

**From Proprietary to Collective Governance:
How Platform Participant Strategies Adapt**

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June 21, 2017

ABSTRACT

Platform scholars tend to focus on how firms design and lead a platform that external participants leverage. Often, platform leaders govern the rules for accessing the platform and can shift these rules to maintain or improve their competitive advantage. When platform leaders alter platform rules, the strategies of external participants can be upended. Scholars have examined the trade-offs between opening and closing aspects of a platform primarily from the perspective of platform leaders, without examining how participants are affected. How do participants adapt their strategies when a platform transitions from proprietary to collective governance? Despite the fact that opening aspects of a platform are key to seeding innovative complements, little research examines this type of transition. With field data from a platform sponsor and 16 participants, we trace how participants adapt their strategic choices to pursue six strategies, varying in participation intensity, over time. Contributions to the platform increased as access and control opened, but most firms reduced their participation intensity when platform leadership became indeterminate. While some firms cooperated with the platform, contributing in ways that enriched the platform, other firms acted opportunistically, contributing in ways that depleted, slowed or redirected the platform's development. Our research explains how participants guardedly learn to participate with open and collectively governed platforms in ways that both preserve and threaten their competitive advantage.

INTRODUCTION

Despite the fact that platforms depend on external participants to create value through added extensions, applications and services that enrich a platform's relevance (Adner, 2017; Parker, Van Alstyne, Jiang, 2016), platform scholars rarely analyze participants' strategies that enable a platform's propagation and competitive advantage (e.g. Jeppesen and Lakhani, 2010; Jeppesen and Frederiksen, 2006). Scholars have been primarily interested in examining how platform owners achieve competitive advantage through platform leadership (Gawer and Cusamano, 2002; Iansiti and Levien, 2004). Platforms are a set of common components, interfaces or frameworks reused across a range of products (McGrath, 1995; Meyers and Lehnerd, 1997; Bresnahan and Greenstein, 1999; Baldwin and Woodard, 2009). Some platforms mediate market transactions between producers and consumers (Parker and Van Alstyne, 2005; Rochet and Tirole, 2003; Rysman, 2009; Boudreau and Jeppesen 2016), while other platforms help firms draw upon common components or frameworks (Boudreau 2010; Wheelwright and Clark, 1992; Gawer and Henderson, 2007) to create extensions.

In either case, platforms benefit from platform leaders who can optimize control over a set of governance rules to manage access and control of a platform (Parker and Van Alstyne, 2017; Tiwana 2013). Even though platform leaders define the rules that govern platform participation, they often depend

on external participants to provide complements to enhance a platform's value (Kapoor and Agarwal, 2017). As a result, many platform leaders selectively open aspects of their platform to either seed the growth of producers or attract consumers that will drive adoption and usage of the platform (Eisenmann, Parker and Van Alstyne, 2009; Chesbrough, 2003; West, 2003). However, these choices are not one-time decisions (Appleyard and Chesbrough, 2017) as platforms are rarely static. Rather, platforms are dynamic architectures (e.g. Baldwin and Clark, 2000) evolving with technical contributions from both the platform leader and external participants. What is less recognized is that some of this dynamism unfolds when platform leaders adjust the rules guiding external platform participation.

When a platform leader revises a platform's rules, they can fundamentally affect the degree to which external participants are motivated and able to use, modify, and recombine with a platform (e.g. Murray and O'Mahony, 2007), thus affecting the capabilities and opportunities extended to external participants. While scholars have pursued deep analysis of how platform leaders create rules to achieve their own competitive advantage (Parker and Van Alstyne, 2017; Gawer and Cusumano, 2002; Iansiti and Levien, 2004; Gawer and Henderson, 2007; Parker, Van Alstyne, and Choudary, 2016), how platform participants respond when the rules governing participation transition is under examined. Platform transitions can be incremental as the product of cumulative innovation (e.g. Murray and O'Mahony, 2007) or triggered by acquisitions. Transitions can change platform ownership and leadership as well as the rules governing participation, particularly when a closed platform becomes open or vice versa. Despite the fact that prominent firms like IBM, Sun, Netscape, and Tesla have made dramatic transitions opening formerly closed and proprietary platforms, few empirical studies of such transitions exist. Transitions can unpredictably relax certain rules or harden others which may affect external participants dependent upon the platform, leading them to re-evaluate their strategies for participation. When platform leaders change a platform's rules, external participants must decide if their existing strategies will produce the same outcomes, as the opportunities available and their payoff structure may change as a result (e.g. Gavetti and Helfat, 2016). However, little research examines platform transitions from the perspective of external participants. How do participants adapt their strategies when a platform transitions

from proprietary to collective governance?

Our research addresses this question with a seven year, inductive field study of the Eclipse development platform, examining how external participants reacted as the platform they initially engaged with transitioned from proprietary to collective governance from 2000 to 2006. By tracking how 11 specific platform governance domains in the areas of technology, architecture, legal and membership, were revised, we identified four modes of governance and traced participants' subsequent adjustments in their platform strategies. While formal models tend to view platform participation as a binary choice (e.g. Parker and Van Alstyne, 2005; 2017; Boudreau 2010), the firms in our study made a range of strategic choices, varying in intensity, with implications for their overarching platform strategy. Most firms increased their participation intensity as the platform opened to collective control but pulled back when platform leadership became indeterminate. While participation intensity fluctuated with transitions in platform governance, differences in platform alignment were immutable. We found many participants 'on the other side of the platform' contributing in opportunistic ways that could be detrimental to the platform, complicating the assumption that external participants with a platform always participate as complements (Gawer, 2014). By examining participants' platform strategies under four modes of governance, where conditions of access and control differed, we contribute a dynamic explanation of how platform participation can vary and affect a platform's vitality.

PLATFORM LEADERSHIP AND THE TRADE-OFFS OF OPEN GOVERNANCE

Platforms are often defined as a set of common components and tools (West, 2003), layered architectures (Yoo, Henfridsson, and Lyytinen, 2010) or common interfaces (Baldwin and Woodard, 2009) that facilitate system-wide development and innovation (Boudreau, 2010). More recently, scholars have appended this definition to include the set of rules that govern external participation with the platform (Tiwana, 2013). Platform leaders govern the rules for participation which regulate the affordances extended to or closed to external participants (West, 2003; Eisenmann, Parker and Van Alstyne, 2009). In analyzing platform leadership, both practitioners and academics vigorously debate the benefits of open vs closed governance approaches (Katz and Shaprio, 1986; West, 2003; Chesbrough,

Vanhaverbeke and West, 2006). By opening aspects of their platforms to external participants, platform leaders can increase adoption and relevance of the platform (West, 2003; von Hippel and von Krogh, 2003; von Hippel, 2005). Opening a platform to vibrant community of external contributors can spur experimentation (Allen, 1983) and decrease innovation costs (von Hippel and von Krogh, 2003; Von Hippel, 2005; Chesbrough, 2003). Further, opening can increase the value of a platform as external producers and consumers may be better apt to predict demand for new services, products and features than the platform leader can on their own (Chesbrough, 2003; Seidel, Langner and Sims, 2016).

Alternatively, opening a platform can also provide rivals access to potentially proprietary information (Farrell and Simcoe, 2012), increase forking and competition (Parker and Van Alstyne, 2017) and induce uncertainty as to the future technical direction of the platform (Greenstein, 2009). Maintaining proprietary control over a closed platform can increase profits to the platform leader by preventing appropriation by external participants (e.g. Teece, 1986) and sustain quality standards over platform architecture and its extensions (Baldwin and Clark, 2000). Thus, platform leaders may restrict access or close their platform to maintain the quality of participants and their contributions (Zhu and Iansiti, 2011); decrease coordination costs (Bresnahan and Greenstein, 1999); and orchestrate platform changes (Eisenmann, Parker, Van Alstyne, 2011). However, these debates often neglect the fact that platforms are dynamic architectures (e.g. Baldwin and Clark, 2000) constantly evolving through interaction with vibrant communities of complementors and users. Rather than a one-time decision to sustain competitive advantage, platform leaders continuously manage the rules which affect the tradeoffs between opening aspects of the platform and maintaining control (Almirall and Casadesus-Masanell 2010). For example, Propellerhead, a music software platform, relied on communities of developers and users to expand the scope of their technology; eventually creating a new market for the firm (Jeppesen and Frederiksen, 2006). As rival platforms shift, platform leaders may initiate generational transitions of product offerings (Kapoor and Agarwal, 2017) or transition access and control of a platform (Appleyard and Chesbrough, 2017) to attract, manage or influence external participation. For example, Boudreau (2010) showed that opening access to handheld computer platforms increased the rate at which new third party devices were

developed. However, devolving control, to allow third parties to modify the platform directly, had less of an effect. This suggests that opening certain governance domains can induce recombinant innovation, whereas opening other domains may not. Further, participants may vary in their responses to governance changes, when granted control, some potentially will contribute, while others may refrain.

Building on Boudreau (2010), we propose that the “rules” for platform governance embody two distinct elements: *access* or the degree to which a platform is legally open and usable to external participants (West, 2003; West and O’Mahony, 2008); and *control* defined as the rights to set the rules which determine how a platform is organized, architected and technically produced. Access and control can be managed in distinct ways and may transition independently. For example, Sun Microsystem opened Java, making it accessible to all, while retaining control over protocols and architecture (Garud and Jain, Kumaraswamy, 2002). Similarly, Netscape opened the code to its Mozilla browser, making it accessible to all, and only years later transitioned control to an open source community. Thus, transitions in access and control may not happen at once, but unfold as platform leaders and external participants grapple with governance transitions amidst changing technical trajectories.

When making decisions about access and control, platform leaders set boundaries regarding *what* to open. For example, Gawer and Henderson (2007) showed how Intel facilitated complementary innovation by opening select platform interfaces in areas that were not strategic to Intel while maintaining control over the platform’s technical direction. Platform leaders set boundaries regarding *who can* participate (West, 2003). For example, while Apple’s application store is open for application developers to sell their goods, developers’ ability to join the platform is heavily vetted by Apple. Application developers who meet Apple’s requirements achieve a stamp of approval through admittance to the platform. Often, to create competitive advantage, platform leaders strive to thread the needle; opening access to their platform to seed participation, but maintaining control to secure competitive advantage for themselves (Eisenmann, Parker and Van Alstyne, 2009; Gawer and Cusumano, 2002; 2008). While many studies examine the role of open access in growing an external community of participants that can add value to a platform (Parker and Van Alstyne, 2017; Boudreau 2010; Gawer and Henderson, 2007), little

research examines how the interests of platform leaders and external participants are navigated in open or collective platforms.

However, an abundance of rich, empirical examples of collective governance can be found in the literatures on standard setting organizations and open source communities. Standard setting organizations offer opportunities for collective governance by providing participants with the power to influence the trajectory of a platform (Simcoe, Graham and Feldman, 2009; Simcoe, 2014). and ability to regulate access, monitor and sanction “those who behave opportunistically” (Simcoe, 2014). Open source platforms that are collectively governed can also imbue thriving communities (Chesbrough, Vanhaverbeke, West 2006; O’Mahony and Ferraro, 2007); spur innovation (von Hippel, 2005; Baldwin and von Hippel, 2011); and still facilitate the coordination needed for a technically coherent architecture (Dahlander and O’Mahony, 2011). While community managed open source projects abound (Dahlander and Gann, 2010; von Hippel and von Krogh, 2003; von Krogh, Spaeth and Lakhani, 2003), the transition to an open and collective form of governance (e.g. Ostrom and Hess, 2007) can also be part of a corporate strategy (Shah, 2006; West and O’Mahony, 2008; Dahlander and Wallin, 2006). However, we know little about how such transitions happen and even less about how changes in access or control affect external participants’ strategies.

While scholars have examined how platform leaders absorb the innovations developed by external participants to maintain or grow competitive advantage (Eisenmann et al, 2011; Parker and Van Alostne, 2017; Jeppesen and Frederiksen 2006; Gawer and Henderson, 2007), only recently have scholars examined platform dynamics from the perspective of those who contribute to a platform’s vitality (e.g. Boudreau and Jeppesen, 2015; Kapoor and Agarwal, 2017). The dynamics of interactions between platform leaders and external participants are complex because these relations are multi-lateral rather than dyadic (Adner, 2017; Davis, 2016). External participants can collaborate, not just with the platform leader, but with each other to develop new products and applications that can either complement or compete with the platform (e.g. Kapoor and Agarwal 2017; Davis, 2016). For example, Symbian initially controlled a common platform which handset providers and application developers depended upon (West

and Wood, 2013), but the strategic choices made by some participants collectively eroded Symbian's leadership position over time. Platform participants can vie for leadership and even challenge a platform leader in unexpected ways (Gawer, 2014; West and Wood, 2013).

This phenomenon suggests that participation with a platform is not a binary choice, as typically modelled, but rather a continuous one. External participants can use a platform, integrate their own products with it or play leadership roles in advancing a platform's technical trajectory. These strategic choices vary in their commitment and structural dependence on the platform (e.g. Adner, 2017), but few scholars analyze how the range of strategic choices that compose a firm's platform strategy adapt over time. What is needed is research that examines how platform participants confront the full range of strategic choices available as platforms transition. Our research takes a step in this direction by examining this question in the context of a platform transitioning from proprietary to collective governance.

RESEARCH METHODS

We conducted a longitudinal, inductive field study to understand how platform participants adapted their strategy with a platform as it transitioned from proprietary to collective governance. Our approach employed an embedded case design, enabling comparison of all of the strategic choices that constituted participants' platform strategy over time (Eisenhardt and Graebner, 2007; O'Mahony and Bechky, 2015). Embedded research designs are useful when analyzing multiple units of analysis, in our case, the individual and grouped strategic choices of platform participants (Yin, 1994; Davis, 2016).

Research Setting. Because many platform transitions have not been executed well (e.g., Symbian, Java), few successful transitions are available for study. The Eclipse platform is well suited to study how platforms transition as several transitions, between 2000 and 2006, took place in public forums providing a reliable and consistent source of data over time. Eclipse is a platform made up of modular projects built on a common set of frameworks and components that collectively constitute an integrated development environment (IDE). An IDE provides developers with a unified design space where developers can visualize and test how their code will perform as it is developed, improving efficiency by reducing set-up time for different tools and enhancing coordination among developers. Rather than

mediate transitions between producers and consumers, Eclipse is a Business-to-Business platform, which facilitates innovation by third parties recombining Eclipse common components. Initially developed as a proprietary IBM platform, over time, Eclipse transitioned to become an open source, collectively governed platform. Since its launch as an IBM open source project in 2001¹, Eclipse has become utilized by nearly 50% of all software developers worldwide², with over 250 firms participating in its on-going development in 2016.

Sample Design. We constructed a sample of 16 firms that participated with the Eclipse community between 2000 and 2006 and collected data from IBM and the non-profit foundation later created to manage the platform. Since our focus is on platform participants, IBM is not included in the sample as they were the original platform leader. Rather than predict which firms would participate with Eclipse, this research was designed to understand how existing participants, those choosing to make at least one strategic choice to engage with Eclipse, adapted their platform strategies. Table 1 presents descriptive data on our sample which broadly mirror the Eclipse member population.

INSERT TABLE 1 HERE

About one third of firms in our sample were small (annual revenue less than \$10 million); one third were medium (annual revenue between \$10 million and \$1 billion); and one third were large (annual revenue over \$1 billion); in line with the population at the time of the study. Approximately 61% of firms in our sample were software producers; 18.5% were service providers; and 18.5% were hardware producer, also congruent with the population at the time of the study.

Data Collection. To triangulate evidence for construct validity (Eisenhardt and Graebner 2007; Yin 1984), we collected several sources of field data. Data sources included: 1) interviews with founders of Eclipse, board members, leaders of the Eclipse Foundation, code committers and project managers; 2) observations of board meetings, committee sessions and three Eclipse conferences; and 3) archival data.

¹ <https://eclipse.org/org/pr.html>

² Zereturnaround.com May 2015

While the period of study ranged from 2000 – 2016, different types of data were available for collection at different times. Table 2 shows how this breadth of data was distributed across the time of study.

INSERT TABLE 2 HERE

(1) *Interviews*. We conducted 44 semi-structured interviews, ranging from one to three hours with the platform sponsor (IBM), foundation employees and the 16 participating firms in our sample. Where possible, we conducted multiple interviews per firm to account for variance in perspective by role (e.g., marketing managers may have a different perspective than developers). Interviews were conducted from 2004 – 2005 (40) and revisited in 2016 (4).

(2) *Observations*. Observations were conducted at board meetings, committee meetings and at Eclipse membership conferences. Observations deepened our understanding of how each firm made strategic choices about their platform participation. Observations at membership meetings and conferences were conducted in two cycles, in 2004-2005 and again in 2016 when we revisited the field to understand how the platform stabilized with collective governance.

(3) *Archival data*. Archival data was collected from 2000 to 2016 to identify each firms' strategic choices and confirm their timing. We reviewed 80+ official board meeting minutes and related documentation; 100+ council meeting minutes and related documentation; blogs, and press releases; 11 foundation reports and 4 analyst reports. Archival data supplemented our primary data to ensure accuracy of each firm's strategic choices as the platform transitioned.

Data Analysis. We followed an iterative process coding our data to develop common themes. Data analysis included five stages: 1) mapping platform governance domains; 2) identifying and comparing firms' strategic choices over time; 3) analyzing participation intensity; 4) analyzing platform alignment; and 5) identifying participants' platform strategies.

Stage 1: Mapping Platform Governance Domains. We began with open coding to understand how the platform transitioned and identified 11 domains of platform governance. For example, “designation of members and member rights” allowed members to determine the rights assigned to new members. We clustered 11 governance domains into four types: *Membership* defined as control of

member designation and rights; *Legal* defined as control over IP ownership; *Architectural* defined as control of cross-project scope and coordination; and *Technical* defined as control of project-level code development. We traced how leadership over each domain shifted over time and identified four modes of governance between 2000 and 2006 as shown in Table 3.

INSERT TABLE 3 HERE

To determine where modes began and ended, we looked for evidence of “continuity in the activities within each period and...certain discontinuities at [their] frontiers” (Langley, 1999: 703). Thus, we defined each mode according to domain shifts and the literature (e.g. West & O’Mahony, 2008; O’Mahony, 2007). During the *Proprietary mode (2000-2001)*, access was selectively granted, but mostly closed and a single owner controlled all governance domains. During the *Sponsor mode (2001-2003)*, access was fully open, but a sponsor controlled the membership, architectural, and technical governance domains. During the *Hybrid mode (2004-2005)*, access was fully open but control over architectural governance domains was indeterminately shared between IBM and the community. During the *Collective mode (2006+)*, access was fully open and control of all governance domains was managed by a collective.

Stage 2: Identifying Strategic Choices. In the second stage of analysis, we identified the full range of strategic choices firms made as the platform transitioned. We consider the choice of how to participate with a platform as a type of strategic choice or a “specific commitment to action” (Mintzberg, Raisinghani and Theoret, 1976). Over 7 years, the 16 firms in our sample made 325 strategic choices regarding platform participation. We coded the entire set of 325 strategic choices and iteratively refined this set to establish 10 categories. Self-report of most strategic choices made by a firm (“Led a project”; “Became board member”) were validated with archival data where possible. Firms were coded with a “1” if they selected a strategic choice in each mode and a 0 if they did not. A firm might, donate code multiple times during a mode or just once, but in both cases would receive a “1” to indicate code donation. We treated each mode discretely as some firms made a strategic choice in one mode and later reversed it. For instance, Firm 8 “Joined a project” during the sponsor mode, but ceased to do so in the hybrid mode.

Stage 3: Analyzing Participation Intensity. We observed a continuous range of strategic choices varying in participation intensity as indicated by the resources and commitment required. Thus, we ranked the participation intensity of 10 strategic choices with a scale from 1 to 6 (See Table 4). Both authors independently ranked the 10 strategic choices according to the intensity of effort and resources as appraised by our informants and research on technical labor as a means to calibrate firm investment in a technology (Tambe, 2014). Any differences in ranking were discussed until agreement reached. Where choices were not distinguishable in participation intensity, they were scored similarly.

INSERT TABLE 4 HERE

For example, “Use Eclipse” was ranked a 1 as anyone could download Eclipse and it required limited participation with the platform. “Join Eclipse” was ranked 2, as joining required minor participation with the platform (e.g., agreeing to membership terms, signing-up). “Become a board member” (ranked 3) required only part-time participation. “Join a project” (ranked 4) required a firm to dedicate at least one full time developer and contribute code. “Develop committers” (ranked 5) required firms to dedicate developers to an Eclipse project for an extended period of time. “Lead a project” (ranked 6), required a firm to commit multiple developers to the platform. While participation was defined as any strategic choice to engage with Eclipse (for example, as a user), technical contribution required donations of code. While all 10 strategic choices constituted participation, only six choices required technical contribution: “Donate code”, “Develop committers”, “Join a project”, “Lead a project”, “Join multiple projects” and “Sync development schedule”. To calculate a firm’s cumulative participation intensity score for a particular mode, we added the number of strategic choices each firm made and multiplied these choices by their participation intensity score. For example, during the hybrid phase, firm 1 “Joined Eclipse” (score 2); “Commercialized around Eclipse” (score 3); and “Became a board member” (score 3); receiving an 8 point participation intensity score. In aggregate, based on our sample, any participation intensity score of 10 or above included contributions of code, whereas scores below 10 constituted participation without contribution.

Stage 4: Analyzing Platform Alignment. We also observed that not all firms acted in alignment with the platform and participated in ways that furthered the platform. Drawing from Adner (2017: 40), we consider platform alignment as the “extent to which there is mutual agreement” among participants regarding not only their motives for platform participation, but also the configuration of their activities. In our context, this includes the nature of participants’ contributions. We found that firms differed in the degree to which their participation aligned with the platform’s growth. Firms with cooperative alignment participated in ways that furthered the platform’s capabilities, quality and scope. Firms with opportunistic alignment, participated in ways that could intentionally undercut the platform by slowing development, reducing code quality or redirecting the platform toward their own ends.

Stage 5: Identifying Platform Strategies. We identified participants’ platform strategies utilizing a configurational approach which enables multiple variables to combine to explain outcomes (Armanios, Eesley, Li and Eisenhardt, 2016). A firm’s platform strategy was determined by their cumulative participation intensity and platform alignment (Cooperative or Opportunistic). We mapped the participation intensity and platform alignment of all 16 firms in each mode, producing four plots of participant platform strategies (Figure 1). Our data revealed six strategies (Observing the platform, Integrating with the platform, Expanding the platform, Front running the platform, Selling-up from the platform and Redirecting the platform) common to our sample (see Table 5).

INSERT TABLE 5 HERE

FROM PROPRIETARY TO COLLECTIVE GOVERNANCE: STRATEGIC ADAPTATION TO PLATFORM TRANSITIONS

As the Eclipse platform transitioned from proprietary to collective governance, most participants (12/16) adapted their platform strategies to increase their participation intensity. However, not all participants contributing to the platform acted in alignment with the platform, as some acted opportunistically, in ways that could be depletive the platform. Firms with a cooperative alignment (9/16) consistently participated in ways that accelerated the pace of development, extended the platform’s scope or improved code quality. For example, one firm launched the CDT project which ensured Eclipse could

be used not just by Java developers but also by those preferring C++, to broaden Eclipse's user base. As firm 11 shared, "Originally it [Eclipse] wasn't architected to be a multiple language IDE. So, now we are trying to clean it up." Alternatively, firms with an opportunistic alignment (7/16), consistently participated in ways that either reduced code quality, slowed the pace of development or redirected the platform toward their own ends. For example, one informant spoke guardedly about how 'desperate firms' might "commit, well knowing buggy code" to protect their competitive interests. Figure 1 plots firms' participation intensity (y axis) and platform alignment (x axis), producing a map of each firm's aggregate platform strategy for all four governance modes.

INSERT FIGURE 1 HERE

While participation intensity was highly variable with governance changes in access and control, platform alignment appeared more immutable. We trace how participants adapted their strategies in each mode to understand collective changes in platform participation as well as variation in participation.

Platform Transitions: Four Modes of Governance

Mode 1: Proprietary (2000 – 2001). Initially, access to the development process was closed and the code was proprietary (see Table 3). To seed adoption and economically build the "best IDE," IBM contracted through an NDA with select partners to use and test "Eclipse". As Firm 8 shared, "IBM lawyers wouldn't let them [meet] without us signing off on all these forms. So, we signed off." Three firms were granted access to the platform source code as "test users". Even though this code was not licensed under open source terms, all three firms previewed the source code, were given limited usage rights and began developing extensions of their own products based on what they learned.

Cooperative Alignment. One firm (9), noted that other IDE options were less than satisfactory. "Too technically limited", "too expensive", and "too costly" to build on their own, firm 9 seized the opportunity to use Eclipse, which promised a "write once, run everywhere" solution. Our informant shared, "IBM showed us a lot of the work they were doing in Eclipse before it was open source. And suggested it would be really cool if we did some of our stuff based on their platform, Eclipse." Firm 9 reviewed the code to learn how their existing offerings could complement Eclipse: "We saw Eclipse as a

platform. We started to investigate it, and we thought ok, we build this one small product on Eclipse.” They observed the code to learn how best to “effectively get their existing technology to operate with Eclipse”. By pursuing the *Observing* strategy, firm 9 could participate without making contributions, ensuring their products would comply with Eclipse. Full definitions of platform strategies can be found in Table 5.

Opportunistic Alignment. Two other firms (8 and 16) engaged in the platform strategy of *Front running* by building competitive products based on Eclipse’s code and getting to market before Eclipse’s release. Firms engaged in front-running offered proprietary products based on pre-release Eclipse code, without contributing code to the platform. Firm 8 considered early access to Eclipse as a source of competitive advantage:

“You couldn’t really get inside. We had access to the source code through our contract. With our access, we could take our [commercial, proprietary browser] functionality and integrate it in so deeply that it just added itself into the menus. Because we got in so deeply no one knew we were there. It was like we were trying to sell our product, and look, it’s already in here.”

Firm 8 was able to front run Eclipse with its own commercial product before Eclipse opened to others. Users that downloaded Eclipse were prompted to download firm 8’s commercial code which offered enhanced functionality to what was available in Eclipse for free. Firm 8 hoped to direct Eclipse users to their proprietary offerings even though access and control of the platform was still governed by IBM. Unsurprisingly when access was mostly closed and all governance domains controlled by IBM, firms were limited in how they could participate with the platform. Thus, all firms participated in low intensity ways by either *Observing* or *Front Running* the platform (Table 5 provides additional examples).

Inviting external participants to test Eclipse clarified three challenges for IBM which motivated a transition from proprietary to open access. First, IBM sought outside talent to robustly build “best in class technology”. Second, the cost to extend Eclipse was significant with minimal expected return due to low margins in software tools. Third, there was some urgency to develop Eclipse quickly to compete with Microsoft and Sun (see O’Mahony, Mamas and Diaz, 2005 for detail on IBM’s rationale). IBM Directors decided in early 2001 that: “to build momentum on this [Eclipse] and to get more vendors to build their

products on top of it, we had to make it open source. Otherwise they [participants] would not take the risk of building on a proprietary platform.” Platform participants recognized that this change was more strategic than charitable: “Eclipse was IBM’s way of burning down the market for Sun. And maybe a little bit for Microsoft.” With a free, robust platform, IBM hoped to attract others to their proprietary middleware and away from competing offerings.

Mode 2: Sponsor (2001 – 2003). In the sponsor mode, access to the platform’s code and development process opened to the public, but the platform continued to be largely controlled by IBM. Any firm or individual could use Eclipse or contribute to the platform under the terms of an open common public license (CPL). As shown in Table 3, IBM transitioned 4 / 11 governance domains to a consortium of invited firms to collectively manage access. However, IBM remained the platform leader by controlling all architectural domains (2/3); membership domains (2 /2) and technical domains (3 /3). With the platform open but IBM still acting as platform leader, other firms were most concerned about potential appropriation of their contributions by IBM. For example, voting rights over the platform’s direction were “on-paper, shared evenly across members” as each firm had a single board-level vote. However, voting rights at the project level were not clearly delineated. If an individual was present at a project-level meeting, he or she had the right to vote on any matters raised. A firm with five individuals joining a project meeting had five times more votes than a firm with one individual attending the meeting. Because IBM always had multiple individuals at any meeting and most other firms only had one, IBM was typically in control of the outcomes of group voting despite efforts to convey openness.

As firm 13 remarked, “IBM walked around looking for columns to hide behind so that nobody would notice that they were there. It was a very aggressive neutral posture because they were trying to create the perception that they weren’t in control, and that they weren’t dominating, and so even though they were, you know how it is? It’s all Open Source. But you control 80 of the 82 guys that are developing it.

Although IBM had been willing to provide all participants with voting rights, the platform was still under IBM de facto control.

Cooperative Alignment. Seven firms cooperatively aligned with the platform during the sponsor mode. Firms with cooperative alignment enacted two types of platform strategies varying in participation

intensity. Three firms (4, 5, 14), sat back, *Observing* the platform: joining Eclipse, using Eclipse and participating as board members. While interested in Eclipse's potential, these firms were unwilling to "commit" development resources to an open source project still led by IBM. As firm 5 shared, "We had a fundamental problem with the fact that it looked to be owned and driven by IBM. From day one our discussions were around how to open up. In a similar vein, "You couldn't commit it [code] back in unless you were a committer, and that was managed by an IBM project leader". From this perspective, contributing code could advantage IBM and other potential competitors at their own expense. As put by firm 4, "All of the committers were IBM. All of the requirements were IBM. All of the management was IBM. So, there was both the perception and reality that it was an IBM Trojan horse". Because IBM effectively led the platform through its sheer numbers of contributing developers, participants worried that code contributions could be appropriated with little prospect of censure. Participants were concerned that contributing code could provide competing participants an advantage: "Why the hell would we contribute? So that [firm x] could turn around and produce our stuff?" What prevented participating competitors with equal access to Eclipse from misappropriating their code contributions?

In contrast, firms 9,10,11 and 7 were cooperatively aligned with the platform but enacted a strategy that required more participation intensity. Firms 9,10, 11 *Integrated* with the platform, joining projects to ensure their existing proprietary products and services were compatible with Eclipse. These firms bet on Eclipse emerging as an industry platform and saw how they could gain. As one firm shared, "it will be a Coke and Pepsi world," in the software tools market and they benefited from market consolidation. If there were 15 IDEs on the market, they had to re-calibrate their products for all, incurring significant development costs. If only one or two IDEs existed, maintaining interoperability reduced costs. As Firm 11 explained, "With Firm [x] moving off of their IDE and standardizing on Eclipse, that frees us a developer." Under open access but sponsor controlled conditions, firms 9, 10 and 11 pursued an *Integrating* strategy, contributing resources to integrate Eclipse into existing product suites. Firm 9 argued that: "good developers require more than just the work in progress code." By joining projects, these firms were invited to attend development meetings, refine working code, review

planning documents and evaluate specs. Contributing code gave firms with cooperative alignment intimate knowledge of how best to integrate with Eclipse and helped further Eclipse's growth. Firm 7 was the only firm attempting to *Expand* the scope of Eclipse, by leading a project to develop new features in support of complementary proprietary products or services (see Table 5 for full definition).

Opportunistic Alignment. Five firms (8, 12, 13, 15, 16) participated by either, *Front-running the Platform* and, now that they could contribute code directly, three firms initiated the strategy of *Selling-up from the Platform*. Firms 15,16 participated by *Front-running* the platform to offer proprietary, competitive products such as debuggers, based on pre-release Eclipse code, without contributing code back to the community. Pre-release code is unfinished code found in an open source community prior to its official release. As one firm shared, "What we'll do is if we want to go into a particular product area, we'll go look at Eclipse. When we find some code with reasonable quality that gets us 50-percent of the way there, or 60 or 70 whatever it happens to be. We'll take that technology." As one informant explained, these firms were taking code from Eclipse and "running in front" to launch proprietary, commercial products before they could be included in the platform's open source release. By launching first, these firms could attract users but also trigger confusion as to code provenance.

Three firms (8, 12, 13) participated by joining projects to explicitly contribute code as part of a *Selling-up* strategy. *Selling-up* entailed firms' contributing code that was limited or inferior to their own proprietary offerings to generate sales leads and differentiate their commercial products. One firm described, "Some of my technology I'll open source. I make sure that my cool stuff will then be proprietary." The thrust of this strategy was to leverage participation in Eclipse by informing those who downloaded or used Eclipse that more advanced, proprietary software was available for purchase. Further, as one firm shared, "We try to become the committers for Eclipse. That means we can purposely make sure that our proprietary product is wonderful and better than the open source version." Contributing inferior code to the platform could degrade platform quality and slow platform growth as users were less likely to adopt Eclipse if better commercial alternatives existed. Opportunistic behavior advantaged participating firms, but could be detrimental to the platform and the community.

Neither the consortia of firms nor IBM penalized firms participating opportunistically. “You are never going to get your competitors to play by your set of rules. And if you are Open Source ... if your objective is to get an open playing field for the infrastructure then you have to enable your competitors as well as yourself” (Platform Director, IBM). Firms that were opportunistically aligned innovated with derivative products on top of the platform. Some of their new products were popular with users, others were not. By tracking extensions to the platform, IBM and the broader Eclipse community could gauge demand for features and offerings that could later be absorbed into Eclipse. For example, firm 8 claimed to be “the market leading Java GUI designer. Eclipse has a rudimentary one... We know that Eclipse is going to look at what we do and eat this product from the bottom.” Eclipse members benefited from observing which commercial innovations did well and could later replicate them (e.g. Gawer and Henderson, 2007; Eisenmann et al, 2011). While open access attracted participation from most firms, and code contributions from more than half, only one firm took on a leadership role. For most firms, IBM’s retention of most platform governance domains inhibited them from taking on leadership roles.

Mode 3: Hybrid (2004-2005). In the hybrid mode, IBM legally transitioned governance to a board representative of Eclipse members and a non-profit, independent foundation. However, multiple firms found that IBM, the board and foundation’s respective roles in leading technical and architectural domains (e.g. establishing new projects, setting the future scope of Eclipse and coordinating across projects) to be unclear. No other firm stepped in to replace IBM as a platform leader. As firm 5 expressed, “It [leading the platform] requires an enormous amount of resources and energy. They [IBM] have got their own things to focus on. IBM made the decision to pull back in 2003, and here we are in the beginning of 2005 and there are still quite a few things that aren’t completely done”. As one firm explained: “There was confusion as to what Eclipse really was – an IBM project? An open source project? A standards like consortium? Many companies were reluctant to make a strategic commitment to build product on Eclipse”. Access was open and IBM appeared to be relaxing its leadership over the platform, and it was not clear how collective governance was going to work in its stead. Participants were less worried about the challenges of unmanaged access or appropriation (e.g. Ostrom, 1990; Simcoe,

2014), but very concerned by provision problems related to maintaining, building, and growing the platform without a platform leader in place.

Cooperative Alignment Most firms with cooperative alignment (3,4,5,6,9,10,11,14) limited their participation to *Observing* the platform, participating only as members of the community, the board, and commercializing products based on Eclipse without contributing code (only firm 7 continued to lead a project). With architectural uncertainty, even the 3 firms who had started to commit development resources and were *Integrating* with the platform began to pull back. Firm 9 recommended that the new foundation, “bring in facilitation help.” Or, as an informant from firm 5 explained, “We had a lot of trouble coming up with how are we going to coordinate across ourselves”. While firms were no longer worried about IBM’s leadership role, firms interested in contributing to the platform struggled with how to do so, because it was not clear how new projects could be approved. As firm 3 shared, this introduced a degree of risk when proposing a new idea:

There was a possibility that we would propose this [new project], get it shut down, and then all of the competitors in the market would know that we’ve got this strategy, but we’ve failed. To be honest one of the biggest challenges that I had in convincing people internally was that anybody could join Eclipse, but could I get the project through and actually launch without having things derailed?

Without clear process guidelines to manage the initiation, review and approval of new projects, firm 3 was hesitant to invest their time and resources and pulled back, observing if and how a workable collective governance structure would unfold.

Opportunistic Alignment. All seven firms with opportunistic alignment (1,2,8,12,13,15,16) also limited their participation with the platform during the hybrid mode. These firms were less concerned about appropriation of the platform and more concerned with firms ‘dumping code’ into the platform and commodifying or disrupting their source of competitive differentiation. This happened to firm 8 when another participant contributed code in an area firm 8 had hoped to commercialize:

We said if you guys are going to put [it] in Eclipse, we don’t want to be there, but nobody was doing [x]. So, we invested for a year and a half and we created this incredible technology and product. About the time we get it done, we start to hear these little rumors... you and all of your

minions told us that you weren't going to do anything in this field, and now we hear this is coming out from your guys?

Ultimately firm 8 introduced their proprietary product only to discover after a year and a half's worth of work, this functionality was now included in Eclipse and freely available: "It was totally proprietary. It was ours ... They stole our ideas which flattered us, but pissed us off. They told us they wouldn't." Firm 8 felt that their product was now "...worthless commercially. I mean it wasn't totally worthless, we did sell a little. But we started getting customer questions like 'hey I just found all of your stuff in Eclipse.'"

Unplanned contributions helped grow the platform's capabilities, but could also commoditize a participant's competitive advantage relative to the platform. As an informant from firm 13 explained: "Eclipse competes with every commercial thing on top of it. That is really the issue, and if it grows too quickly, it wipes out those commercial interests... I don't mind competing with [firm x] with our tools or [firm y], or anyone else, the competition is fair. But you can't compete with your own platform."

Participants were more concerned with unregulated growth of contributions than with free riding or opportunistic behavior like front running. The success of the platform created a threat for firms that depended on commercializing extensions on top of the platform. They feared "getting eaten from below" as the platform grew in functionality. Firm 8 was so distraught that they reduced their participation intensity and considered leaving the community.

In the hybrid mode, both access and control were opened to platform participants who became members engaged in limited collective governance, but platform leadership over critical technical and architectural domains was indeterminate even to those closest to Eclipse. Legal divestiture from IBM to the foundation had been successful, but there were open questions as to how the platform's growth would be managed. With reduced concern over IBM's control over the platform, scholars might expect firms to vie for platform leadership (e.g. Parker et al, 2016; Gawer and Cusumano 2002), yet, no firms in our sample did so. Rather, participation intensity moved in the opposite direction as all firms (except firm 7) reduced their participation intensity. Firms with a cooperative alignment were concerned about their ability to control their investment in a collectively governed platform when they could not predict the development

trajectory. Firms with an opportunistic alignment were nervous about their ability to create commercially differentiated products under a free-wheeling structure where their ideas could be rapidly commoditized or appropriated by others.

Mode 4: Collective (2006+). Eclipse transitioned to a collective governance mode when a representative board of participants and independent foundation assumed control over all governance domains (as shown in Table 3). First, the foundation led the collective in developing a road-mapping process, outlining a clear direction for every project, at the approval of the board. Those leading projects had to work within the approved scope and could not drop in unexpected code at any time. This process outlined review and comment periods before new projects could be approved, providing firms with temporal predictability so they could adapt their commercial strategies with the platform's growth. As firm 13 explained, "projects will be reviewed for a certain time so they won't show up overnight," creating both an exclusivity period and time for adaptation. Second, the foundation introduced "release train," a coordinated release of Eclipse projects 4-6 times per year that would help participants coordinate their development timetables with Eclipse and enable predictable integration with commercial products. Firms could no longer release code for the Eclipse platform without coordinating with the broader community. Third, the foundation established a clear process for evaluating the provenance of code contributed to the platform. With these new collective governance rules bounding how participants could contribute and providing collective choice over the platform's future, participation intensity increased: 56 percent of firms now contributed code, a significant recovery from the hybrid mode and many firms took on new project leadership roles.

Cooperative Alignment. With collective governance, firms with cooperative alignment either intensified their participation by leading projects or participated without contributing code. Nine firms with a cooperative alignment participated with the strategy of either *Observing* the platform or by *Expanding* it. Firms *Expanding the platform* developed new features in Eclipse to support their own complementary product offerings, which required high levels of participation intensity. Six firms (3,4,5,6,7,9) with a cooperative alignment *Expanded* the platform by contributing significantly as board

directors engaged on architectural domains of governance and by joining multiple projects, leading projects and even syncing their internal development schedules with Eclipse's release train. Once firms saw that IBM was not in control anymore and they now had the right to determine the future trajectory of the platform, most increased their participation intensity and took on new project leadership roles. As Firm 6 explained, "there were two things [of concern], one was just how much IBM people ran Eclipse and the other was the governance model. Who got to decide on what? So, when they moved to this model where IBM is like any other member company. I think that was one key point." Under collective governance, many firms deepened their participation, contributing more code and resources to the platform, effectively distributing platform leadership across a diverse set of hardware, service and software firms.

Opportunistic Alignment. Firms with an opportunistic alignment participated at mainly at two extremes: either by *Front-running the platform* or by *Redirecting the platform*. Firms 12, 13, 15 and 16 explained that, with the creation of the roadmap, board membership provided adequate visibility and influence over the direction of Eclipse without contributing code. Now armed with visibility as to the technical direction of Eclipse six months out, firm 13 had the opportunity to influence the platform's pace without becoming directly involved in a project. Firm 13 explained how the roadmap and process for evaluating new projects helped his firm adapt to platform growth:

I need visibility six months out. I can't be commoditized tomorrow. If you give me six-months, then I can adapt. That was a kind of compromise. The projects will be reviewed for a certain amount of time and won't appear over-night... That is really one of the big differences between Eclipse the way it is now vs. the way it was.

Board members also had the right to approve the charters and roadmaps for each project, with power to veto, by majority, if a project seemed "out of accord with the purpose and scope of Eclipse", per firm 15. These governance rules provided value to platform participants as they now had access to more information and more ability to influence the platform's direction and growth than in the prior phase.

Two firms with opportunistic alignment (1, 8) participated by *Redirecting the platform*: which required that a firm led a project in order to reprioritize requirements based on their own interests or

“hold-back” from developing features or code suggested by the community. These firms participated as board members, joined multiple projects, led projects, and synced their development schedule to align with Eclipse. Project leadership afforded these firms the chance to influence a project and *Redirect* it towards their own competitive interests. As Firm 1 explained “So, then it was the question, do you want to build on Eclipse and not have any influence on the dependency you are taking? And also not be seen as a leader, but a follower in the space? Or do you want to jump in and lead? Well, you’d jump in and lead.” While a firm might not be able to dramatically shift a project’s scope towards its own interests with the roadmapping process in place, project leaders had, as explained by firm 7, “negative authority” or veto rights. That is, project leaders could redirect projects by shaping development priorities or by omitting bug fixes that would enhance the platform relative to proprietary products. This type of behavior could be depletive to the community as failing to commit bug fixes offered by users not only devalued code quality, but could discourage community members from sharing their ideas. Firms with an opportunistic alignment assumed project leadership roles only in the collective mode but the intent was primarily to maintain competitive differentiation from the platform rather than to advance the platform.

Understanding Participant Variation. By tracing participants’ strategic choices, we pinpointed critical micro-moves that provide new insight on platform strategies which would be missed if platform participation was measured as a binary choice. Participation intensity was highly variable under different modes of governance for most firms. In the proprietary mode, when access was closed under sponsor control, firms participated with low intensity platform strategies by *front-running* or *observing* the platform - but without contributing code. In the sponsored mode, when access was open but sponsor controlled, firms started to deepen their participation and contribute code by *front-running*, *selling up*, *observing* or *integrating* with the platform. In the hybrid mode, when access was open, but platform leadership was indeterminately shared, firms that had deepened their participation now pulled back (except 7); by pursuing a strategy of either *front-running* or *observing* the platform. In the collective mode, once provisional issues guiding contribution were addressed, most firms deepened their participation, surpassing prior levels. Firms not only engaged in the platform strategies of *front-running*,

selling up, and *observing* but also, took on new leadership roles to *expand* and *redirect* the platform. In sum, external contributions to the platform increased as access and control opened to the collective and produced distributed platform leadership, but most firms reduced their participation intensity when platform leadership became indeterminate, even under conditions of open access.

Without fine grained analysis, we would also miss identifying variation in *how* firms participated: While some firms contributed in ways that enriched the platform's expansion (cooperative), other firms contributed in ways that could deplete, slow or redirect the platform's development (opportunistic). In contrast with the literature (Gawer, 2014; Parker and Van Alstyne, 2017), this variation in platform alignment was not sensitive to governance changes in control or access and persisted in all four modes. After revisiting the data, we discovered that firms with an opportunistic alignment were more likely to be in the software tools sub-industry and close complements or direct competitors with the platform, while firms with a cooperative alignment were more likely to be from diverse sub-industries and distant complements the platform (See Table 5). What is surprising is that participants competing with a collective and open platform would contribute technical resources at all. What we uncovered is a set of opportunistic strategies (in the form of *front running*, *selling up* and *redirecting the platform*) that encompass strategic participation in open platforms: where competitive differentiation is asserted by means of participation.

DISCUSSION

While many scholars have argued that platform leadership is a critical source of competitive advantage, the focus is often on the strategies of the platform owner rather than on those firms participating with the platform (Gawer and Cusumano, 2002, 2008; Van Alstyne et al, 2016; Adner and Kapoor, 2010; Adner 2017; Kapoor, 2013; West and Wood, 2013). How platform participants craft strategies to create value from the other side of the platform is an equally interesting avenue for exploration - particularly because the success of any innovations participants create also affect the success of the platform (Adner, 2012, 2017). Firms innovating from the other side of the platform embed their futures with the platform (Adner and Kapoor, 2010), yet, these firms typically have little control over the

platform's trajectory. Although most scholars acknowledge that platforms are dynamic, little empirical research has examined platform transitions from either the perspective of the platform leader or platform participants. This is an underexplored opportunity as platform transitions offer a clear window into platform dynamics. For, it is these moments, when a platform's rules guiding participation are most likely to be revised, that can trigger platform leaders and participants alike to reevaluate their strategies. In our case, access and control were gradually opened to collective governance. This phased transition enabled the examination of firm behavior under four different modes of governance, lending insight and precision to different access and control conditions that can impede or foster participation intensity, a key variable of concern for scholars for open innovation (Boudreau, 2010; Boudreau and Jeppesen, 2015, Kane and Ransbotham, 2016, Dahlander & O'Mahony, 2011; Jeppesen and Frederiksen, 2006).

Prior platform scholarship has focused on a single decision to grant others access to a platform at a specific point in time (Parker and Van Alstyne, 2017; West, 2003). Yet, access is but one aspect of governance that platform leaders can leverage to seed platform adoption. We consider how a more expansive set of governance domains influence participants' ability and willingness to participate which offers additional levers to designers of platform ecosystems (Adner, 2017). Most scholars tend to study platforms under one or two modes of governance (typically proprietary and/or sponsor), our data set allowed us to examine a common set of firms under four modes of governance – offering unique insight into two modes that are less understood (hybrid and collective). With a longitudinal, multi-method field study, we show how 16 participants adapted their participation intensity but not their platform alignment. In doing so, we specify not only how varying governance conditions can affect platform participation, but also identify an underappreciated source of variation on the other side of the platform. While much existing research assumes that only complementing firms are likely to participate with platforms, we show how firms can also contribute in opportunistic ways. Both discoveries contribute to the literatures on open innovation and platform governance.

Governance conditions and platform participation. Prior research has focused on how technological changes (Hargrave and Van de Ven, 2006) can upend a community or platform

(Chesbrough and Appleyard 2017, forthcoming) without appreciating how changes in governance affect platform dynamics. We have shown how governing access and control differ and how these two elements can be amended independently. Access affects the degree to which platform participants can use the platform and innovate cumulatively, whereas control over decision rights affects the incentives and rewards guiding contributions to the platform (e.g., Boudreau 2010). Although scholars recognize that platforms have dynamic architectures (Baldwin and Woodard, 2009), little empirical research has examined how changes in access and control conditions affect platform participants.

Scholars recognize that collective governance over a platform, standard or common pool resources is challenging to establish due to concerns with either the problems of appropriation or provisioning (e.g. Ostrom, 1990, 2007; Simcoe, 2014). Problems of appropriation concern how a common pool resource is accessed; problems of provisioning concern how a common pool resource is developed and maintained. Scholars have been mostly focused on over-appropriation or free-riding stemming from the failure to set rules governing platform usage. Yet, participants in the platform we studied focused on the opposite problem, what Ostrom (1990) calls provision problems: how to manage unfettered contributions to an open and collective platform. While scholars of open innovation might expect a community to thrive under hybrid modes of governance (Shah, 2006; von Hippel, 2005), we found most participants reducing their participation intensity when the rules guiding provision issues were not clear. Similar to a standard setting organization (Farrell and Simcoe, 2012; Simcoe, 2014) or collectively managed resource (Ostrom, 1990; 2007), establishing participants' ability to control the platform's trajectory, or what Ostrom (1990) calls "collective choice", was critical to revitalizing participation.

We recognize that our focus is on changes internal to the platform and there are other relevant variables external to the platform not measured in this study that can affect participants' platform strategies (e.g. Simcoe, 2010). There is no way to confirm a causal relationship between changes in access and control and the participation outcomes observed. All firms in our sample were subject to common conditions in the software industry. With consolidation in the software tools industry, a linear increase in platform participation might be expected as other platform options were retired. Yet, our informants

reported substantive reductions in participation intensity during the hybrid phase in response to provisioning challenges, followed by a significant recovery once collective governance was established. Thus, conditions of openness alone may be inadequate to stimulate platform participation. Providing participants with clear decision rights over a platform's trajectory and temporal predictability may be critical antecedents to external strategic investment. Participation intensity is a key factor explaining the logic underlying theories that champion open innovation (Chesbrough, 2003). It is the diversity and frequency; constancy and vitality of contributions that enrich what open innovation systems can offer (Raymond, 1999). Thus, changing the rules guiding access and control of any system purporting to support open innovation must be done with care to remain open but sufficiently structured to encourage high levels of diverse contribution.

Opportunistic Behavior in Open Platforms. The empirical and conceptual focus of much research has been on the platform leader without appreciating how participants on 'the other side of the platform' adapt their strategies. Our research contributes a dynamic perspective of platform participants' behavior and complicates their intention. Despite the fact that competition is a critical driver of partnership dynamics (Nalebuff and Brandenburger, 1996); and core firm strategy (Teece, 1986), platform scholars tend to assume that all external participants engage with a platform cooperatively (Gawer, 2014 an exception) and complementors are presumably undifferentiated (Parker and Van Alstyne, 2017). Our research questions this assumption and suggests that platform participation is not sufficient evidence to determine if a complementary relationship exists. We encourage scholars to look "under the hood" to determine how platform participation can be leveraged to serve potentially competing interests.

We observed firms with both cooperative and opportunistic alignment participating with Eclipse under all governance conditions. Both types of firms assumed leadership roles under collective conditions, but to different ends. When opportunists participated, they did so to further their own interests even when those interests could be depletive to the value of the platform; when cooperative firms participated, contributions were typically accretive to the value of the platform. At an extreme, opportunistic behavior can produce a competitive environment that can limit innovative outcomes

(Boudreau and Jeppesen, 2015) or destabilize an ecosystem (Wareham, Fox and Giner, 2014). Some may even consider the persistent participation of depletive, “opportunist” firms to represent a governance failure (Williamson, 1975), but our data suggests that firms with an opportunistic alignment played a vital role. While opportunistic firms enacted strategies that threatened the quality and vitality of the Eclipse platform, by using Eclipse and extending it in new ways, they also pioneered new technical advances and provided valuable signals as to the platform’s trajectory. Furthermore, since Eclipse was open and accessible in its later phases, any advantage gained by opportunists was temporary, as other participants could track or emulate the strategic moves and activity of opportunistic firms (e.g., Allen, 1983).

We have taken an initial step to identify variation in platform alignment that affected participants’ platform strategies, but future research could predict what types of firms are likely to act cooperatively vs. act opportunistically. In our sample, those firms producing complements closest to the platform were more likely to participate in opportunistic ways but future research could test this proposition. Since we were interested in understanding the adaptations firms make when engaging with a platform undergoing transitions, our research design is focused only on those firms deciding to participate with the platform. We cannot predict which types of firms were likely to initially join. We focused on participants’ cumulative strategic choices and identified a set of platform strategies but these likely constitute only one component of a firm’s broader strategy. We did not trace firm level strategic changes but recognize that these may also affect participation with external platforms. Our framework specifies a range of platform governance domains and strategic choices that may enable further comparative analysis. In sum, while much scholarship has attended to the power of platform leaders and their singular ability to control a platform’s trajectory, the success of these platforms often depends on the platform strategies of external participants. We contribute an initial step toward understanding not only the conditions shaping external participants’ platform strategies but also a renewed appreciation of how participation from diverse participants affects ecosystem vitality.

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TABLE 1: Platform Participant Descriptive Data

Firm	Joined Eclipse	Size (Rev \$M)	Industry	Sub-Industry	Public vs. Private
Firm 14	2002	10,000	Software	Business applications	Public
Firm 9	2002	700	Software	Database Management	Public
Firm 12	2002	15	Software	Development tools	Private
Firm 8	2002	10	Software	Development tools	Private
Firm 15	2002	<5	Software	Development tools	Private
Firm 16	2002	200	Service	IT Services	Public
Firm 5	2002	79,000	Hardware	Printing, Imaging	Public
Firm 12	2003	5	Software	Development tools	Private
Firm 4	2003	1,500	Software	Business intelligence	Private
Firm 10	2003	<5	Service	IT Services	Private
Firm 7	2003	34,000	Hardware	Microprocessors	Public
Firm 3	2004	100	Software	Business intelligence	Public
Firm 13	2004	<5	Service	IT Services	Private
Firm 1	2005	1,000	Software	Application integration	Public
Firm 2	2005	5	Software	Development tools	Private
Firm 6	2005	2,000	Hardware	Telecommunications	Public

TABLE 2: Data Sources

Modes of Governance	Proprietary	Sponsor	Hybrid	Collective
Dates	2000	2001-2003	2004-2005	2006-2016+
(1) Interviews (44)			████████	████████
(2) Observations (90+ hrs.)			████████	████████
(3) Archival Data				
80+ Board meetings				████████████████████
Sponsor documents	████████████████			
11 Foundation financial reports			████████████	
100+ Committee meetings, blogs and press releases		████████████████████		
4 Analyst reports				████████████████████

██████████ **Field Data**
 ██████████ **Archival Data**

TABLE 3: Platform Governance Transitions

Domain Types	Platform Governance Domains	Proprietary (2000)	Sponsored (2001-2003)	Hybrid (2004-2005)	Collective (2006+)
Membership	Designation of member rights – Who assigns voting rights?	IBM	IBM	Board	Board
	Designated voting rights – Who has voting rights?	IBM	Board	Board	Board
Legal	Ownership of IP - Who owns contributed code?	IBM	Participants	Participants	Participants
	Stewardship of IP - Who can assert licenses?	IBM	Participants	Board	Board
	Development of extensions - Who acquires rights?	IBM	Participants	Participants	Participants
Architectural	Eclipse scope - Who determines the direction and scope?	IBM	IBM	unclear	Board
	Design coordination - How are projects prioritized and coordinated?	IBM	IBM	unclear	Board
	Project leadership - How do new projects launch?	IBM	IBM	unclear	Board
Technical	Project requirements - How are project requirements prioritized?	IBM	IBM	Project leaders	Project leaders
	Release management - Who determines when projects are released?	IBM	IBM	Project leaders	Project leaders
	Code commitment - Who determines who can commit code to a project?	IBM	IBM	Project leaders	Project leaders

Table 4: Strategic Choices and Participation Intensity

Strategic Choice (N = 10)	Definition	Code Contribution	PI* Score	Representative Data
Use Eclipse	Utilize Eclipse as an internal integrated development environment	No	1	Firm 13: "Once we saw Eclipse, the development staff here started glomming onto it. Our developers started using it, they liked it."
Join Eclipse	Become a formal member of Eclipse consortium or foundation	No	2	Firm 3: "Most of our customers initially were IBM customers as well. When WebSphere Application Developer came to play, they jumped on that wagon and they wanted us to support that effort...so, that was one of the major reasons initially why we decided to join Eclipse."
Become a Board Member	Hold position on the board of stewards or foundation	No	3	Firm 12: "When it first became visible to me, I really scratched my head and said this is the first time I ever heard of an Open Source project with a board of directors. "
Commercialize around Eclipse	Develop a proprietary product built on top of the Eclipse platform	No	3	Firm 1: "We need to build on Eclipse. We need to stop what we are doing now and change and move onto Eclipse, because customers are demanding it. We need to bite the bullet and slip our schedule and do it now."
Donate Code/IP	Distribute freely and share existing IP or code with open source community	Yes	4	Firm 13: "The aspect where commercial quality software appears overnight is still a bit of a problem. But what has happened is even though pieces of commercial tools have shown up, they now go through a due diligence."

Strategic Choice (N = 10)	Definition	Code Contribution	PI* Score	Representative Data
Join a Project	Contribute development capacity to an official Eclipse project	Yes	4	Firm 5: "It varies, and it goes up and down, probably between six and ten [developers working on Eclipse]. It goes up and down based on what we are trying to do"
Join Multiple Projects	Contribute development capacity to multiple Eclipse projects	Yes	5	Firm 8: "We've got two Open Source, two Eclipse projects running right now. One we might have put in there anyway because we don't care so much about it. The other one we did because we care."
Develop Committers	Achieve status which enables publishing of code without peer review	Yes	5	Firm 12 "They are committing to it. I think that you'll find that people who are committing to it more, have a lot more committers it's just the best way to gather information."
Sync development schedule with Eclipse	Plan proprietary product releases to align with Eclipse releases	Yes	6	Firm 15 have to be adaptive, and you have to be prepared to quickly move forward with initiatives based on what is going on with Eclipse. So, I think it's time—it's a critical time-to-market notion."
Lead Projects	Architect, and guide development of key priorities for an official Eclipse project	Yes	6	Firm 7: "The complexity of integration. If counting on a component and dependent on features... as project leaders and board members, we have a great deal of influence over development cadence."

Key: PI = Participation Intensity. Participation Intensity is ranked from 1 being the lowest level of intensity to 6 being the highest level of intensity.

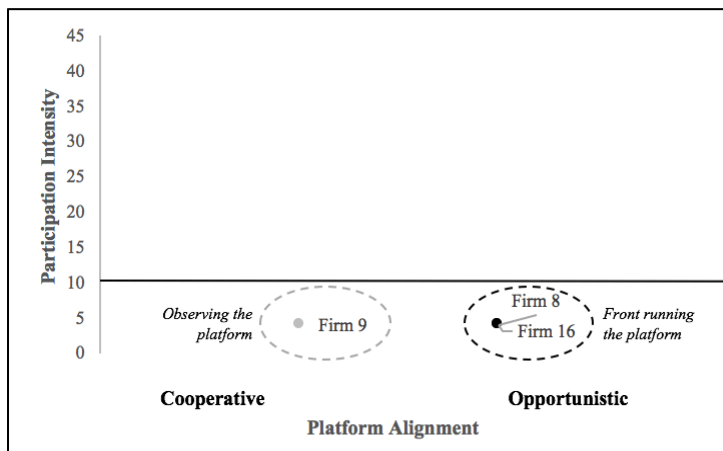
TABLE 5: Participant Strategies by Platform Alignment

Alignment	Types of Strategies	Representative Data
Cooperative (Firms 3,4,5,6,7,9,10,11,14) <u>Sub-Industries</u> Business intelligence Printing, Imaging Telecommunications Microprocessors Database Management IT Services Development tools Business applications	<u>Observing.</u> Engaged with Eclipse community without contributing code (Low PI) <u>Integrating.</u> Ensure existing proprietary product suite is compatible with Eclipse (Mid PI) <u>Expanding.</u> Develop new Eclipse functionality to support complementary business (High PT)	Firm 13: "Naturally I watch the areas that first affect me...like the Web tools project that is out there." Firm 11: "In the past we have had plug-ins to just about everything you can imagine. The idea of having one plug-in to write means instead of writing multiple plug-ins, our developers, can go and write more features for building. So, Eclipse is critical to us because of that reason." Firm 7: "We started looking across various opportunities and it started to become clear that one of the more appropriate places for us to contribute would be in the test and performance tools infrastructure which is where we have a lot of our new tools effort."
Opportunistic (Firms 1, 2, 8, 12, 13, 15, 16) <u>Sub-Industries</u> Application integration Development tools IT Services	<u>Front-running.</u> Offer proprietary products based on pre-release code without contributing back (Low PT) <u>Selling up.</u> Develop code that is limited or inferior to existing proprietary offerings (Mid PI) <u>Redirecting.</u> Prioritize or omit build requirements based firm-interests advantage (High PI)	Firm 8: "But we are there, we are involved primarily to watch. If they ever got their fundamental basic code to be better than ours, which right now it's nowhere near as good as ours, then we'll take theirs and put it under our product" Firm 2: "It's got to be a good enough teaser to get people to want to use it but will also adequately promote my stuff...So, I'm probably going to use the Open Source stuff as a lead generation capability." Firm 12: "Would I do holdbacks [holding back high quality code] too if I was sitting up there [leading a project]? No I wouldn't. But I'd sure have an aggressive parallel commercialization program to try to get to market ahead of my competitors regardless."

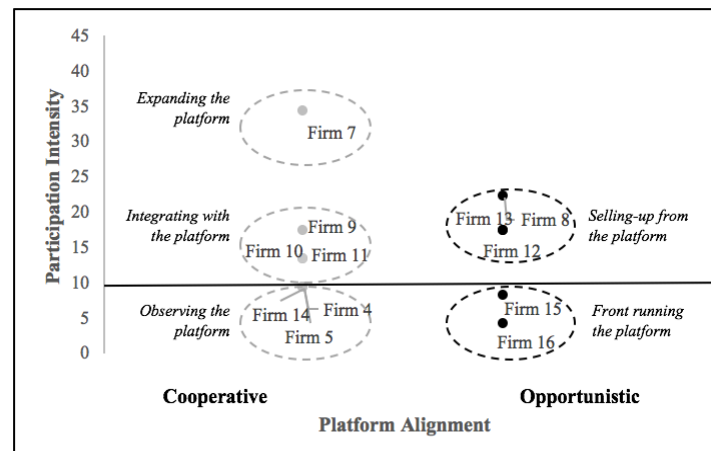
PI = Participation Intensity

FIGURE 1: Participant Platform Strategies (2000-2006)

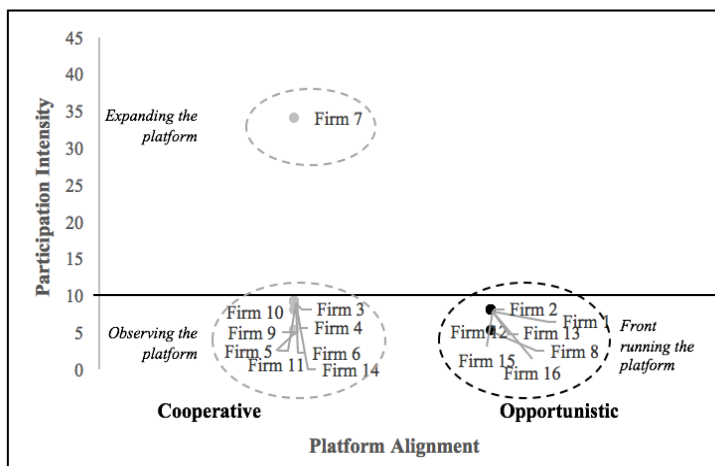
Phase 1: Proprietary (2000-2001)



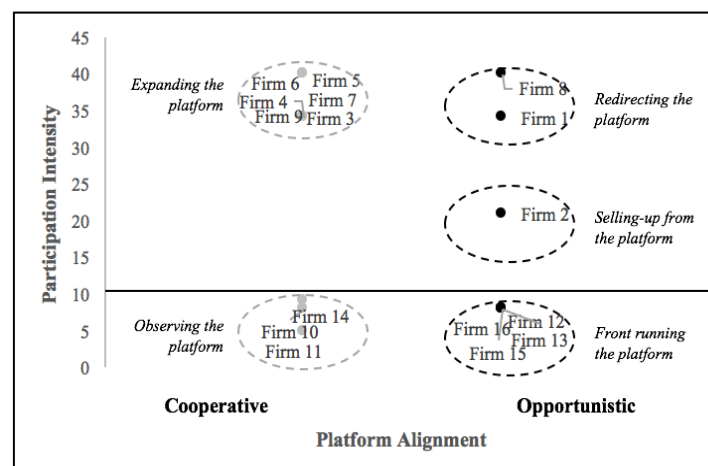
Phase 2: Sponsored (2001-2003)



Phase 3: Hybrid (2004-2005)



Phase 4: Collective (2006+)



Key: Firms' platform strategies are plotted based on their platform alignment (x axis) and participation intensity (y axis) by phase. The black line indicates the point in which participation intensity includes contributions of code to the platform.