for compliancy, it was still dealing with significant technological dependency broadly defined to encompass various specification types as Apple continued to impose requirements. An informant explained,

"So, there's a lot of things that are value added, but all this other junk comes along and now…it came up again a couple of weeks ago ...they're specifying more and more of the implementation details of our product and I'm not very happy about it. …because it's starting to constrain us and second guess us more and more and more. I understand their intent. Their intent is they want this ... so that it works properly. ...but as it's maturing they're getting into their partner's shorts more and more." (4-25-14)

Table 2.3 provides additional quotes illustrating technological dependency.

Information Dependency

Another form of dependency Zuni faced was information dependency. I define information dependency to characterize situations when Zuni needed information from a platform manager to deliver product or services. To compare this with technological dependency, when Zuni was required to meet standards, the need to comply with those standards generated a technological dependency. In contrast, needing to *communicate* about standards, obtain information about them, learn about them, and so on, generated information dependency. Information dependency was characterized by difficulties related to communication between Zuni and an MSP and challenges obtaining information that generated uncertainty related to product design.

As with technological dependency, the data analysis showed sub-types of information dependency. Two types included: 1) *availability* or *completeness* of information, and 2) *timing*

obtaining information. In some circumstances the challenge of the dependency was to get information that was not being released. In other situations, the difficulty was trying to obtain information faster than it was being offered. Related to the former, one manager said:

"It is a little bit hard to get answers from them. They have a lot of people, and then they have this certification, 'Made for iPod, iPad' certification that can be a little bit of a pain too, and they have a whole suite of tests but they'll never tell you which ones they'll run..."(10-25-11)

Because of lack of information availability, Zuni spent more time and resources than would have been necessary if it had obtained better information. As a member explained,

"So, you spend a lot of that time because they are so secretive and don't tell anybody anything… spending a lot of your time sort of speculating, 'if this, then we'll do that,' and having contingency plans." (2-28-12)

Members not only recognized this information dependency, but also the potential impact on their business and the advantages of trying to respond to the dependency. An informant explained,

"We're always trying to extract from them, 'Okay, what are you guys going to do next?' They don't tell us, but sometimes they'll give us a wink, wink, nod, nod. Or, we'll say, 'Hey, we are going to be doing this.' And they'll say, 'I'm not sure I'd do it like that, I think I'd do it like this.' And when you don't have that relationship, it's like a tsunami. You get wiped out." (2-28-12)

Apple provided Zuni with various forms of requirements (technological, packaging, financial, etc.) and controlled information flow. There were many times Zuni wanted more information about topics like compliance testing and product design. One manager noted:

"You know they're very closed about what they do technically…very closed. So, it's really difficult to figure out what their product roadmap is." (4-24-13)

Even once the relationship between Zuni and Apple was well established and Zuni was more sophisticated in its interactions with Apple, Zuni faced information dependencies significantly impacting product development. A manager explained the difficulty,

"Another thing that was a real pain in the neck, even though we're a great partner and they want to work with us, just like everybody, nobody got to know what the size of the iPhone 5 was going to be. We guessed." (8-26-14)

Table 2.3 provides additional quotes illustrating information dependency.

Values-Based Dependency

A third dependency Zuni experienced was values-based. I define values-based dependency as situations in which Zuni's core values were challenged or threatened as a result of Zuni's attempts to participate in an MSP-governed ecosystem. Examples of this type of dependency were challenges to how Zuni treated customers or managed interfirm relationships. For instance, Zuni had a different view of customer relationships than did platform managers. As Zuni became a member of MSP-governed ecosystems, those MSPs began to shape boundaries that governed Zuni's customer relationships and Zuni began to lose control of the boundaries. Values-based dependencies can also be broken into sub-types including: 1) *values threats*, and 2) *values clashes*.

Zuni prided itself on customer service and ensuring products lasted a very long time. Zuni informants often mentioned the need to assure products continued to work with older (and newer) generations of products (a.k.a., backwards (and forwards) compatibility). Zuni noted a mismatch with MSPs on expectations of appropriate product lifecycles, which threatened Zuni's values. A member explained,

"…it was just these very small mechanical changes that they require that make things incompatible with previous versions and then make it hard for people to use them with other products … and so their whole philosophy of not worrying as much about backwards compatibility as we do, is a disconnect sometimes." (11-8-11)

Another informant also noted the difference in perspectives:

"It was very important to us, but it takes a lot of bandwidth to do this to make sure that it worked with all the devices that they make as they change. Because they don't have a lot of backwards compatibility drive. As a matter of fact, they have said to us, 'You guys are nuts. It's not compatible anymore. Tell them to buy a new one.'" (10-25-11)

In 2014, over three years after Zuni had started actively participating in Apple's ecosystem, Zuni managers across functional areas still noted that problems remained related to disconnects in customer service. Zuni's values were not aligned with Apple's, yet Zuni was dependent upon Apple and thus affected by Apple's values.

"It's a challenge because…and this is the thing where I can't understand how they continue to grow. They have no concern about their customers …they'll introduce a new product, they will have new technology and new functionality and new everything, and they completely ignore their previous customer and the product that they had." (4-29-14)

The values-based dependency went beyond product compatibility to encompass an overall approach to product development. In 2012, a manager summed up the tension and how that derived from the values of the organization.

"*I have to admit that ... I still don't want to be a part of these ecosystems. That's still where I am. I recognize the need and I recognize how I can be successful, but I would still rather not be a part of it. That's where I stand... It's just not the way we were raised here. We're not supposed to do that. It's just not right. Our products are our products. They speak for themselves."(2-8-12)*

Another values-related dependency Zuni experienced was related to interfirm relationships and expectations. This dependency created clashes with Zuni's values. Before joining Apple's ecosystem, Zuni managers noted Zuni had not placed high value on working with other firms. One manager noted:

"There's a saying around Zuni, which is quote-unquote, 'We dip our flag to no one.'"(10-7-11)

Zuni didn't acknowledge a need to work with other organizations, particularly in relationships in which another party had more power and could dictate activities. As Zuni started to realize the

importance of a relationship with Apple, and the importance of having Zuni products work well with Apple (and other MSPs') products, this began to change. As another member noted:

"…the reason why we are willing to do that now is because of a change in corporate philosophy right now. Apple created such an environment that we finally had to swallow our pride and say, 'If we don't do things contrary to the way that our philosophies tell us to do things, we will not be compatible.' (10-28-11)

There was also growing recognition of the asymmetry of the relationship between Zuni and Apple and the dependency that created. As the same manager continued,

"So, that was a philosophical change. 'Okay, they win. They win. We used to be bigger, they were smaller. Now they're a heck of a lot bigger, and we're a heck of a lot smaller than they are, and they win. We dip our flag and we've got to learn to work with them.'" (10-28-11)

Table 2.3 provides additional quotes illustrating values-based dependency.

Table 2.3 Dependency data examples

Dependencies	Data example
Technological	"Apple is the only one who we customize our products to work with their products." (10-25-11)
	"So, when we actually came back and said, 'Okay, these are the demands of Apple. They are incompatible with our technology strategy and, frankly, we don't agree with them. We don't think this is the right customer experience.' We said, 'No, thank you.' We walked away from tens and tens of millions of dollars of business." (10-28-11)
	"Once the needle is in the arm and you're used to that drug, and you've got a big business… the company can't afford for it to go away overnight. I'm responsible for making sure that it doesn't go away, and that Apple doesn't take a hard right turn and we keep going this way." (2-8-12)
	"One thing I worry about is that as the ecosystem matures the base functionality expectation keeps rising, and so the amount of money and engineering effort we have to put into stuff that is checkbox…which, if just doing checkbox we're going to execute on it extremely well, so we still want to do the job, but I'm really uneasy about the portion of our time focus, BOM costs on the stuff that is not making us stand out from others is becoming too high..." (5-1-13)
	"So, I think in the Apple context they have the ability to leverage the technologies that they believe are the most important, and [technology X] has no value to us but it has real value to them." (5-9-14)

Table 2.3 (Continued) Dependency data examples

Information	"Now, the scary part about that is they continue to change their products and the iPhone 4S is out… And they don't tell us. There's no communication to us ..." (10-25-11)
	"That's well beyond the bandwidth they have to deal with us. They've got their teams. They're designing their stuff, then there's the engineer that works with the alliances or the ecosystem that says, 'Okay, can I answer your questions for you?' There's not the path to bring it back in, at least we haven't found that path, yet." (10-25-11)
	"What my hope is that we can just still be communicative. I wish they would be a little bit clearer on some of their expectations. I wish that they would be clearer on what's coming next, but I can't really begrudge them that. I mean, I wouldn't tell anybody what's coming up, so why would they tell anybody what's coming up?" (2-8-12)
	"Yeah, I would love it if these people could figure out, what's an Android standard? What's a Windows standard? What's a RIM standard? Oh, my god. It's not out there. There's just no standard and it looks like…oh, god, it looks like there may…what is it? HTC, I think it's HTC, might even be trying to create their own Android standard." (2-8-12)
	"One form of communication with Apple is called their MFi portal...Apple limits the number of people that have access because there is company confidential information...Our solution was to create this group of people so even though there might be another product that wants to get certified, that program product manager would come to me and say, 'I need to do x, y and z,' and I would help them get that done.." (5-21-13)
	"They keep enabling more functionality. So, with more functionality just comes more complexity which is more testing, but actually where I think the problem is coming into play more is as their ecosystem grows and more players want to be a part of it, it's harder to get Apple's attention to get approval. Sometimes you need the approval, sometimes you can self-approve. It's a little confusing..." (8-26-14)

Table 2.3 (Continued) Dependency data examples

Values-based	"One of our challenges with [Apple] is we are very customer focused and if [a customer] bought our product, we want that product to be able to work with other products. Apple doesn't care. They don't worry about last year's version… Well, if that phone changes and you bought [X] two years ago and they are on iPhone 6 or 7, they don't care about you… And that is different for Zuni. We struggle a lot with that... So they do create more turmoil for us, if you will, in how they operate." (10-25-11)
	"Yeah, this is only hearsay, but … 'Apple, wait a minute. Do you realize that you've gone to a nonstandard [interface] and that nothing is compatible?' And the answer back was, 'Those are the old customers. We care about the new customers. You guys spend too much time worrying about customers who have already given you money. Worry about the ones who haven't given you money yet.' That is hard for us…that's hard for me to fathom. I don't get it." (10-28-11)
	"I think..., philosophically, they don't really worry about backward compatibility. Buy a new one, right? Get the next one. Get the latest. They don't feel an obligation for… that's not as high a priority for them as it is for us... They've got a business model and a set of user expectations that say, 'Yeah, just throw it away. Get the next one. Get the next one.' People expect our products to last for shockingly long amounts of time and they get really, really mad at us when they wear out." (11-8-11)
	"By the way, the whole relationship with Apple is quite new… We developed products on our own terms. Now, we have this external force that is coming and giving us nudges to what is right and wrong. Where, as an organization, for the last 30 years, we decided what was right and wrong." (3-15-12)
	"Our general strategy is one of differentiation in the marketplace. The challenge with having a differentiation strategy when you are working within an ecosystem, or with a partner, is that we, almost by default, don't necessarily want to do things exactly the way they were put in the specification, or they ask us to. So, figuring out how to balance our needs against their needs, and find the middle ground to say, 'Here is what we will do, here is what we will be able to do, and here is what we would like to do. We understand this is where you are, what can you live with to let us do the things we need to do in our products?' And, sometimes that works really well; sometimes it doesn't go our way." (3-29-12)
	"…here we're doing all this quote, unquote, work, with these…the team, and yet we're not…clearly, we're not being treated as enough of a partner that they would even share that seemingly basic information on the dimensions of the product." (4-24-13)
	"We had everything lined up, ready to go, because we have [a product] that's designed to work with an iPhone and it says right on the box, "Compatible with iPhone." ... There's one human being on the face of the earth who has to approve those accessories. It took that one individual on the face of the earth six months to approve it." (8-26-14)

RESPONSE STRATEGIES TO DEPENDENCIES

Zuni experienced technological, information, and values-based dependencies associated with joining ecosystems managed by powerful MSPs. Over time, as Zuni learned to manage its relationships with platform managers and became more experienced at being a complementor in each ecosystem, Zuni developed a variety of response strategies to cope with these dependencies. The data show evidence of three types of response strategy: 1) compliance, 2) influence, and 3) innovation. In different phases of maturity becoming a complementor in an ecosystem, Zuni used combinations of these strategies, with varying emphasis on each, to address dependencies. In the following sections, I provide evidence of each of these response strategies.

Compliance

There were times when Zuni adopted a compliance strategy as it chose to live with challenges associated with ecosystem-related dependencies and comply with rules and mandates imposed upon it. Accordingly, I have labeled the first response strategy *compliance*. For example, when Zuni decided to increase the number of products optimized to interoperate with MSP products the general manager, senior leadership staff, and product managers decided to comply with specifications, guidelines, requests, and so on even though doing so required trade-offs related to performance and other dimensions (e.g., added costs). In these instances, Zuni did not attempt to resolve tensions associated with becoming technologically, information, and values-based dependent, but rather learned to work within constraints associated with them. This strategy is characterized by Zuni learning about the new constraints imposed upon it (e.g., technological requirements, branding guidelines, etc.) and deciding how to cope with these new constraints (e.g., to what extent does it want to be compliant and in what ways). Compliance spanned not

only technological requirements, but also marketing (e.g., compliance logo guidelines, packaging requirements), financial (e.g., royalty audit clauses), and so on.

Some cases of compliance addressed the heart of the organization, its product design decision-making associated with product performance. Early in Zuni's path towards becoming a mature complementor, Zuni recognized that standards Apple required it to meet were not only dictating product design decisions, but also leading to designs that diminished performance below what Zuni could otherwise accomplish operating independently. Still, after weighing trade-offs, Zuni chose to comply, as one manager explained,

"We had a lot of conversations about whether or not the performance they were dictating was up to the standards of being a Zuni product. We had a lot of conversation about that. Finally, in the end we agreed that it was acceptable, but it was certainly not preferred." (10-28-11)

Although Zuni initially resisted complying with specifications imposed by other firms, it began to acknowledge the need to do so to ensure interoperability and gain access to larger markets. Recognizing the value Apple was creating throughout the ecosystem, even though it was demanding compliance, a manager explained,

"Apple is the only one right now who has really effectively created a well…I say this in air quotes, 'well-understood ecosystem where you know what you have to do to be able to play.' And once you've done that and you've got your certificate, then you can put this icon on your product and everybody knows."(2-8-12)

Still, challenges remained even as Zuni became a much more mature complementor and accepted its need to comply with requirements. An informant acknowledged Zuni's need to comply and relayed the ongoing frustration,

"*[Apple is] continuously increasing the requirements document around compatibility with their Made for iPhone program, and so the list of things we must comply with... they're ever increasingly specifying what must be done to the point where I'm starting to get really unhappy and uncomfortable." (4-25-14)*

Apple maintained significant influence on Zuni product design choices that required compliance and cross-organizational interfirm processes. A manager who played a leadership role in this process explained the certification process,

"...we communicate with Apple through this web interface. We tell Apple what products we're about to develop and they either accept that idea or reject it, and if they accept the idea, then we can start buying certain components... we develop prototypes... we send them to Apple and they certify they operate appropriately ,...we also submit our packaging...." (5-9-14)

Influence

Compliance is associated with acceptance. Influence, in contrast, is based on the notion of not accepting circumstances, but rather aiming to change them. The data analysis shows that as an element of Zuni's multi-pronged strategy to address ecosystem-related dependencies, it employed an *influence* response strategy to try to improve circumstances in which it operated and to test the boundaries of the constraints under which it was operating. Whereas the compliance strategy was most directly aligned with responding to technological dependencies, the influence strategy applied across all three dependencies: responding to technological by trying to alter requirements, information by trying to influence to gain better and more timely information, and values-based by trying to change values-challenging situations. Although compliance and innovation responses encompassed Zuni activities within boundaries of its own organization, the influence response addressed interfirm relationship challenges and crossed boundaries. It centered on interactions outside organizational boundaries, and captured instances in which Zuni attempted to influence sensemaking (Weick, 1995) and activities of another party.

Early in the study when Zuni was newly operating as a complementor, the data suggest that influencing was not a notable part of Zuni's overall approach. Zuni did not yet believe it had the ability to influence. A working level manager explained,

"... basically, we take what we're given, interpret it to the best of our abilities, go through, basically, normal and routine channels of question asking, but that's really all it is. It's a specification with question asking and clarification without any ability to impact those specifications or change them ...." (10-28-11)

Even at that time early in its path to becoming an established complementor, a more senior Zuni manager held the optimistic expectation that if they worked hard to build a relationship with Apple the relationship would grow and be mutually beneficial. Zuni placed a high value on relationships and building trust over time, and presumed other companies did as well. Thus, this manager believed that by executing a compliance strategy, or playing by the rules, Zuni would be able to influence the relationship. He explained,

"I think part of our philosophy is also that, over time, if we can respond appropriately and behave appropriately, then that kind of behavior, hopefully, will drive products that will be very successful at Apple. And the good company they are, they'll recognize, 'Whoa, there's an opportunity for a lot more success working with this company than others. Alright, let's make this relationship stronger.' So, I think that our unwritten hope is that by following the rules, doing what we're supposed to do, that will be the entry into a bigger relationship." (10-28-11)

As Zuni became more mature as a complementor, it developed established processes for working with Apple, and slowly started to push back on certain requirements to address dependencies it encountered. Though Zuni could have pushed for changes for the entire ecosystem, Zuni's main motivation was to gain freedom of action for its own products so, at least initially, Zuni was content (and potentially preferred) to gain exceptions to existing requirements, or waivers, rather than requirement changes. Referring to how Zuni used influence to address a technological dependency, a product planner explained,

"...[Apple] puts together guidelines for certain technologies and says, 'You should do this big list of things' And, for one of our products...we wanted to treat it like a different set of requirements... so, I brought pictures and I pitched it to them... We actually got through that... we got an exception." (3-29-12)

There were also occasions in which requirements caused problems and Zuni attempted to influence Apple to change these requirements. Apple started to recognize the value Zuni brought technically and began to more readily accept Zuni's technical inputs. A Zuni manager explained,

"Well, Apple, in their last upgrade, they somehow [caused a problem with the product interface] ...we pointed it out to them. [Apple said,] 'Ahh, yeah, we'll have to fix that.' So…they appreciate …what we bring to the party from a technology point of view..." (4-24-13)

Relevant to both technological and information dependencies, a manager explained how the relationship between engineering teams had evolved,

"...the engineering relationship is actually at this point quite deep and you know the thing we talked about where we feel like we can give them information to make it work better? I mean we've been having actually that kind of relationship with their engineers where we found some bugs that they didn't know ... and you know they revised it..." (3-14-14)

When I asked if this type of relationship had existed from the beginning, the manager replied,

"Not at all. No, not at all. I mean first of all, Apple is not open to that mostly but, second, we just haven't been positioned but we sort of said to ourselves a few years ago we need to get in deeper. We're so dependent on them. We need to try to get in deeper, and the only way to get in deeper is to offer them value... To help them establish the standard for something new."(3-14-14)

Zuni's aspiration was to be a preferred partner of Apple's in their complementor role. They hoped Apple would come to them first to discuss product ideas and provide early information regarding upcoming technology changes. Put another way, as Zuni managers referred to it, they were trying to avoid being one upgrade cycle behind, which happened when they did not get advance product information (and therefore had to wait until a product was launched to get full information about it). To that end, as Zuni became more adept in its role as a

complementor there were times when Apple asked Zuni for input, so Zuni was able to exert influence. An informant explained,

"So, we have zero visibility because we're not a customer, we're not a supplier, we're a user of their technology and they look to Zuni for helpful input because they trust us." (4-25-14)

Though engineering interactions grew stronger, as the relationship matured, the management team began to perceive the relationship in a less positive manner. Apple had always competed to some extent with Zuni products by offering their own versions, but as the market grew they began to more aggressively do so and started to compete more directly with Zuni. As this occurred, it became clear that Zuni would not be a preferred partner and Zuni managers recognized that though they had some success influencing Apple's technical decisions, they had not built the relationship for which they had originally hoped. They realized that their product offerings would always be slightly behind those offered directly by Apple because of the imbalance in information.

In August 2014, a key manager reflected,

"*I think the relationship we established was only on the surface. It never went deep."(8-26-14)*

This comment, and others like it, contrasts with previous quotes explaining the improved depth of the relationship and may have been affected both by Apple's more aggressive moves into Zuni's markets and also Zuni's evolving maturity as a complementor. It illustrates that there were different opinions within the organization about the level of influence Zuni had with Apple, and these opinions seemed to depend on whether one was discussing technical bug fixes and such, or more strategic technology and product planning. The strategy of influencing was quite successful relative to tactical problems with technical specifications, fixing bugs, clarifying

confusion, and so on, but was much less effective relative to generating substantive product changes that benefitted Zuni (and in keeping Apple out of direct competition with Zuni).

As Zuni management recognized that the level of influence they were able to have was limited, and that the relationship they were building was not as mutually beneficial and trusting as they had originally hoped, Zuni became more sophisticated with its communication approaches and its influencing attempts. Continuing the previous discussion about having a surface-level relationship, the manager explained further how he only wanted to influence in ways beneficial to Zuni,

"…every meeting I had with [our liaisons] where we would talk about this I reminded [them] every chance I got, 'Don't…go too far with this. Please don't teach. Please don't share. Please answer questions in a way that still lets us keep our competitive advantage but…enables us to impact *some of the decisions they might be doing so our stuff can work better.'" (8-26-14)*

Zuni was attempting to influence, but to do so to improve its own ability to innovate. Still, outcomes were not always as expected or desired. This was particularly true for outcomes that were less tactical and more strategic in nature. Lamenting the difficulties with the relationship, the same manager further explained,

"If I can interpret some conversations I had from the engineers after their meetings I actually think we helped... I think we helped the Apple engineers think through, architect, and craft some of the [interfaces]…There's no question in my mind we helped. But there's also no question in my mind we reaped absolutely no benefit from that. None, none whatsoever."(8-26-14)

Innovation

Beyond compliance and influence, the data show Zuni invoked a third response strategy, which I have labeled *innovation*. Zuni chose to make changes to its offerings, and organizational processes, to resolve challenges associated with dependencies of being a complementor. These

changes can be grouped into two types, 1) those aimed at making Zuni a better complementor within the constraints of an MSP's ecosystem (e.g., developing innovative approaches (possibly technologies) that enable it to comply better with requirements), and 2) those aimed at Zuni avoiding dependencies by creating products that do not require compliance even though they still may work with an MSP's products (e.g., by using a standard industry interface, or developing products to work with competitive products).

In the first type of innovation within the constraints of an ecosystem, innovations sometimes were product-design-specific (e.g., modifying a product design to be less dependent upon Apple technology) and other times affected marketing and other functional areas (e.g., changing a product's color or advertising). Though Zuni accepted it often needed to be compliant with MSPs' requirements, and realized it had some ability to influence, it also recognized that even with an ecosystem, compliance did not limit flexibility along *all* dimensions. Zuni retained the ability (and necessity) to innovate to differentiate, and understood that although it could become compliant along some product dimensions, it could still innovate along other dimensions that might lead to higher differentiation.

Pursuing the second type of innovation, Zuni also began to innovate with other technologies that had much less or potentially no dependency on ecosystem requirements. These initiatives were aimed at Zuni being able to offer products that would work with an MSP's products, and thus Zuni would still be a complementor, but might not require Apple compliance. A non-Zuni example of this would be if an accessory maker produced a case for an Apple product, but didn't run it through any Apple testing. It would not be able to display the "Made for iPhone" logo, but it also would not be faced with Apple dependencies. Zuni pursued innovation projects that might enable it to also offer products that would work with Apple

products, but not have as much (if any) significant dependencies. Additionally, as Zuni became more mature in its relationships with MSPs, and particularly with Apple, it began to more actively join other ecosystems (e.g., Samsung's) and to innovate in how it operated in new ecosystems to attempt to reduce risks associated with dependencies.

Zuni had always been a technology-centric innovation-focused organization, which was clear from the earliest interviews. At that time, the innovation focus was almost entirely on technological innovation, and not innovating around Apple requirements. A manager explained,

"Our goal is not to become the largest market share or the highest sales dollars. It's around technology innovation, because our philosophy is always that if you can drive that, then the level of profits and margins all come after." (10-28-11)

Thus, Zuni's inclination was to think in terms of technological innovation. As it focused more on products to work with Apple products, Zuni needed to think more holistically about its products. Joining an ecosystem began to affect how Zuni was innovating from a product perspective. Another informant explained,

"... the whole relationship with Apple is quite new... We developed products on our own terms. Now, we have this external force that is coming and giving us nudges to what is right and wrong. As an organization, for the last 30 years, we decided what was right and wrong."(3-15-12)

Zuni started to consider how to balance its need for compliance with its desire for differentiation. An organization member relayed the difficulty,

"As a company, our general strategy is one of differentiation in the marketplace. The challenge with having a differentiation strategy when you are working within an ecosystem, or with a partner, is that we, almost by default, don't necessarily want to do things exactly the way they were put in the specification, or they ask us to." (3-29-12)

As Zuni's role as complementor continued to evolve and it became more sophisticated in its thinking about how to remain competitive and address the dependencies it faced, it realized that although historically it looked to measures of technological performance, it needed to re-

frame its conceptions of performance and focus on other dimensions beyond technology. Zuni innovated by redefining what it considered its primary means to differentiate. A manager said,

"The heart of the product has to be technology. The reason for the product to exist and the reason for it to be in the Zuni portfolio is because it's delivering performance…in the past that was what we focused on and that's what we marketed. What we are understanding now... is that we have to expand our definition of the word 'performance.'" (4-11-13)

Zuni eventually also recognized that becoming part of an ecosystem, and the dependencies associated with that, affected multiple parts of the organization so responses needed to permeate the organization, including affecting product innovation processes. The same manager explained,

"...when we define our product concept up front we have to take into account relationships now. We have to take into account which products are these going to be used with and which parts of the ecosystem do we have to have alignment with?...it's got to be much more tied together?"(4-11-13)

Since Zuni employed a multi-pronged response strategy, the innovation strategy was deployed in conjunction with compliance and influence strategies. For example, as Zuni was becoming an active complementor to other MSP businesses such as Samsung, Zuni recognized it could use its ability to innovate to be more successful at influencing. Although Zuni didn't like being burdened by technical requirements, it came to recognize the value of requirements for increasing interoperability and reducing risk. A manager speculated about what actions Zuni might take to innovate and create its own standards and then influence an MSP to use them,

"They have no ecosystem so we're going to have to probably build an ecosystem for them. We'll probably have to point out to them that there is nothing to develop to, that they don't actually have standards, and so we're going to have to make decisions like: Are we going to make standards and give them to Samsung? …" (5-9-14)

Table 2.4 provides additional examples of response strategies from the data.

Table 2.4 Response strategy data examples

Response strategy	Data example
Compliance	"...we needed to recognize the value of Apple products to our customers. Like I said, when 80 percent of them are using Apple products, if we wanted to continue to grow sales, we needed to make that realization..." (10-25-11)
	"It creates a service issue for us, so we need to come up with a minor tweak to our engineering to work with their systems, if you will." (10-25-11)
	"...in the past we were more than willing to walk away from business. It's not quite the same anymore. We needed this business; otherwise, all of our great technologies were not going to end up being used anyway. … I can honestly say I would not be sitting here in this role and this division would not be doing what it's doing if [Apple] hadn't done what they did." (10-28-11)
	"…we're going to be massively influenced now by the biggest players in this ecosystem. If (platform managers like) Samsung are all of a sudden going to dump $2 billion dollars in marketing around their new device, and guess what, we don't work with it…(sigh)…bad news." (4-11-13)
	"The thing that's happened recently, and we're still ... trying to get our head around this, is that Samsung is emerging as a pretty substantial competitor to Apple in the smartphone space where it seems like they're starting to become the one that's going to bubble up above all the others. That's interesting because now… there's maybe a smaller subset of things that if we could make sure we're compatible with those, then life is good, right?" (5-1-13)
	"So, it's a love/hate relationship with them, you know? Their sales have allowed us to grow ourselves, but they don't make it easy." (4-29-14)
	"... we still make our products [perform] right, but we are either adding in cost or complexity. There are new failure modes that could happen. So, from not necessarily customer-facing but internally we're like, 'We could have made this better. There are more elegant designs'…but we had to do it this way." (5-9-14)
	"... everything that we did was sort of justified in the market context. Like, 'If we don't do this with Apple, we will lose the majority of our business.'" (5-9-14)
	"The only thing special we're doing is we are incorporating the design that they require. So, to use their [technology] there's a certain [technological] approach. There are specifications that have to be in the product to do that. ... So, we do something specific so that it can [work with] an Apple device and we put the little Apple thing on the packaging based on their specifications, but that's it. There's nothing else that we're doing…" (8-26-14)

Table 2.4 (Continued) Response strategy data examples

Influence	"I think our hope someday is to have our engineers speaking with their engineers to generate solutions. And, also, our marketers [to be] speaking with their marketers, although I think that is more pie in the sky… We're not going to really work with them in that sense, but I mean that would be nice if we could mutually solve those types of problems as well." (3-15-12)
	"I mean so once the spec is a spec…I mean so what I will say I've observed is they do actually listen to us and we have some relatively special access to be able to talk to people who will listen and are close enough to decision making, but they occasionally…you know months later they'll come back and say, "Hey, this changed." It's like, 'Oh, okay.' We never know if that's under discussion or it's a closed convers…we don't know what is actually being taken and run with versus just dismissed." (4-25-14)
	"As a company we've made a conscious decision that we're not going to have…not anybody can just reach out to Apple with questions or concerns. They all get funneled through [name]. I'll craft an e-mail that goes to [name] and I'm like, '[Name], this is why we did it,' and he and I will banter back and forth whether or not I was right or wrong because…it's possible that I'm wrong. ...And then we craft that reply together..." (5-9-14)
	"What else has to change is that you need somebody that can go out and interface with them and understand, okay, make the proper impedance match so there's just relationship management and then there's some technical management that has to happen. …the person that's going to take advantage of the ecosystem, in this case Zuni, that has to understand the licensing deal and it has to be maybe a combination of a legal person and/or a licensing specialist and then finance has to be involved because they have to be paid royalties, so we have to figure out how am I going to do this?" (6-2-14)
	"... outside of the just general transactional side I think there's a little bit of bilateral influence going on. We certainly advocated for certain things and even gotten them. They've advocated for certain things and gotten them from us... I mean in the scheme of things they probably…well, they certainly have more power in the relationship but the nature of influence has been reasonably well balanced ... They're incented to build an ecosystem and work with partners so they want to do well." (6-3-14)

Table 2.4 (Continued) Response strategy data examples

Innovation	"...the reason the products are changing is because the applications that they're attached to are changing." (11-8-11)
	"We don't necessarily want to be expert in xyz. And then we had to decide, was that important enough to us? It is. Can't find it. Develop it. And we have the research backing in [parent] where we've got material science groups, we got pure researchers.'" (10-25-11)
	"Honestly, I've worked for three other companies. I've never seen people as passionate about the company, the brand, the products as I have [here]. It's really... it's a beautiful thing. It really is. We encourage innovation in all aspects of our work, not just engineering, but everywhere and, together, we create value for our customers." (11-8-11)
	"We've gone both ways. We've changed products when we've needed to meet their spec, and we've excluded their technology." (3-29-12)
	"... finding the right balance of, you got to do those things to stay in the game, at least some of them, but if you do them all you've got nothing left for the stuff that is why you're better and different than everyone else. And so, that balance worries me." (5-1-13)
	"I don't think the performance part is ever going to go away. I don't think engineering ..., I don't think that will ever go away. I mean that's really, really, really at the heart. The difference is that it's not only that. There are other pieces that are part of it..." (3-14-14)
	"I don't think anything has changed as far as values go. That is actually pretty strong. It can be a hindrance to progress because [values are] used as a crutch. Because people sort of use [values] as an excuse, so people are like, 'Oh, we haven't done it that way in the past because we never do this, this or this.' And it's like, 'Alright, so I just have to frame the problem differently so that it does fall within our values.'" (5-9-14)

Table 2.5 provides examples of how Zuni applied the three response strategies to each of the ecosystem dependencies. The responses along the upper left to lower right diagonal (i.e., complying to cope with technological dependence, influencing to resolve information dependence, and innovating to address values-based dependencies) are the most obvious and

ones that potentially might have been expected. The off-axis responses provide some more surprising and interesting findings and examples. For instance, Zuni's struggles related to compliance in the context of threats to their core values, and Zuni's efforts to innovate to reduce information dependency, show the broader scope and applicability of the framework and highlight how it can be used to uncover more subtle challenges and responses of MSP-complementor relationships, particularly in the presence of power asymmetries.

Table 2.5 Example response strategies mapped to dependencies of ecosystem joining

Response Strategy	Technological dependence	Information dependence	Values-based dependence
Comply	• Comply with specifications (e.g., technical, packaging, business processes)	• Proceed with info received and don't share to influence	• Comply with logo guidelines and work to understand intention of MSP as comply; Focus on interpretation and customer implications
Influence	• Provide feedback to fix and improve specs	• Create liaison process and appoint contact people to negotiate	• Suggest standards and logo compliance guidelines; aim to change intentions and customer experience
Innovate	• Design products that take into account platform requirements and re-define how to differentiate	• Design products less dependent on platform info	• Offer products less sensitive to backwards and forwards compatibility to reduce customer concerns

COMPLEMENTOR MATURITY

Zuni matured as a complementor as it improved its ability to respond to the dependencies associated with joining an ecosystem, adopted new behaviors, and shifted attitudes toward being a complementor. Zuni combined three response strategies (compliance, influence, and innovation) into strategies addressing ecosystem dependency challenges. The relative mix of response strategies Zuni used varied as Zuni became more mature in an ecosystem relationship. Since the data in this study encompass primarily Zuni's relationship with Apple, I use the evolution of Zuni's maturity as a complementor to Apple to distinguish three phases (or stages) of complementor maturity. Leveraging the temporal element of this data, enables me to take a process perspective and identity an arc of stages through which Zuni passes as it becomes more mature as a complementor to Apple. It is also clear in the data that Zuni began to move through similar stages as it joined other ecosystems. In subsequent ecosystem joining, such as with Samsung, Zuni started to move quickly through the phases, but still started at the first phase (rather than starting at a later phase). Using this data set and related analysis, I can identify a strategic process Zuni followed as it aimed to increase its performance through its role as a complementor to Apple.

The data collection for this study took place in three main blocks of time separated by approximately one year each (see Table 2.1 for dates). The identified phases closely align to these time periods since they match well with Zuni's evolution as a complementor. During the first interview block, the focal division had recently started offering products optimized for Apple's ecosystem. Thus, data in this block matches well with Phase 1 since Zuni was very compliance-centric. During the second interview block, the division's product portfolio had

become almost entirely designed to work with Apple products. This corresponds well with Phase 2 since Zuni was working to influence Apple and align products with Apple product launches. However, to more closely match with the data, the second phase spans two interview blocks and crosses from the second to the third interview block. In the early portion of the third block of interviews, the division was still heavily focused on attempting to influence Zuni and build a stronger relationship. During the later time of the third block of interviews, Apple began to more aggressively compete with Zuni by entering its markets. Thus, the third phase starts during the middle of the third interview block when Zuni started more vigorously pursuing an innovation-centric strategy. By the end of this block, with Zuni firmly in Phase 3 of complementor maturity, the data show Zuni more actively focusing on products for other ecosystems and becoming less dependent on technologies, information, and aligning values with Apple.

Various indicators provided evidence as to when Zuni moved through different stages of complementor maturity. For example, during later interviews, informants mentioned organizational structures, liaison processes, and standard operating procedures that had been established to address compliance considerations. Similarly, informants explained routines related to meetings with Apple and the outcomes of these meetings, which provided data associated with Zuni's influencing strategies and accompanying activities. They provided indications of the difficulties associated with working with Apple, gathering information from them, and attempting to modify the constraints under which Zuni was operating.

Phase 1 – Compliance-centric

In the first phase, which I refer to as *compliance-centric*, Zuni expended a great deal of effort reacting to the new requirements imposed on it as it became a more active ecosystem participant.

During this phase, not only was Zuni figuring out how to become compliant, but it was also wrestling with decisions about to what extent it was comfortable with following requirements. Though the phase is called compliance-centric to represent the amount of attention being paid to the notion of compliance, it is important to recognize that some of this effort was, in essence, being directed at figuring out ways not to be compliant. Still, the data shows a good deal of effort being placed focusing resources and attention on how to become compliant. An informant explained the difficulties of compliance:

"…engineering never goes like it's supposed to. Simply being handed a card or handed a spec or handed a requirement... it's not rocket science, but I think it's more work than a lot of people would guess… you can make A work and you can make B work, but when you plug A and B together, you always get unexpected interactions, period."(11-8-11)

A great deal of managerial focus was spent on challenges and tensions related to compliance with various informants mentioning meetings and discussions struggling with performance trade-offs and debates about new design influences and Zuni's willingness to comply with new requirements. Although Zuni was highly focused on technological prowess and product design, during this phase it was grappling with a growing recognition of the need to compromise to participate as a complementor in an MSP ecosystem.

An example of this compliance-centric thinking that moved beyond product design to branding and packaging revolved around ecosystem compliance logos. Zuni strongly resisted adding any other firm's brand to its packaging and struggled with the idea of having to comply with branding requirements. It eventually chose to allow the logos, but this was a highly emotional decision for many of the managers. An informant explained,

"And then the fact that you have to put Apple mandated stuff on your packaging - that made it tougher. One of the things I'm realizing now, it's actually beneficial to be able to do that... So, if I can finally accept the fact that our product is an accessory and not a product, which…don't tell

anybody in the company I admitted that. Then, it behooves the customer at the point of sale to be able to know: 'Can I use this accessory with the thing that I want to use it with?'" (2-8-12)
Zuni became accustomed to including others' brands on its packaging. Contrary to Zuni's initial resistance to logo inclusion, Zuni became so comfortable with this complementor compliance mentality that managers became frustrated when MSPs would not provide logos and guidelines:

"I mean…we're trying to figure out, what is Windows' compatibility? Windows doesn't even know and they won't let us use their icons. So, how can you tell a customer, 'I'm compatible with a Windows phone,' when Windows' licensing team won't even let you use the Windows name or icon on your product?" (2-8-12)

During this phase, Zuni did not emphasize influencing Apple but rather recognized it did not have a relationship with Apple in which it could provide input. An informant explained,

"They're not asking us, 'So, what are you trying to do? What experience are you trying to create?' There's none of that."(10-25-11)

Still, supporting the notion that Zuni was following a multi-pronged strategy, a senior manager noted that Zuni needed to start thinking along the lines of an influence strategy:

"We'll learn from our relationships with Apple to make sure we do things better in the future, but I think at this point everything is moving so fast, we've got to ramp up our ability to contribute to this ecosystem, as well."(2-8-12)

Though Zuni was not significantly innovating against dependencies in this phase, Zuni was starting to develop an innovation response. Zuni senior managers were beginning to think about innovation to address the dependencies. A manager explained,

"It's time for us to start to think about, how can we create a new category? We need to be looking at technology that is not just going to be subservient to them. How can we create an experience that is independent of this ecosystem? Ideally, it would be one that doesn't even need this ecosystem. So, that is actually where I'm putting my creative juices emphasis..." (2-8-12)

Phase 2 – Influence-centric

In the second phase, which I refer to as *influence-centric*, the angst associated with being newly saddled with compliance requirements seemed to abate somewhat. Zuni accepted the need for

compliance and started to learn to work within Apple's processes. One of the key managers explained how they coped with testing requirements,

"...as Apple evolves their products there's increasing amounts of interoperability testing we need to do, but they do a very good job of supporting their devices in a way that maybe there's some slight variation, but largely we do things according to their rules and it works." (5-1-13)

Zuni developed a liaison process with regular meetings, documentation, etc., which enabled less significant senior management involvement in the process. A participant explained,

"So, we have a standing meeting that we call the MFi meeting…some of us were chosen to make sure we fully understand how to introduce a new product for Apple. We sit down and we discuss all the issues that we're having with Apple. We then document all those issues and give them to one of two people." (5-21-13)

In a similar example, the organization accepted the need to include compliance logos on its products, and implemented a process for complying with these requirements (but emotional tension around it remained):

"With Apple it was sort of a…we had to work with them to get permission and to get the logo, pay the royalty; we held our nose and we did all that stuff." (6-14-13)

Compliance continued as an essential response strategy to cope with dependencies, but on a relative basis, management effort towards it was reduced.

With regular compliance-related interactions somewhat under control, and thus increased bandwidth available for other types of response strategies, Zuni continued to mature as a complementor and shifted its attention towards relationship building and influencing circumstances. Zuni was able to place more emphasis on instances in which dependencies caused problems and needed to be substantially addressed. Explaining a Zuni response to a situation that included a technological dependency and a performance trade-off, an informant explained:

"...sometimes it's like, 'Well, that's not what we were going to do and really that's not the best way to do it,' and so we'll argue with [Apple] sometimes, but I gather that we're actually one of the few people that argue with them about that sort of stuff." (5-1-13)

Similarly, a manager explained another interaction in response to a technology dependency in which Zuni influenced the situation:

"So, we went back to them and we said, 'We are not implementing [that technology],' and their reaction was typical which is, 'Why not? We told you to.' And then, we provided data that said it degrades the experience - we cannot do it. They reacted well to that and had us provide data with our measurement techniques... they really appreciated the thoroughness..." (5-21-13)

Another manager emphasized the extent to which Zuni was learning how to submit feedback, work within Apple's systems, and move beyond a simple compliance mentality. He explained,

"...right now we're trying to be more proactive, so not only would we submit a bug report but then we're beginning to improve our network where whoever submitted the bug report will e-mail [a Zuni liaison] and say, 'You ought to bring this up [to Apple] and tell them to reach out to me with a more detailed explanation with data.'" (5-21-13)

While operating in this phase, Zuni also began to more steadily incorporate an innovation response as it started to more specifically recognize how dependencies were causing inefficiencies in Zuni products. While explaining another very specific example of a technological dependency, the same manager explained,

"So now I'm always thinking of ways around that because that annoys me. It just makes the [part of the Zuni product] expensive and it's not value added to the customers... It doesn't degrade the experience but it's not adding value to the customer, so it bothers me that I pay for it when I could use that money elsewhere to enhance the experience." (5-21-13)

Phase 3 – Innovation-centric

Though in Phase 2 the data show examples of Zuni beginning to innovate to avoid dependencies, it is in Phase 3 when Zuni continues its evolution as a complementor and more substantially starts to use innovation as a relatively significant response strategy. In this phase, Zuni places

relatively more management emphasis on innovation than compliance or influencing. Consistent with these behaviors, I refer to this third phase as *innovation-centric*.

In this phase, Zuni seemed to spend less management attention on compliance details because, though the organization still exhibited many compliance behaviors, these behaviors (or routines) had become part of a normal operating mode. As a manager explained,

"We've gotten a lot more mature… There's a lot more organizational ownership of working to their specs. I've set up a whole cross-functional team and they're mostly running on their own. We've got much more internal buy-in that this is what we're doing…we all grump about it sometimes but people understand why we're doing it and we do it …it's just part of our standard work." (4-25-14)

Similarly, yet somewhat counter-intuitively, in this phase Zuni also started to reduce its emphasis on influencing as a response strategy; during Phase 2, Zuni's management emphasis on influencing seemed to have peaked. By Phase 3, senior managers recognized Zuni was not going to be successful in building the type of relationship with Apple to which it had initially aspired. A managed commented:

"So, I think the lesson that we've sort of learned here is…there really isn't a two-way ecosystem. There really isn't something where two companies who are competing in a marketplace really…really want to work together for mutual benefit because one is always bigger than the other." (8-26-14)

Apple had started to aggressively enter Zuni's markets and compete head-to-head with Zuni products. Zuni's influencing efforts reverted to focusing primarily on tactical changes to technical specifications and bug fixes.

Zuni's primary emphasis in this most mature of the three phases was on innovation and determining how to continue to offer differentiated competitive products while living with the dependencies imposed by operating within a large ecosystem controlled by a more powerful organization. A manager explained,

"If I don't pursue these other side opportunities I think the way that Apple has evolved is going to prevent me from getting the growth I need. That's why I need to do it."(8-26-14)

As part of these efforts, Zuni not only focused on innovation within its own boundaries, but also on actively engaging with other ecosystems run by large MSPs (e.g., Samsung, which by this time had emerged as another powerful market leader). Referring to working both with Apple and Samsung, yet also highlighting the need for an innovation strategy, one informant noted,

"I still have to work with Apple. I mean, my god, I still have to make things that work with the Galaxy device. I realize that. But I've got to do more." (8-26-14)

To summarize, Zuni progressed through three phases of complementor maturity. In each phase, Zuni deployed three response strategies (compliance, influence, and innovation) to varying degrees to counteract the effects of dependencies they experienced as they joined an MSP ecosystem. Figure 2.4 summarizes shifts in management attention through the phases.

	Phase 1: Compliance-centric	**Phase 2: Influence-centric**	**Phase 3: Innovation-centric**
Compliance			
Influence			
Innovation			

Key: ● = substantial management attention

◒ = medium management attention

◌ = less management attention

Figure 2.4 Management attention variation by complementor maturity phase

Reading across the columns provides an overview of the relative emphasis on strategies in each phase. In the first phase, Zuni focused primarily on compliance with much less attention placed on influence and innovation. In the second phase, Zuni placed a great deal of emphasis on influencing, and still worked considerably on managing compliance while also starting to increase attention on innovating to respond to dependencies. This phase was the peak time for Zuni's efforts related to influencing. In the third phase, Zuni had shifted its attention to a great extent towards innovating while still placing some emphasis on influencing (mostly around tactical topics like software bugs). In this third phase, Zuni had already established new norms and operating procedures to address compliance, so exerted less management effort on compliance.

Reading across the rows provides a view of how each response strategy shifted through the phases. The compliance strategy started high and steadily decreased in management attention. The influence strategy started low, then increased in the middle, then decreased once Zuni recognized the relationship was not progressing to address strategic initiatives. Finally, the innovation strategy started low when Zuni was heavily focused on compliance, and then steadily increased as Zuni matured as a complementor.

DISCUSSION

In this chapter I explore how mature incumbent firms that join MSP-governed ecosystems as complementors cope with dependency challenges. I highlight three response strategies that employed in combination comprise multi-pronged strategies complementors execute as they pass through three phases of complementor maturity. My theoretical framework illustrates how a less

powerful firm joining an established ecosystem experiences dependencies and then addresses these challenges over time by modifying a hybrid set of response strategies.

A complementor perspective - The vast majority of current literature related to MSP-based businesses and ecosystems focuses primarily on platform managers governing these systems and the various barriers to growing and competing in ecosystems such as the "chicken and egg problem" (Caillaud & Jullien, 2003) and winner-take-all concerns (Cennamo & Santalo, 2013). Scholars have proposed solutions to address these problems that include types of pricing strategies (Hagiu, 2009), governance mechanisms (Boudreau, 2010), and multiple approaches to building and growing ecosystems (Eisenmann, Parker, & Van Alstyne, 2011). By looking at platforms and ecosystems from the perspective of an accessory provider joining ecosystems as a complementor, and focusing on an organizational perspective, I am able to contribute new insights to our understanding of these systems including those related to dependencies, response strategies, and phases of complementor maturity.

Complementor maturity - Recent literature on ecosystem governance has studied technology ecosystems at different stages of maturity considering how ecosystem evolution may affect generativity and innovation of entering complementors particularly in the face of contradictory logics and paradoxical tensions (Boudreau, 2012; Wareham, Fox, Cano Giner, 2014). Wareham, et al. (2014) note that from a population perspective complementor maturity is relevant and they call for further exploration of generativity as ecosystems evolve, but this work does not explore strategic and organizational changes undertaken by complementors as they mature in their ecosystem participation.

MSP-complementor relationships are different from other types of interfirm relationships - Whereas supply chain and alliance researchers study interfirm relationships

similar to complementor relationships that also exhibit joint dependencies with shared risks and outcomes (Gulati & Gargiulo, 1999; Helper, MacDuffie, & Sabel, 2000) and potential asymmetric power dynamics, the MSP complementor relationships studied here have characteristics that distinguish them from these other forms of interfirm relationships. As illustrated in Figure 2.1, MSP relationships exist in a triangular form in which both the MSP and the complementor establish relationships with end customers. In contrast, in supplier relationships and alliances, the focal organization operates in a linear fashion with its suppliers and/or partners whereby one entity (usually the buyer or larger alliance partner) owns the customer relationship and ultimately provides the added value (Brandenburger & Stuart, 1996). In contrast, in complementor relationships, the MSP offers a product or service and the complementor offers a distinctly different product or service (e.g., an accessory product) that builds upon the initial offering to add increased value (Brandenburger & Nalebuff, 1996; Yoffie & Kwak, 2006). The primary difference between linear and triangular form relationships is that in the triangular (MSP) form, the complementor maintains a direct channel to the end customer. Thus MSPs have some similar characteristics to other forms of interfirm relationships, but are distinctly different (see Hagiu & Wright, 2015b for a more extensive comparison of the MSP business form with other business models). It follows also then that dependencies associated with MSP-complementor relationships might be different than those exhibited in other types of interfirm relationships.

Dependencies and responses are different in MSP-complementor relationships - Management scholars have explored responses organizations use to control dependencies in interfirm relationships (Green & Welsh, 1988; Provan & Skinner, 1989; Xia, 2011). Since MSP relationships share attributes with traditional interfirm relationships, it is worth considering

whether dependencies and responses in complementor relationships are different than those in other forms of interfirm relationships. Technological dependencies are evident in linear buyer/supplier relationships in which a buyer can dictate specifications and requirements to a supplier. However, the risks associated with this dependency are different than in an MSP complementor case because contractual guarantees exist between buyers and suppliers, and roles of the two are very clear. Hence, there is less risk that the supplier ends up with unsalable product. In the MSP case operating as a triangle with multiple customer relationships, there is considerable technological dependency and risk because the MSP can unilaterally change specifications. This is principally true when the MSP controls a sizable share of a market. Because both the MSP and complementor have relationships with customers, when the MSP changes technologies, the complementor may be negatively affected as it still needs to manage its relationships with its customers. The complementor's product offerings may potentially become non-interoperable with the MSP's offerings.

As in MSP-complementor relationships, information dependency also exists in buyer-supplier relationships in which suppliers desire more and quicker information from buyers. However, in MSP-complementor relationships, an MSP might have a strategic incentive to withhold information because it is managing across multiple complementors and may be attempting to maintain a "level playing field" across the ecosystem. The MSP might also withhold information when it is competing, or planning to compete, against its own complementors (Gawer & Henderson, 2007). There might be some of this behavior evident in the case of buyer-supplier relationships, in which a buyer might be maintaining multiple sources of a component or item, or might be planning to vertically integrate (Hagiu, 2015a and b). Still, information dependency is likely to be much more pervasive in the MSP context because MSPs

maintain a separate and distinct relationship with customers. They aim to maintain these relationships and need to be sure they do not get commoditized. One of the ways for an MSP to retain power in an ecosystem is by carefully managing information flow and creating information dependencies for complementors, making information dependencies more severe in MSP-complementor relationships.

The same types of dynamics hold true relative to values-based dependencies: they exist in other forms of interfirm relationships, but are different in an MSP context. In buyer-supplier relationships there might be values mismatches between actors, but once the supplier chooses to engage in a relationship with a buyer, these become minimized. In this linear relationship, the buyer will own the relationship with the customer, so the buyer's values related to customer relationships will dominate. In complementor relationships, because the complementor also maintains customer relationships, it is more likely there will be core values divergence and therefore values-based dependencies as evidenced in the Zuni case. Thus, across all three types of dependencies, we see they exist in other forms of interfirm relationships, but they are likely to be more prevalent, and more impactful, in the MSP-context.

The same analysis is relevant for response strategies comparing how we would expect them to manifest in more traditional linear forms of interfirm relationships versus in MSP-complementor relationships. Asymmetries in power affect relationships between firms and their responses to challenges (Dahl, 1957; Emerson, 1962; Nye, 2011). With respect to compliance, a less powerful and more dependent entity must comply with requirements of a more powerful entity. This dynamic is likely to be similar across forms of interfirm relationships in which there is an asymmetric power relationship, including with MSPs. However, again as illustrated by the triangular business model schematic (Figure 2.1) complementors create and maintain

relationships with their own customers, so they retain flexibility in determining to what extent they will comply with MSP-requirements. Still though, the MSP can use mechanisms such as compliance logo branding programs (e.g., Apple's MFi program) to encourage and enforce compliance behavior by complementors. Thus, whereas at first analysis it may seem like compliance is a less relevant strategy with MSPs versus other interfirm relationship forms, the data in this research shows compliance is a dominant strategy early in a complementor's maturity and stays relevant as long as the complementor remains in the ecosystem.

The influence response strategy appears to be quite different in the MSP case versus a linear business model. In most buyer-supplier relationships, a supplier has minimal leeway to influence the requirements of a buyer, though there are some strategic relationships in which a supplier may work directly with a buyer to influence requirements. Still, in the MSP case, the complementor can use its relationships with customers (all of whom by construction are also customers of the MSP) to influence the MSP. Additionally, if the complementor has its own high level of technological (or other functional domain) expertise, as was the case with Zuni, the complementor may be able to use this knowledge to influence an MSP. Further, a high risk of vertical integration by a platform into a complementor's market space affects opportunities for complementors (Gawer & Henderson, 2007; Hagiu & Wright, 2015a and b). An influence strategy might enable a complementor to get an early inclination that an MSP might be considering vertical integration into its market. Thus, an influence strategy is likely to be more prevalent in MSP-complementor relationships versus other interfirm relationships.

Finally, the innovation strategy also appears to be different in MSP-complementor relationships versus traditional linear buyer-supplier or alliance business models. In a buyer-supplier relationship the contractual obligations provide significant restrictions. In an MSP-

governed ecosystem, the complementor can decide along which dimensions it desires to comply and on which it wants to innovate. This can be as simple as choosing to change product colors or marketing strategies, or as technologically complex as switching to adopt an industry standard versus an MSP-proprietary one (e.g., switching to an industry-wide wireless interface standards such as Bluetooth).

In addition to articulating types of dependencies and response strategies in MSP-complementor relationships, this study recognized three phase of complementor maturity. Since these phases incorporate how a complementor employs responses, and these strategies can be different in MSP-complementor relationships versus other interfirm relationships, these maturity phases are also likely to be different in MSP relationships. In sum, the findings show that dependencies, responses, and maturity phases are related to those evident in linear interfirm relationships, but distinctly different. This is primarily due to the triangular nature of complementor-MSP-customer relationships in which both the MSP and customer maintain customer relationships.

Why do complementors choose specific combinations of responses as they mature? - In this study, why Zuni chose the response strategies it did during each phase, and why it moved from one phase to another might be attributed to a number of factors. One plausible set of explanations relates to Zuni's strong and long established organizational identity (Albert & Whetten, 1985). Joining an ecosystem governed by a much more powerful player may have challenged Zuni's identity (Dutton & Dukerich, 1991; Elsbach & Kramer, 1996). Zuni considered itself to be a fiercely independent technology-centric product organization. It also believed strongly in "doing the right thing" and behaving with the utmost integrity. Thus, it is not surprising that as Zuni started to participate in an ecosystem, its first concerns would be those

related to technological performance and complying with the imposed requirements. Additionally, Zuni struggled with the notion of being a complementor and becoming significantly dependent upon other organizations. Early in the study, Zuni's behaviors were consistent with a very independent organization trying to comply, but on its own terms.

As the organization gained experience in the ecosystem, it started to recognize how dependent it had become on another organization and began to more actively test boundaries, resist rules, and work to change them; it moved into the influence-centric second phase. Over time, as the results of the influencing were not progressing to the organization's liking, and the organization became more accustomed to its role in the ecosystem and its ability to be successful as a member, it fell back on its strong heritage and organizational identity characteristics as an innovator. In the later phase, the organization showed signs of having modified some of its identity dimensions. It underwent an attitudinal shift by accepting that it was an accessory provider and dependent upon another organization, but it also adopted behaviors completely consistent with its dominant identity characteristics of being an innovator. Rather than exhibiting a substantial organizational identity shift, Zuni showed organizational identity resilience as its fundamental identity remained.

Reacting to technology-driven change as a complementor - Scholars have long known that organizations find it difficult to adapt to technology-related change (Tushman & Anderson, 1986, Henderson & Clark, 1990; Christensen, 1997) and that managerial cognition plays a role in this inertia (Tripsas & Gavetti, 2000). This study builds on this tradition by empirically exploring over a multi-year period the challenges a complementor organization faced as it joined a technologically driven ecosystem and how the routines, behaviors, and capabilities of the organization evolved. The organization gained experience as a complementor as it became

successful offering products in the ecosystem. It began to accept its role and also learned how to adjust to perform even more effectively within it developing new heuristics and capabilities.

This is particularly noteworthy because accepted wisdom is that significant discontinuous organization change is usually accompanied by executive team change (Tushman & Rosenkopf, 1996). Throughout the duration of this study, the management team of the division did not change; this organization exhibits very little management turnover. It is true and noteworthy that the president of the parent organization had changed soon before this study began and it is likely that executive shift affected the approach of this division. Still, over a multi-year period it was very clear the management team associated with the studied division altered its mental models related to its participation in MSP-governed ecosystems.

Complementor maturity as an ecosystem-specific construct - During the duration of this research, Zuni was joining and participating in multiple ecosystems. However, because of the market dynamics in the smartphone and tablet markets, it made most sense for Zuni to focus its efforts on creating products that worked well with Apple products. Somewhat unfortunately for Zuni, but fortunately for this research, joining Apple's ecosystem imposed more requirements (and thus dependencies) on Zuni than those of Android, Microsoft, or other device makers. The question arises: Were the phases of complementor maturity here relationship-specific or were they applicable to the Zuni such that when it later joined another ecosystem it would already be more mature?

The data indicates that these phases are relationship-specific. The idiosyncratic nature of relationships between complementors, in this case Zuni, and platform managers seems to affect how a complementor moves through phases of maturity. As each relationship is different, it follows that there might be variation in how a complementor manages its relationships with

platform managers. This is particularly interesting in situations, which are becoming increasingly common, where complementors simultaneously compete in a variety of MSP-based ecosystems.

Towards the end of this study, Zuni began to more actively create products to work with Samsung devices as Samsung was emerging as an Android smartphone market leader. When presented with the phases of complementor maturity framework in March 2015, Zuni's general manager agreed that they were in essence operating in Phase 1- Compliance-centric as they navigated their relationship with Samsung. He noted that they would probably move through the phases more quickly than they had with Apple as they joined this second large ecosystem, but confirmed that they were not starting with an innovation-centric mindset. First, they needed to focus on how they were going to address compliance questions, including the possibility of helping Samsung develop standards. Again, Zuni was pursuing a multi-pronged strategy with variable relative emphasis on responses.

Since each MSP is unique and creates its own governance regime, it is reasonable to expect that the phases of complementor maturity would to some extent reset as a complementor joined a new ecosystem. However, it also seems that Zuni underwent attitudinal and behavioral shifts, and gained competencies, as it became a more mature complementor such that it would go through subsequent sets of phases more quickly and more skillfully. The research suggests that these findings are generalizable beyond the joining of Apple's ecosystem and should hold relative to other ecosystems as well. Additionally, though this study included extensive data from one complementor, confirmatory interviews with other industry participants also suggests that the findings should hold for other complementors as well.

FUTURE RESEARCH

A construct not thoroughly covered in this research, yet commonly associated with ecosystem development is that of co-opetition in which an organization joining an ecosystem is both cooperating with, but also competing against, the platform manager (Brandenburger & Nalebuff, 1996; Afuah, 2000). The notion of organizations both competing and cooperating is not a new one (Deutsch, 1968), and organizations operating within MSP ecosystems are often confronted with the dynamic since platform managers have been known to compete with the complementors they enable (Gawer & Henderson, 2007). Because the empirical data in this study provided insights into new frameworks of dependencies, responses, and complementor maturity associated with joining MSP-governed ecosystems, I chose to focus this chapter on internal challenges and responses rather than on competitive dynamics. However, there is great potential to continue this research considering co-opetition dynamics and tying more tightly to existing and emerging research on co-opetition.

Though we can use organizational identity theory to consider when and why an organization might invoke response strategies, this study focused almost entirely on organizational identity in terms of insiders' views of their own organization. An extension might be to include how insiders account for how others perceive them (particularly because there was significant branding work underway during this study) and also how others perceive the organization. Also, since identity theory spans both micro (individual) level and macro (organizational) levels, future research could tie this work more closely to micro identity themes. It could also complement emerging work on ambivalence in organizations (Pradies & Pratt, 2010; Ashforth, Rogers, Pratt, & Pradies, 2014) since that research shares considerations with identity research and also spans micro and macro levels.

Agency and leadership are two topics that also were not addressed in this chapter, but are relevant and would add further insight into how an organization copes with challenges studied here. The general manager played a significant leadership role throughout the time of this study as did one of the senior managers on the team. Yet, organization members had significant autonomy in how they interacted with MSP representatives and interpreted platform requirements. Studying the interplay between leadership directions and de facto strategy development (Burgelman, 1994) in this context would be very interesting.

Though this single case study is appropriate for this topic, this empirical work might also benefit from additional cases. During the course of this research, Zuni was entering multiple ecosystems in addition to its efforts related to Apple. The findings indicate that Zuni was starting to move through similar phases with Samsung and others, thus one option for continued research would be to conduct more extensive fieldwork in the same division as it more aggressively joins additional ecosystems. Another option would be to study another division of the same firm, and yet another option might be to expand the study to other firms in the same ecosystem. A further expansion might be to include accessory or complementary provider firms in additional industries. Finally, although qualitative methods are appropriate to address the research questions here since they are nascent and the theoretical contribution is a suggestive model (Edmondson & McManus, 2007), as the research questions become more well defined, quantitative survey and other methods might provide further insight.

This chapter addresses challenges and responses as organizations join ecosystems. Consistent with the focal case study, it addresses mature incumbent organizations joining ecosystems. Another related research area could investigate challenges faced by organizations that become complementors, but which are not already well established, such as entrepreneurial

ventures. Based on the findings in this chapter, it is reasonable to expect that dependencies encountered by entrepreneurial ventures might be similar, particularly related to technology and information, though possibly less so related to values. The complementor firm might have had less time to establish processes strongly aligned with existing values. Similarly, it is reasonable to expect that response strategies might incorporate compliance, influence, and innovation, but potentially to different extents. Thus, the nature and timing of the phases of complementor maturity might differ.

Additionally, whereas this chapter focused entirely on organizations joining ecosystems, as information constraints continue to decrease and platform-based businesses become increasingly more prevalent (Altman, Nagle, & Tushman, 2015), firms are transitioning from product to platform-based business models and undergoing changes in institutional logics (Gawer & Philips, 2013). Though this is a different transition than ecosystem joining, organizations adopting MSP-based business models are essentially on the other side of the dynamics explored in this chapter as they are imposing dependencies and encouraging response strategies from their complementors. It would be interesting to study organizational changes associated with product-to-platform transitions exploring dependencies, responses, phases of maturity, and organizational identity considerations (see Altman & Tripsas, 2015 for an introduction to this topic).

CONCLUSION

This chapter contributes to the burgeoning research on multi-sided platforms (e.g., Hagiu & Wright, 2015a; Gawer & Phillips, 2013) and that related to business ecosystems (e.g., Iansiti &

Levien, 2004; Adner & Kapoor, 2010, 2015; Kapoor & Adner, 2012; Kapoor & Lee, 2013; Wareham, Fox, & Cano Giner, 2014) by taking an organizational theory approach and elucidating challenges, response strategies, and phases of complementor maturity as organizations join complementor ecosystems. This research extends existing research on complementors (e.g., Cusumano, Myloanadis, & Rosenbloom, 1992; Gawer & Henderson, 2007) in that this is one of the first empirical studies to take the perspective of a complementor entering and participating in these networks to understand the challenges it encounters and its responses. Although most of the platform and ecosystem literature is economics-based and focused on pricing, competition, and governance, this work considers organizational and managerial challenges and identifies three types of dependencies (technical, information, and values-based) confronted by organizations joining ecosystems, three response strategies (compliance, influence, and innovation), and three phases of complementor maturity characterized by the use of these strategies to varying degrees. This is also the first time that dependency, power, influence, and organizational identity theories have been brought to bear to help us understand phenomena associated with platforms and ecosystems.

The dependencies and response strategies articulated in this research are characteristic of MSP-based ecosystem and complementor relationships, and the managerial implications of this work are numerous. The frameworks presented here can be adapted such that managers of complementors starting to join an ecosystem can consider the types of dependencies they might face and how they might respond to them. Technological dependencies map to concerns related to product and service development and delivery. Information dependencies encompass communication-related challenges. Values-based dependencies are related to considerations of identity and culture that are of great concern to organizational leaders. Managers could use these

frameworks to develop their own responses taking into account those presented here. In addition, managers of MSPs can consider these dependencies and responses as they create ecosystems and better understand how their complementors may be affected by their actions and policies.

Complementor firms play a large role in the arena of multi-sided platforms and ecosystems, yet their challenges have been substantially under-explored and researchers rarely focus on the interactions between complementors and platforms. As tablets, smartphones and other devices that rely on complementor products to deliver full functionality continue to grow in popularity worldwide, and firms continue to recognize value in joining ecosystems in which they can offer complementary products, there will be increasing interest in challenges organizations face as they join ecosystems governed by powerful platform managers.

Appendix 2.1 Sample interview guide for semi-structured interviews

Interview Guide
Elizabeth J. Altman – Zuni Field Research Project
November, 2013

OPENING COMMENTS:

- Explain purpose and nature of study: Research for doctoral project – potentially will become dissertation material and academic paper.
- Show consent form
- Some questions may seem odd or farfetched because they may be appropriate for one person and not another; we can skip ones if they don't make sense for this person's role or if they are uncomfortable answering for any reason.
- No right or wrong answers. Interested in their opinions and personal experiences.
- Feel free to interrupt, ask for clarification, criticize line of questioning, etc.
- Would like to ask permission to record the interview for my research purposes.

PROVIDE CONSENT FORM

QUESTION PROTOCOL

BACKGROUND/RAPPORT BUILDING

- **Please tell me a little about your primary role in the business.**

{Follow-ups: Expand on business role, clarify, and ask questions that might help understand organization both from formal and informal perspective…}

- **How long have you been in your current role? In this organization?**

- **Where were you before?**

- **[Ask any appropriate follow-up questions about organizational structure, who reports to whom, etc.?]**

JOINING ECOSYSTEMS

- **Does your business provide any products that work with other companies' products? Can you tell me a little about those products and how this works?**

{Trying to see if they have complementary products and what they might be. If they aren't naming any, but I know they have them, ask about ecosystems, applications, accessories, etc.}

- **Do you have any direct relationships with the makers of those other products?**

{Looking for understanding of whether or not they are "arm's length" relationships where they can just get information such as Software Developer Kits (SDKs) on-line, or whether or not they have interactions with the other company.}

- **How have those relationships changed in the past few years, months?**

{Aiming to see if there has been a transition, particularly in the nature of the relationships. If so, try to find out why. Did the technology change so the products now interoperate more (e.g., one product can control the other)?}

- [OPTIONAL IF WE ARE NOT GETTING THERE…] **I understand that your company has started to supply products that work with Apple [or Samsung] products. Can you tell me a little about when that started and how it is going?**

- **How do you envision they might change in the future?**

{They may know a technology shift is imminent. If I know one is, this is also a way to see how aware they are of what is happening in their ecosystem. Tech shift might require them to license technology from the platform company, or modify products to interface differently.}

- **What are the benefits and challenges that you have with these types of relationships?**

{Interested both in external challenges related to how the companies interact with each other and also internal challenges related to how internally they are dealing with having these types of relationships. Prompt further about the other type if only getting one, but be sure to go far enough with whichever one they mention first.}

  - **Do you consider that your business is participating as a member of any business ecosystems? If so, which ones?**

{Possible prompts: Application developer? Accessory provider? Avoid specific supply chain discussions and focus on complementor roles.}

- **Why does your firm participate in this/these ecosystem(s)?**

- **If only in one, do you plan to be in others? Why did you choose one over another?**

{See if can also determine who is making the decision in the organization.}

- **How long have you been participating in this ecosystem?**

- **Do you know if there are other companies in this ecosystem that produce products similar to yours? If so, how would you compare your company with those companies?**

{Looking for information about competitors; trying to see if they have anything to say about power relationships here also...can probe for this.}

PRODUCT TO PLATFORM TRANSITIONS

- **I am also interested in product to platform transitions. Are there any efforts underway that you are involved in where the organization is moving to be more platform-based?**

- **Do you need to incorporate technology from other firms into your products? If so, how is that relationship structured and managed?**

{e.g., licensing? Software developer kits (SDKs)? etc.}

- **Do you enable others to incorporate their technologies into your products? If so, how is that relationship structured and managed?**

- **Are there interfaces that you are opening that enable others to work with your technologies? Please tell me about these.**

{Follow-up with questions related to APIs and SDKs, and trade-offs of the two. Anything related to who is the platform versus who is in the ecosystem.}

- **What are the challenges related to these transitions?**

- **Are you creating any developer ecosystems?**

- **Do you think there are challenges particularly because your company is an incumbent firm in these markets?**

- **Do you need to incorporate technology from other firms into your products? If so, how are those relationship structured and managed?**

{e.g., licensing? Software developer kits (SDKs)? etc.}

- **Do you enable others to incorporate their technologies into your products? If so, how are those relationship structured and managed?**

- **Have you had to address questions related to how open or closed a platform might be?**

- **In what way?**
- **What are the considerations?**
- **Challenges?**
- **Successes?**

INTERNAL/ORGANIZATIONAL SPECIFIC

- **Have you had to make any changes in business processes as you have started to work in the ecosystems we discussed earlier, or started to create these platform-based businesses?**

{e.g., in product development processes, in financial systems, in HR, etc.}

- **Any changes related to interfaces?**

- **Have you had to make internal organizational changes? If so, how were these changes received by the organization?**

{e.g., Team organization, recruiting, retention, training, compensation?}

- **Have you had to make any changes relative to how you work with external parties? Developers, for example?**

- **How successful or unsuccessful have any of these changes been?**
  - **What are the biggest challenges with the changes?**
  - **What are some of the greatest accomplishments?**

- **Has goal setting changed if at all?**

IDENTITY AND VALUES RELATED

- **What is most important to you about being an employee of [***company name***]?**

- **What are you most proud of related to [***company name***]?**

- **What are you most frustrated by?**

- **What do you think [***company name***] stands for?**

- **What is most rewarded at [***company name***]?**

- **What do you think employees here value most about [***company name***]?**

- **Have these changed in the last year? Two years? Three years? (with appropriate pauses)**

- **Can you think of anything that has caused changes to the above?**

- **How would you describe the overall mission of this organization?**

- **If you were to describe the values that people share in this organization, what would they be?**

  - **Is there any part of this values discussion that is relevant for joining ecosystems**

        - **Do any of the values help with these transitions?**
        - **Hinder them?**
    - **Is there any part of this values discussion that is relevant for product to platform transitions?**
        - **Do any of the values help with these transitions?**
        - **Hinder them?**

EMPLOYEE MORALE AND LOYALTY

- **On a scale of 1-7, will you please tell me how satisfied you are working at this organization?**

- **For how much longer do you think you will work at this organization?**

- **On average, how long do you think most of your co-workers plan to work here? Can you provide me with a range?**

EXTERNAL FOCUS

- **How do you think customers view [***company name***]?**
    - **What do you think would be the first three things a customer would say if I asked them to describe [***company name***]?**
    - **Have these changed in the last year? Two years? Three years? (with appropriate pauses)**
    - **Can you think of anything that has caused changes to the above?**

- **[If appropriate]: How do you think developers view [***company name***]?**
    - **What do you think would be the first three things a developer would say if I asked them to describe [***company name***]?**
    - **Have these changed in the last year? Two years? Three years? (with appropriate pauses)**
    - **Can you think of anything that has caused changes to the above?**

ADDITIONAL PROBING

- **What are the biggest challenges you see your business facing both in terms of what we have been talking about, but also more broadly? Relative to your business role, what keeps you up at night, if anything?**

- **Is what we have been talking about important to your business or are there other more pressing issues?**

SNOWBALL SAMPLING

Are there other people in the organization, either on your team or elsewhere, with whom you think it would be beneficial for me to meet?

THANK YOU

- **Thank you very much.**
- **Look forward to staying in touch as the research progresses.**
- **If you have any questions for me, feel free to contact me.**
- **If you think of anything more that you think we should have discussed, please let me know.**

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Chapter 3: Product-to-Platform Transitions: Organizational Identity Implications

Elizabeth J. Altman and Mary Tripsas

ABSTRACT

Organizations are increasingly recognizing that value they once derived from offering stand-alone products can be significantly enhanced if they transition to platform-based businesses harnessing innovative capabilities of complementors. Whereas the competitive dynamics of platform-based businesses have been studied extensively in the economics and strategy literatures, the organizational implications of shifting from a product- to a platform-based business model remain relatively unexplored. We propose that such a shift is not simply an operational change but may challenge the core of how an organization views itself, calling into question organizational identity. Organizations that define themselves as creative and innovative may have trouble accepting a platform-based context in which outsiders engage in creative activity on their behalf. Organizational identity can also influence whether and how organizations become platform-based. To succeed, organizations must question elements of their existing identity and actively modify it to become consistent with their new business approach.

Keywords: *organizational change, organizational identity, multi-sided platforms, ecosystems, complementors, managing innovation*

INTRODUCTION

The ability of organizations to innovate and adapt to changes in the external environment is a critical component of competitive success. Historically, scholarship has focused on understanding the challenges of technological innovations that require organizations to master new scientific disciplines and develop new competencies (e.g., Henderson & Clark, 1990; Tushman & Anderson, 1986). More recently, scholars have started to explore the role of business model innovation (e.g., Casadesus-Masanell & Ricart, 2010; Zott & Amit, 2008). In particular, organizations in many industries have adopted platform-based business models in which, rather than simply sell a product, organizations manage multi-sided platforms that "get two or more sides on board and enable direct interactions between them" (Hagiu & Wright, 2013). Some platforms, such as mobile phone app stores, connect producers of a complementary product (e.g., developers) with consumers, whereas others serve as marketplaces that connect buyers and sellers of goods (e.g., eBay) or match users (e.g., dating platforms). Platforms enable direct interactions between both sides, but each side also typically has a relationship with the platform provider. These relationships range from less formal interactions, such as single people signing up for an account on a dating site, to formal economic contracts such as application software developers registering with a smartphone manufacturer's developer website and then selling software via an app store. Figure 3.1 provides a schematic representation of this type of business.

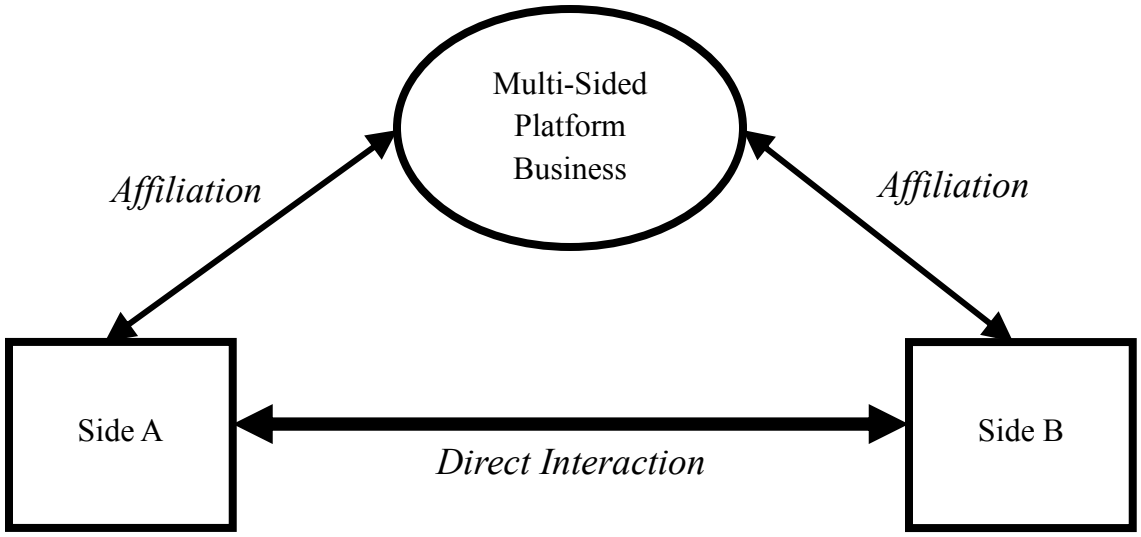


Figure 3.1 Multi-sided platform business model schematic

The traditional yellow pages directory is a classic example of a multi-sided platform-based business enabling buyers and sellers to search for (and then interact with) each other, yet both buyers and sellers are also customers of the yellow pages provider (Evans, 2003; Rysman, 2004). eBay is a more modern example of a multi-sided platform-based business: Buyers and sellers interact directly with each other (i.e., a seller pays a buyer directly when buying an item), yet the interaction is enabled through eBay. Both sellers and buyers are affiliated with eBay; sellers pay eBay a fee, and buyers have a registered account on the site. The videogame industry provides a hardware- and software-centric example. Manufacturers sell videogame consoles to consumers, and game titles are developed by both console manufacturers and independent producers. Consumers can buy games from manufactures or directly from third-party producers through console manufacturers' websites (e.g., www.microsoftstore.com/) and other venues. Thus, the videogame console manufacturers enable interactions between consumers (one side)

and game producers (the other side); the game producers offer a complementary product that enhances the value of the game consoles. Multi-sided platform firms are now primary players in a variety of both online and offline industries that include mobile phones, tablets, personal computers, on-line retailing, credit cards, media, innovation contests, financial services, and shopping malls (Eisenmann, Parker, & Van Alstyne, 2011).

Although some of these markets have existed for a long time, current technological advances are making these industries and organizations increasingly relevant (Gawer, 2009). Leveraging the declining costs of information processing, storage, and communication and the associated increasing penetration of broadband Internet and computing, organizations in many industries are expanding their innovative activities by engaging with external communities, frequently through platform-based business models (Altman, Nagle, & Tushman, 2015). In addition, with the widespread adoption of technologies such as software operating systems that enable external development of applications and other complementary services, industries that were traditionally composed of single-sided, product-based businesses now consist of organizations adopting platform-based business models. Even the automotive industry has recently moved in the direction of multi-sided platforms, with firms like General Motors creating new structures such as their developer ecosystem program. This program facilitates interactions between consumers and external software application developers, such as those building apps that enable drivers to communicate with their cars remotely or that track mileage for business expenses (Trop, 2013).

As multi-sided platform-based businesses have become ever more relevant in the global economy, researchers have increasingly focused attention on topics related to their growth and management. The competitive and strategic implications of multi-sided platforms have been

studied extensively in the economics and strategy literatures, including modeling of pricing, competitive dynamics, and growth strategies (Armstrong, 2006; Rochet & Tirole, 2006). However, the organizational implications of shifting from a product-based to a platform-based business model remain relatively unexplored.[31]

In particular, the implications of this transition for organizational identity and the role of organizational identity in guiding the transition are not well understood. Yet, these transitions can affect the essence of how an organization views itself and operates. If an organization attempts to make a product-to-platform transition without taking into account the implications of identity, problems may arise. If organizational identity does not evolve to accommodate the activities and beliefs that accompany a platform-based business, dissonance may result between those involved in building the platform-based business and those historically involved in the product-based business, inhibiting an organization's ability to successfully transition. At the same time, some aspects of organizational identity may influence the type of platform-based strategies a firm utilizes. In this chapter, we explore the relationship between movement to a platform-based business model and organizational identity.

ORGANIZATIONAL IDENTITY

We conceptualize organizational identity as a shared understanding on the part of organizational members about "who we are as an organization." It represents what individuals believe is central to and defining about their organization, often in contrast to other organizations (Albert & Whetten, 1985; Corley, Harquail, Pratt, Glynn, Fiol, & Hatch, 2006). Organizational identity manifests in two ways. First, organizational identity can address the question, "How do we

[31]In this chapter, when we refer to transitions from product-based to platform-based business models, we also include those that might be from merchant-based to platform-based models. We see this in the case of Amazon, which shifted from being entirely merchant-based to including platform-based offerings.

define what business are we in?" This aspect of identity is often expressed by claiming membership in a particular product market or industry category (Glynn & Abzug, 2002). For instance, Koch Industries was defined as an "oil and gas company" (Barney, 1998), and Linco as a "digital photography company" (Tripsas, 2009). Second, organizational identity can consist of a set of attributes that members collectively believe are core. For instance, in their study of the New York Port Authority, Dutton and Dukerich (1991, p. 526) listed a set of six attributes that organizational members identified as distinguishing their organization. These included items such as being "a professional organization . . . , ill-suited to social service activities," and being "ethical, scandal-free, and altruistic." Similarly, in their study of a unit that was spun off from an established firm, Corley and Gioia (2004, pp. 185–186) found that key elements of the unit's identity included being a "younger, more agile competitor than [Bozco,] 'an industry founder,' 'an aggressive competitor,' [and] a ground-breaking marketer."

Because organizational members have a shared understanding of "who we are," there is also an implied agreement about "what we do" (Navis & Glynn, 2011). Organizational identity therefore creates a clear set of expectations about what constitutes appropriate action. These expectations often result in a set of heuristics and routines that guide and coordinate organizational action (Kogut & Zander, 1996). Interpretation of the external environment is filtered through the organization's identity, providing a common ground for decision making (Tripsas, 2009).

Although organizational identity can serve as a guidepost that unifies an organization, it can also create conflict. Actions inconsistent with the organizational identity result in discord and dysfunctional behavior within the organization (Elsbach & Kramer, 1996; Golden-Biddle & Rao, 1997). Kraatz and Zajac (1996) found that when liberal arts colleges adopted vocational and

professional programs that were inconsistent with a liberal arts identity, those programs were denounced by key actors. In addition, if a firm violates the norms and expectations that outsiders have for a given product market category, the firm loses legitimacy (Benner, 2007; Zuckerman, 1999, 2004). For instance, Zuckerman (1999) found that securities analysts provided less coverage to firms that did not conform to generally accepted categories, and the share prices of those firms suffered.

Managing identity effectively can help increase an organization's flexibility in response to environmental shifts. For instance, in contrast to Polaroid, which maintained a narrow identity as an instant photography company, Fujifilm redefined itself as an "information and imaging" company, an identity that encompassed digital imaging activities and made those activities legitimate in the eyes of organizational members (Tripsas, 2013). Scholars have also shown that proactive, planned changes in identity are often necessary to effectively accomplish other types of organizational or strategic change. For instance, Gioia and Thomas (1996), in their study of institutions of higher education attempting to become more business-like, found that articulation of a new, desired future identity was important in managing the transition.

MULTI-SIDED PLATFORMS

With multi-sided platform firms gaining in prominence, there has been a focus on this organizational form in the field of economics, with roots in industrial organization (Armstrong, 2006; Boudreau, 2010; Rochet & Tirole, 2006). Research can be grouped roughly into two segments addressing two broad areas of strategic choice. The first relates primarily to competitive dynamics and examines the implications of network effects on pricing and growth strategies. The second addresses platform governance and covers questions about how open a

platform should be, whether standards should be proprietary, and the establishment of criteria for interacting through a platform.

Competitive Dynamics and Network Effects

From an economics perspective, one of the factors that distinguishes a platform-based business from a product-based business is the presence of network effects, also sometimes referred to as network externalities (Hagiu & Yoffie, 2013). Network effects are present when the value of a product or service increases as others utilize that product or service and expand the size of the network (Katz & Shapiro, 1985). Network effects are said to be direct when the source of increased value is direct connections among members. The classic historical example is a public telephone system: Having more people to call increases the value of the system to each individual who has a telephone.

There are also systems that exhibit what are referred to as indirect network effects, in which the source of increased value for customers is the greater number and variety of complementary products and services that are available when more customers use a product. A classic example is the computer hardware/software paradigm: As more users adopt a particular type of hardware, such as a personal computer or videogame console, more software will be developed for that hardware (Katz & Shapiro, 1994). Indirect network effects are also sometimes referred to as "opposite side network effects" because the value to an individual member on one side is affected by the actions of members on the other side of the network.

Multi-sided platforms are most affected by indirect network effects: The larger one side of a platform becomes, the more value is created for actors on the other side of the platform.[32] For instance, the availability of more high-quality applications for a smartphone platform is beneficial to consumers, and the more consumers there are on the platform, the more attractive the platform becomes to application developers (Armstrong, 2006; Hagiu, 2009; Rochet & Tirole, 2006). Empirical research has demonstrated the strength of these network effects in the yellow pages (Rysman, 2004), the personal digital assistant (PDA) industry (Nair, Chintagunta, & Dubé, 2004), the video cassette recorder (VCR) industry (Cusumano, Mylonadis, & Rosenbloom, 1992), and the videogame industry (Clements & Ohashi, 2005). In some cases, network effects are so strong that a "winner take all" phenomenon is at play and the market "tips" in favor of the dominant platform (Arthur, 1989; Cusumano et al., 1992; Shapiro & Varian, 1998).

Given the strength of network effects, much of the research related to platforms has focused on how firms can quickly build critical mass on both sides of the platform to get a feedback loop started (Evans, Hagiu, & Schmalensee, 2006; Gawer & Cusumano, 2002; Parker & Van Alstyne, 2005; Rochet & Tirole, 2003). This is sometimes referred to as the chicken-and-egg problem, or getting the flywheel going, and it addresses the challenges of getting early adoption (Caillaud & Jullien, 2003; Evans, 2009). Scholars have shown the effectiveness of a number of approaches to growing a platform when network effects are in place. These include

[32]Economics scholars disagree about whether, strictly speaking, the existence of network effects is necessary for an entity to be considered a platform. However, because we are studying product-to-platform transitions and the platforms of most interest to us tend to have indirect network effects as a defining characteristic, we center our discussion on platforms that contain network effects (Katz and Shapiro, 1985; Rochet and Tirole, 2003; Gawer, 2009). Additionally, in this chapter, when we use the generic term *network effects*, we are in most cases referring to indirect network effects.

pricing strategies, potentially including subsidization, and providing free services to some participants on the platform.

To achieve early growth, firms may cut prices to generate demand. In a formal model of two-sided markets, Caillaud and Jullien (2003) focused primarily on e-commerce marketplace platforms and found that effective pricing strategies were in the mode they called "divide-and-conquer," where the firm subsidizes one side and recovers the loss on the other. Parker and Van Alstyne (2005) extended this work by addressing the question of which side of the platform is optimal to subsidize. Using a formal model, they show that in two-sided markets comprised of content producers and consumers, the best approach is to subsidize the side of the market that contributes more to demand for the other side.

Another approach to jump-starting a platform is to provide free technical support to either or both sides. For instance, to encourage adoption of the Postcript standard, Adobe Systems provided laser printer manufacturers with a free boilerplate reference design for a Postcript interpreter and also gave technical support to application developers who wanted to create Postcript output (Tripsas, 2000). Parker and Van Alstyne (2005) illustrated the theoretical justification for this approach in their model; they found that firms can profitably invest in developing products they give away for free (e.g., application development toolkits) because doing so increases the number of providers on one side of the platform (e.g., number of application developers), which drives demand on the other side of the platform (e.g., end-users), and the revenue from the enhanced demand more than covers the cost of development.

While platforms need to obtain the appropriate level of participation to start their growth engines, the dynamics related to gaining a "critical mass" of adoption vary (Evans, 2009). For some markets, such as dating platforms, organizations need to secure critical mass of both sides

at launch to succeed. There are yet other cases in which organizations may need to make pre-commitments to one side to entice them to invest in the platform. For example, in the case of hardware/software products such as console-based videogames, hardware providers (console manufacturers) need to convince software developers to invest in product development (creating videogames) before the console is on the market and proven to be a hit with consumers. Hardware providers must provide enough pre-release confidential information to convince developers to invest or provide financial guarantees to catalyze demand for the console (Evans, 2009).

Multi-sided Platform Governance and Management

Scholars have also addressed platform management questions, such as to what extent a platform should be open or closed and how to manage the quality of contributors to a platform. The distinction between open and closed is not straightforward, because there are varying degrees of openness (Baldwin & Woodard, 2009; Boudreau, 2010). Although organizations that have decided to provide a platform-based offering have already chosen to be open, at least to some extent, by enabling others to transact through their offering, there are still many choices related to the level of openness they are willing to allow and the means with which they achieve it.

For example, organizations that offer closed, self-contained software products and decide to transition to a multi-sided platform-based business model need to decide to what extent to open their software and how to enable complementors (developers) to interact with their products. One such decision, which is tactical but may have significant strategic consequences, is whether an organization is going to offer application programming interfaces (APIs) and/or a software developer kit (SDK) to developers. Decisions about whether and how to offer APIs and

SDKs highlight trade-offs between open and closed access, flexibility for developers, and ease of access for developers, all of which reflect an organization's stance toward moving to a platform-based business model. An API is essentially a set of specifications and rules that explain how to interact with and access software code. The act of "opening an API" means that the organization is providing access to code for developers and is a step toward openness. An SDK is a set of software development tools for designing apps on a particular system; it typically includes one or more APIs (and possibly software code for accessing those APIs). The tools that are part of an SDK may provide structure and guidance for developers but only proscribed access to the code. Thus, although they may deliver significant assistance to developers, this may come at the expense of constraints on access, which may limit creativity and flexibility. Decisions about which APIs to offer, whether or not to include an SDK, and what form the SDK should take are examples of practical decisions that an organization transitioning to a platform model needs to make that set the stage for the level of openness the organization is willing to allow for its complementors.

Organizations must choose between developing their own proprietary standards through which to interact with others and adopting industry standards. West (2003) noted that firms have an incentive to follow closed, proprietary strategies that can provide better barriers to imitation, higher margins, and more control (because they do not necessitate interoperability with other standards). However, there are frequently technical and economic considerations that force organizations to move to either open or hybrid strategies. For example, to balance the creation and capture of value, when Adobe Systems introduced the Postcript "page description language" and font standard that allowed software applications to communicate with laser printers, it was both open and closed. To increase adoption of Postscript and thereby create value, it was open to

application developers. As Charles Geschke, one of the founders, explained, "We made a decision early on that the standard itself—the documentation for how you describe the page—would be open, freely available and we would publish it. We would retain the copyright and the trademark, but we would make the interface open to anyone" (Tripsas, 2000). To capture value, however, the standard was closed, in that Adobe did not disclose the technology for interpreting the Postscript language in a laser printer. Laser printer manufacturers had to pay to license the controller technology from Adobe.

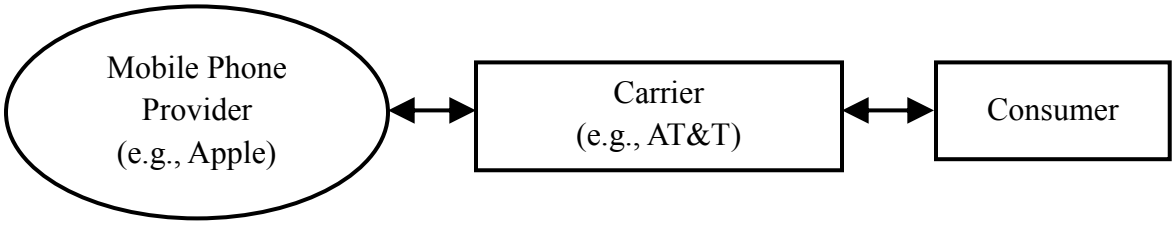
Another topic related to multi-sided platform governance is how organizations keep out unauthorized or low-quality contributors through a regulatory role. In the videogame console industry, Atari suffered from allowing too many poor-quality games into their ecosystem. Nintendo later solved the problem through deploying a security chip that enabled only authorized games to work with their systems (Boudreau & Hagiu, 2009). Similarly, Apple addressed this problem when they introduced their App Store by maintaining the ability to remove inappropriate applications such as the "I Am Rich" $999 app that didn't provide any useful functionality (Boudreau & Hagiu, 2009). With the introduction of topics such as the regulatory role that multi-sided platform-based businesses play, this research is starting to address more management-related issues.

PRODUCT-TO-PLATFORM TRANSITIONS

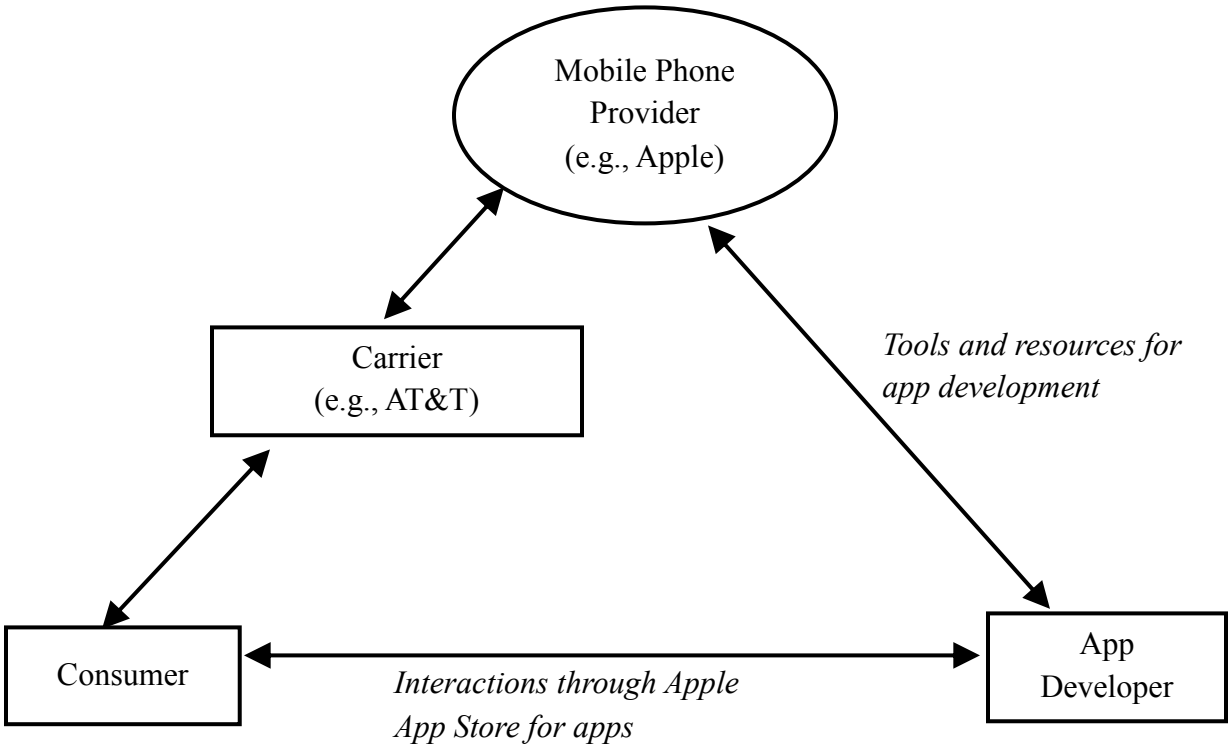
Some organizations are born platform-based. eBay was founded as an online auction and shopping website with the aim of connecting buyers and sellers; Match.com was initially started as a test site for a newspaper classified advertising system with the explicit goal of connecting individuals. In such cases, from the start of building the business, a management team can take

into account that there are multiple sides of the platform to be served. The activities of the organization can be aligned with creating a platform-based business or marketplace. However, in some instances, organizations start as product-based, directly providing complete products to customers, and then transition to multi-sided platforms that enable other entities to transact with each other. As technologies are evolving such that products and services are becoming more receptive to complements, product-based organizations are increasingly finding themselves in situations where they need to transition to being platform-based to remain competitive.

The mobile phone industry exemplifies a historically product-based industry that has become platform-based as mobile phones have become technologically more sophisticated such that consumers add after-market applications (apps) to increase a smartphone's functionality. For many years in the United States, firms in this industry thrived by selling basic mobile phones (called feature phones) to network carrier customers (e.g., Verizon Wireless), who then sold them to consumers. Firms that developed feature phones created most of the innovations and features in their own R&D laboratories or contracted directly with developers to embed new technologies in phones before they were shipped. As microprocessor technology evolved such that programmable operating systems could reside on inexpensive mobile devices, smartphones that could run apps began to substitute for feature phones. With smartphones, consumers could procure their own apps and add them to their devices to increase functionality. With the widespread proliferation of smartphones, most firms in this industry now operate as multi-sided platform-based businesses. They enable consumers and software app developers to interact through an intermediary (e.g., the Apple App Store, Google Play marketplace). Figure 3.2 provides a schematic representation of this transition.



Product-based Business Model



Multi-Sided Platform-based Business Model

Figure 3.2 Example of transition from product- to platform-based business model

As organizations make this change, they not only need to modify their product or service offerings, but they also need to modify the activities that support these offerings. We next describe the primary activity-related changes that organizations undertake as they transition from being product- to platform-based (Table 3.1).

Table 3.1 Product-based versus platform-based activities

Product-based Activities	Platform-based Activities	Example
Provide the best product	Develop best network of complementors	**Amazon**: From providing best selection of books to providing best selection of vendors offering both new and used books
Maximize product profit	Drive platform adoption	**Adobe Systems:** Offering Acrobat Reader for free to drive adoption of Acrobat software that creates PDF files
Maximize units sold	Maximize transactions enabled	**Amazon**: From books sourced and sold to revenue shares of transactions enabled and hosting fees

From Providing the Best Products to Developing the Best Network of Complementors

In product-based businesses, an organization's goal is to develop products that best meet customers' needs. The organization that offers the most value to customers—the best product given its price—will generally outperform others in the marketplace, all else being equal. Organizations, therefore, focus their efforts on gaining a deep understanding of customer needs and segmenting the market so that they can target products effectively.

In platform-based businesses, the value created for a customer is dependent not only on the quality of a particular product but also on the number and quality of the complementors. What matters is the volume of participation on the platform and the strength of the network effects. Rather than focusing exclusively on developing superior technology to have the best

product performance, organizations need to develop structures to identify and attract the best complementors to grow adoption of their platform. In the videogame console industry, for instance, having a blockbuster game such as Electronic Arts Tiburon's "Madden NFL" or Activision's "Call of Duty" available to run on a firm's platform is just as important as including features such as superior graphics capability of a gaming console. Organizationally, in some cases, a separate group may be developed with professionals who are adept at working with this second type of customer (e.g., with developers). Policies for this new group, such as compensation, may also need to be modified to align with and provide proper incentives for serving these complementors.

From Maximizing Product Profit to Driving Platform Adoption

It takes time to build a critical mass of users in a platform-based business. In addition, many of the short-term strategic moves that organizations make to encourage adoption, such as cutting prices or giving products away for free, result in losses. The goal is to maximize the number of customers participating on each side of the platform, even if this means losing money in the short term. This type of behavior is in direct contrast to accepted norms of product-based businesses, in which profits and profitable growth are primary (and usually short term) goals. Shifting this behavior is important, but not without controversy.

After developing Postscript, Adobe Systems started to compete aggressively in the shrink-wrap software business with products such as Photoshop and Illustrator. Then, in 1993, the firm introduced the Acrobat software system, which required two types of software: one product to create PDFs and another to read them. When Adobe introduced the software, the products lost money for about 4 years. Initially, Adobe charged for both types of software:

people who just wanted to read PDFs paid between $35 to $50 for Acrobat Reader software, and those who wanted to create PDFs paid $195 for simple Acrobat creation software or $695 for the full-featured Acrobat product. Eventually, to encourage adoption, Adobe changed its approach and offered the Acrobat Reader software for free. Essentially, they needed to incentivize one side of the market to adopt the software, so they subsidized it. As Adobe founder, John Warnock, explained in a recent interview, "The board questioned [the decision.] 'You're going to give the Reader away?' I think it was one of the first instances of giving software away" (Adobe Acrobat at 20, 2013). Other Adobe software packages, such as Photoshop, followed a more traditional product-based model, and the contrast with Acrobat created internal organizational conflict. Warnock noted, "We had meetings where [the managers of] other applications, like Photoshop, [would say], 'Why in the hell are we spending a dime on Acrobat when we make all the money?" (Adobe Acrobat at 20, 2013). However, providing the Acrobat Reader for free created a large base of users that could consume PDF content and therefore helped increase demand for Acrobat PDF–creation software. Acrobat eventually became one of Adobe's most profitable lines of software, and 20 years after its launch, the PDF format is still a dominant means for exchanging documents.

From Maximizing Units Sold to Maximizing Transactions Enabled

Two conventional measures of success for product organizations are units sold and market share. Employee compensation, bonuses, and award structures are often based on these numbers, and individuals typically make decisions with the goal of maximizing sales profitably. As an organization transitions to becoming platform-based and starts to enable others to transact with its traditional customers, other, nontraditional metrics may become relevant.

In 1995, Amazon began as an online book seller that procured books from publishers and sold them to consumers. In 2000, the Amazon team launched Amazon Marketplace, which allowed other businesses to sell merchandise, in an integrated fashion, on Amazon's website. The shift also meant that a portion of Amazon's traditional sales would likely be cannibalized because buyers could easily purchase from competitors through Amazon's main website. In fact, over time, the volume of sales through Marketplace affiliates grew to the point that it became a significant portion of Amazon's overall business. Although Amazon's profit on individual Marketplace transactions was lower, the overall number of transactions increased. In addition, by simply collecting a royalty payment and not holding inventory or incurring logistical costs associated with physical handling of goods, Marketplace became highly profitable. With the new platform-based model, however, prior metrics for measuring success, such as units sold and market share, might no longer be adequate. Instead, metrics such as number of merchants participating in the program, number of transactions, or aggregate royalties might be more relevant.

PLATFORM TRANSITIONS AND ORGANIZATIONAL IDENTITY

When an organization transitions from being primarily product-based to being platform-based and adopts new activities and behaviors consistent with this transition, there are important implications for organizational identity. Given dramatic changes in "what we do," the answer to the question, "What business are we in?" may change. Similarly, new activities associated with platforms may be inconsistent with existing identity attributes, and this may cause discord if left unresolved. In the following section, we explore how specific aspects of identity may be challenged by the shift to a platform-based business model (Table 3.2).

Table 3.2 Example implications of the shift to platforms on organizational identity

Product-based Identity	Platform-based Identity	Example
Merchant bookseller	Marketplace	**Amazon:** Bookseller to marketplace
Technology driven	Business development focused	**RIM/Blackberry**: Early history from internally product driven to third-party application business development focused
End-user service oriented	End-user and complementor service oriented	**Amazon**: From focused on serving consumers only to focusing on consumers along with other merchants
Creative	Disciplined	**Canon:** Impact of display size design changes when there is not a community of complementors versus when there is one
Self-reliant	Team player	**Nokia**: Difficulty transitioning to a platform-based industry

From One Definition of the Business to Another

As organizations evolve, their identity claims also sometimes shift. For instance, as it extended its product line from memory cards for digital cameras to include flash drives, Linco went from defining itself as a digital photography company to defining itself as a memory company (Tripsas, 2009). After breaking away from AT&T and the Bell System, US West went from being part of a telephone company to "not a telephone company" to a "multimedia company" (Sarason, 1998). Similarly, the transition from a product-based to a platform-based business is likely to imply a shift in how an organization defines its business—in other words, what category claims it makes.

When Amazon started operations as a bookseller, Jeff Bezos, the founder, referred to the company as "Earth's Biggest Bookstore" (A Retail Revolution Turns 10, 2005). Consumers

visited Amazon's website, searched for a book, and then ordered it from Amazon. Amazon took the payment from the customer, procured the book, and sent it to the customer. Amazon was a straightforward online merchant (Hagiu, 2007). Although the business model was innovative at the time, the sales transaction still occurred simply between the end customer and Amazon. When Amazon launched its Marketplace initiative, allowing third parties to sell goods through Amazon's platform, the business model shifted from a pure merchant model to a combined merchant and platform-based model. Given this major change in "what we do," Amazon broadened its identity claims to encompass being a marketplace for books and many other types of goods. Today, Amazon's website lists as its mission, "To be Earth's most customer-centric company where people can find and discover anything they want to buy online" (Amazon Inc., 2015).

By changing the answer to "what business are we in?" through both modifying its business activities and claiming membership in a different or broader industry category, a firm can alter what is considered legitimate behavior. In Amazon's case, the organization expanded its strategic mission and modified its claims to support that expansion in alignment with its new activities and behaviors. This sort of shift in organizational identity may be particularly important when moving from product- to platform-based businesses given the significant changes in "what we do."

From Technology Driven to Business Development Focused

In many organizations, the prominence of a particular functional area is a key identity attribute. For instance, Fiol (2002, p. 654) discussed the transformation of a large information technology organization from an "engineering-driven data storage company [with] a primarily hardware,

engineering mind-set to a mind-set of information management and storage solutions." Similarly, Nag, Corley, and Gioia (2007, p. 822) explored how one telecommunications organization moved "from an engineering-oriented ('technology-push') R&D organization into a business development–oriented ('market-pull') R&D organization." In each of these cases, organizational members had originally considered the firm's technical skills and accomplishments to be defining characteristics; then, through an identity transformation process, they shifted to consider market-based capabilities to be more salient. In the case of the information technology company, developing total solutions required a deeper understanding of customer needs, and in the case of the telecommunications company, once the organization became a separate establishment, business development capabilities became essential.

We propose that when organizations shift from being product-based to platform-based, like those studied by Fiol (2002) and by Nag et al. (2007), these organizations may need to shift their identity to become more focused on business development. In a product-based organization where research and product creation are the most highly valued skills, scientists and engineers may be the most respected, well compensated, and well treated members of the organization. As a result, these organizations are likely to view being "engineering oriented" as a core part of their organizational identity. However, in a platform-based organization that depends on complementors to be successful, business development people may hold more sway. They may be the employees who primarily manage relationships with complementors and ensure that an organization is building solid relationships with external partners. As these external interactions increase in number and importance, so too should the prominence of the people who manage them. In some cases, identity may evolve in an emergent fashion as business development gains importance, such that eventually the organization is no longer engineering driven. In many cases,

however, this type of identity shift encounters resistance because it implies a change in the power dynamics among functional areas.

For example, Blackberry, which was formerly known as Research in Motion Limited or RIM, is a highly technology-driven organization that early in its history changed from being primarily internally product-driven to becoming more business development–focused as its products became more platform-based and dependent on applications. At the time of their initial public offering (IPO) in 1996, the focus was on engineering. The paragraph describing the corporation in the IPO prospectus stated, "RIM develops and supplies radios and other network access devices. . . . RIM has developed an international reputation in the wireless industry for innovations in radio engineering" (Research in Motion Limited, 1996, p. 2). In 1998, Jim Balsille, RIM Chairman and Co-CEO, noted the importance of externally developed applications in an earnings release, emphasizing "the broad range of industries currently developing applications for our products—such as financial services, field service, health care, public safety, real estate, retail, security, telecommunications, transportation, utilities and the military" (Research in Motion Limited, 1998). By that time, RIM appeared to have moved beyond focusing solely on their own capabilities and recognized the need to highlight the role played by other organizations in developing applications to drive demand for RIM's products.

From End-User Service Oriented to End-User and Complementor Service Oriented

Commitment to customer service is often a salient element of an organization's identity. For instance, Dutton and Dukerich (1991, p. 526) found that being "a provider of superior service" was a key identity element of the New York Port Authority. If an organization's identity is tied to the quality of its customer service, when the nature of the customer changes, such as in a

product-to-platform transition, the organization's identity may be challenged. Product organizations are focused on serving customers who use their products; being customer service oriented means that understanding and satisfying end-users is paramount. In contrast, platform-based organizations attempt to serve the needs of not only end-users but also complementors. More specifically, organizations with developer platforms serve customers that purchase end-products (e.g., smartphone buyers) and also the developers that create products that complement those end-products (e.g., application developers). Those with marketplace platforms serve both customers who wish to acquire products (e.g., buyers of used goods) and entities that aim to sell to those customers (e.g., sellers of used goods). So, when an organization shifts to a platform-based offering, members must expand their view of who the customer is and what good customer service means to them. If they fail to do this, deeply held beliefs about being a "service-oriented" organization may be violated as employees make trade-offs that emphasize the welfare of complementors as opposed to prioritizing end-consumers or vice versa.

When Amazon was simply a bookseller, its focus was entirely on consumers who purchased books and other items the firm offered. After introducing the Marketplace, a large-scale platform initiative integrated into its main consumer website, it also needed to meet the requirements of merchants selling on Amazon's platform. Whereas booksellers may care more about ease of posting items for sale or ease of transaction processing, book buyers might be more concerned with breadth of offerings and competitive pricing. In some cases, the preferences of participants on a platform may be in direct conflict; for instance, Amazon merchants may want more advertising opportunities, whereas Amazon buyers may want fewer (Hagiu & Jullien, 2011). To manage these situations, we propose that an organization must adapt its identity.

Unlike other identity attributes that we have discussed, in this situation, organizations may be able to adapt by broadening the meaning of existing identity labels such as "service driven," to accommodate service to both sides of the platform. This sort of "adaptive instability" (Gioia, Schultz, & Corley, 2000) enables organizations to accommodate the new behaviors associated with a platform-based business without completely shifting their organizational identity. Intuit is in the process of transforming its QuickBooks small business accounting software product family to a platform-based offering. It is working to expand its traditionally end-user customer-focused organization to one that similarly places high value on serving the needs and challenges of developers and other complementors. In the process, it may be undergoing identity work that takes into account the new behaviors while maintaining core elements of the existing organizational identity (Hagiu & Altman, 2013).

From Creativity to Discipline

For many organizations, being creative and being innovative are important identity attributes. For instance, the organization studied by Corley and Gioia (2004) included "an innovative company" as one of its core descriptors, and many of the universities studied by Elsbach and Kramer (1996) also included "innovative" as an important dimension of their identity. Bang and Olufsen, a design-oriented audio/video system manufacturer, included "inventiveness" as one of its seven identity components (Ravasi & Schultz, 2006). When organizations produce stand-alone products, they control the overall architecture, which allows for high levels of freedom and creativity in making design decisions. They can optimize product designs based purely on aesthetic design and functionality considerations. Firms designing small kitchen appliances and tools, for example, can place aesthetic and ergonomic design considerations high on their list of

priorities and not worry about interdependencies with accessory or application providers. Similarly, on an old Sony 8mm camcorder, if the designers decided to move the hand strap from one side to the other, the change influenced only the design of that product and did not affect any other products supplied by members of an ecosystem. On a digital camera, if Canon decides to change the size of a display on the back of a camera, no complementor firms are affected.

For platform-based offerings, designers cannot unilaterally make changes that might affect complementary products; potentially many external firms are relying on a design to remain stable along certain dimensions so that accessory or application products can work with that design. Organizations need to be aware of considerations such as backward compatibility because these affect the complementor firms in their ecosystem. As a result, discipline—following an orderly process to determine which product characteristics to maintain as product generations mature—becomes a valuable and necessary skill. Further, standard interfaces that enable seamless interoperation among products become essential elements and need to be mandated and enforced by the organization. For software products, this is frequently discussed in terms of adopting a service-oriented architecture (SOA), and the extent to which an organization does so may be considered a measure of how committed it is to transitioning to being platform-based.

When design decisions affect complementors, it can cause extreme difficulties for them if they do not have enough lead time to redesign or modify their complementary products (Staudenmayer, Tripsas, & Tucci, 2005). If a smartphone manufacturer decides to change the size of a display, an entire cadre of application developers and accessory providers is affected. This curtails the level of creativity that a platform-based organization's designers can exhibit. They operate under significant constraints imposed by the needs of the complementors and have

fewer degrees of freedom within which to operate. If Canon decides to adopt an open operating system that allows independent developers to create apps for cameras, then its designers will have a whole new set of constraints. Display size decisions will become dependent on operating system versions and the needs of application developers. Designing to standards and creating rigidly standardized interfaces to benefit an ecosystem may be perceived as "not nearly as much fun" as designing what looks and works best.

As organizations transition from product-based to platform-based, particularly if they are moving from an entirely closed product to one with open interfaces, they may notice that designers and/or engineers are frustrated by newly instituted requirements to hold elements of designs constant for the benefit of complementary developers or accessory providers. Engineers and designers, who pride themselves on their creativity, may have difficulty with the transition to an organization that has to choose upon which elements to compete and upon which to adopt standardized approaches. They may resist this change by continuing to design products that are not fully compatible with other platform elements or trying to design around platform specifications.

From Self-reliant to Team Player

Organizations accustomed to performing most key activities internally may include self-reliance as a key identity element. For instance, "individuality" was an identity component at Bang and Olufsen, and this was projected using the phrase, "We think differently" (Ravasi and Schultz, 2006). Becoming a platform essentially involves moving into a mode of working more extensively with and enabling an expanded group of partners in one form or another. The transitioning organization needs to change from prioritizing providing solutions through internal

development and a select, narrow set of strategic partners to enabling a broader range of complementor partners (e.g., developers, users, other ecosystem members) to serve their customers as well.

This is particularly difficult for organizations that consider independence and self-reliance to be core parts of their identity. Their management's first impulse is generally to consider how they can accomplish tasks themselves and build their own internal capabilities. Even for organizations that have previously entered into many supply or marketing partnerships, if they have not engaged extensively in product development alliances that affect core operations, they may encounter significant challenges. Opening up interfaces and allowing others to contribute to their products, possibly affecting central product propositions, can be a very hard, and thus identity-threatening, shift. If an organization's general approach to challenges is to work harder internally, or potentially to acquire an outside firm, rather than build relationships with other organizations, moving to a platform orientation can be particularly difficult.

Nokia provides an example of an organization that had trouble changing along this vector. Throughout the 1990s and the early 2000s, part of Nokia's identity was its emphasis on internal technology development. It was also known to be a very difficult firm with which to partner (Vilkamo & Keil, 2003). When the mobile phone industry shifted to being smartphone-centric, which required phone providers to build strong relationships with application developers, Nokia faltered. Although it attempted various platform-based strategies related to mobile software, none of them took hold to the extent of becoming an enduring industry-wide standard, perhaps in part because they were not implemented in a way that was attractive enough to developers and other partners (Selander, Henfridsson, & Svahn, 2010; Steinbock, 2001). Although the reasons for Nokia's troubles are certainly complex, the inconsistency between

partnering behaviors and Nokia's historical organizational identity as an internally focused mobile phone developer may have contributed to the situation. The organization's existing identity served as a barrier to change.

DISCUSSION

In this chapter, we have examined the relationship between innovation in the form of platform-based business models and organizational identity. We propose that moving from a product-based to a platform-based business model requires organizations to engage in a broad range of activities that may influence, or be influenced by, an organization's identity. We have primarily discussed cases in which the product-to-platform transition required activities that challenged expectations associated with the organization's existing product-based identity. However, we also recognize that there are cases in which existing organizational identities are supportive and reinforcing of these changes. An organization's strong identity may guide the strategic choices necessary to accomplish these transitions.

For example, when Apple needed to choose a standard to enable its devices to stream media with one another and with other firms' products, it chose to develop its own proprietary system called Airplay instead of adopting the industry standard platform, Bluetooth. Although the literature frames this as a strategic decision (West, 2003), one could argue that it also echoes Apple's identity. Apple has always been a design-focused firm with an emphasis on creating the most customer-friendly experiences. Controlling the user experience by developing Airplay was consistent with Apple's identity. Similarly, while creating the iPhone App Store resulted in Apple's losing some control of the user experience, the manner in which Apple implemented the App Store, with approval required before an app could be offered, was fully consistent with the

meticulous approach the firm takes to managing customers' overall experiences with Apple offerings. In the same vein, after introducing the Marketplace, Amazon marketed a branded guarantee program, which provided customers a full refund if they had a problem with a purchase made through an Amazon affiliate. This step was consistent with its identity claim of being "Earth's most customer-centric company" (Amazon Inc., 2015). In each of these cases, although the transition to a platform-based business model likely challenged many aspects of the organization, by incorporating elements that were well aligned with the core, management did not challenge organizational identity.

Still, in many cases, particularly during times of considerable transition, organizational identity may be challenged by substantial strategic change. Organizations must rethink the "who we are" as the "what we do" changes dramatically. To be successful, organizations should question elements of their existing organizational identity and, when there are inconsistencies with new business approaches, actively attempt to adapt their organizational identity to resolve them. Whereas proactively changing identity can be a challenging process frequently accompanied by organizational resistance, as illustrated by prior research (e.g. Dutton and Dukerich, 1991, Ravasi and Schultz, 2006, Tripsas, 2009), ignoring the need to attempt an identity shift may result in dissonance and contribute to dysfunctional behaviors that may hinder innovativeness, creativity, and entrepreneurial behaviors.

In this chapter, we contribute to the literature on platforms in two ways. First, platform-related research generally considers the focal entity to be an existing or emerging platform-based organization rather than an incumbent, more mature, organization transitioning from another business form into a platform-based one. Yet, established organizations with a long history of traditional, product-based business models make up a significant portion of the organizations

starting to compete in platform-based markets. We suggest that understanding how to manage these transitions is as important as comprehending the pure competitive dynamics of platform-based businesses. Second, we link our discussion of organizations making this transition to considerations of organizational identity. Although economics and strategy scholars have done an excellent job of evaluating the optimal strategic moves in platform-based markets, they have for the most part ignored the organizational considerations suggested by a shift from product- to platform-based competition. We propose that success in the implementation of new strategic opportunities created by transitioning to a platform-based business model may require a shift in organizational identity.

Future Research

Although our discussion has encompassed a variety of considerations related to product-to-platform transitions and organizational identity, we believe there are significant opportunities to expand this research in a number of directions. These research avenues include contributions to both the organizational identity literature and the multi-sided platform literature. Additionally, they encompass multiple research methodologies, some of which have yet to be fully leveraged in these arenas.

This chapter has highlighted a variety of dimensions of organizational identity that are relevant to product-to-platform transitions. However, the dimensions discussed here are by no means exhaustive. We believe there are likely to be other identity elements that generally change when an organization makes the type of shift we have discussed. Furthermore, organizations will potentially need to overcome constraints imposed by their current organizational identity. In-depth qualitative field-based research could enable researchers to better understand the change

mechanisms associated with transitions to platform-based organizations and determine which dimensions of organizational identity are most salient. Additionally, there may be interdependencies among these dimensions affected by shifts from product to platform that are worth studying further.

As organizations become platform-based, in some instances the dimensions of organizational identity may not shift from state A to state B, but rather move from state A to state A+B (or, A+B+C, and so on). We highlighted such a shift as we discussed Amazon's transition from being end-user focused to being both end-user and complementor focused. We recognize that new dimensions of organizational identity may be added to an organization as it makes this type of shift, and this may lead to potentially interesting implications for the study of organizational identity. What happens if the new additional states are inconsistent with the existing states? For example, if the existing organization has been entirely consumer focused but the platform-based organization must also focus on application- developers, what are the implications? Are they the same as when an organization simply expands into new markets, or is something different at play because these new markets consist of complementors and function as part of a platform-based business model? We know that organizational identity can constrain an organization's ability to adapt and implement change. What is the process by which organizations accomplish changes in identity associated with the transition to platforms? Are there instances in which an organizational identity change precedes a strategy change or modifications in activities? Or is it primarily the case that strategies and activities are changed first, followed by a realignment of organizational identity? How does this differ from other contexts in which organizations shift identity? Are some mechanisms more effective than others?

Although we have emphasized changes to organizational identity, some attributes of organizational identity may remain intact as an organization makes a transition to platforms. In general, values dimensions of identity that relate to beliefs, social concerns, or morals are unlikely to be affected. For instance, organizations that are connected to a particular religious doctrine or have political affiliations are likely to maintain those aspects of their identity even if they move from a product-based to a platform-based model. Ironically, having some elements of identity that remain constant may actually make it easier for organizations to change other aspects. In general, changes in identity are difficult to accomplish and are disruptive to the organization (Fiol, 2002; Tripsas, 2009). Individual-level identification with the organization makes changes in organizational identity a highly personal and emotional experience for employees. If organizational members are provided with identity anchors that remain consistent, they may be more willing to accept changes in other aspects of the organizational identity. This connection between individual-level identification with macro-level organizational change, particularly in association with product-to-platform transitions, remains a fertile area for multilevel research.

Finally, multi-sided platform research has also observed that organizations can operate along a continuum of dimensions ranging from being pure multi-sided platforms to being pure product suppliers or retailers (Hagiu & Wright, 2011). Although we have considered the transitions that organizations make, we need to remember that the transitions are not necessarily binary and may involve moving only partially to a platform-based model (e.g., allowing other entities to offer complementary products, yet retaining strict control on what they can offer and who is authorized to do so). Or only part of an organization may transition (e.g., maintaining a traditional product-focused division alongside a platform-based one). Regardless of the extent

and form of the transition, challenges to organizational identity are likely to be present. Research considering different units of analysis beyond more traditional organization-level platform analysis (i.e., considering transitions for product divisions within multidivisional firms) may be particularly interesting.

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