



A process approach to understanding multiple open source innovation contests – Assessing the contest structures, execution, and participant responses in the android developer challenges

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ABSTRACT

As organizations recognize the importance of open innovation, understanding emerging mechanisms for soliciting outside participation is a growing area of academic interest. Strategies can be as diverse as hosting innovation contests, sponsoring open source software (OSS) communities, or engaging in bilateral partnerships. While these have been studied as distinct strategies, more recent work has identified the possibility for combining these approaches, or deploying different methods at different times. Because each of these open innovation strategies are characterized by different incentive systems as well as different work and social practices, the combination of these can reveal unexpected participant responses (e.g., collaboration in innovation contests, competitive behavior in OSS communities). This study examines an explicit attempt to combine these strategies, to host an open source innovation contest. Through the case of Google's Android Developer Challenge, a series of multi-million dollar innovation contests used to launch an OSS community over several years, this study utilized a process approach to understanding open source innovation contests to understand how participants responded and also how the contest conditions changed over time. We found several practices of competition and collaboration that worked around the short term and long term incentives and constraints posed by the contest. We also followed the contest through various transition phases and found that participants reacted strongly to changes in structure, execution, and shifting conditions over time. Through this case, we extend our understanding of innovation contests as a process and specifically the promises and pitfalls of open source innovation contests.

1. Introduction

A recent survey of large firms showed that open innovation is now a standard practice, with nearly 80% of organizations adopting methods of open innovation (Brunswick & Chesbrough, 2018). For organizations interested in attracting external innovation, one strategy is to host an innovation contest. Innovation contests, sometimes also referred to as tournament-based crowdsourcing (Afuah & Tucci, 2012; Boudreau & Lakhani, 2013), an idea tournament (Morgan & Wang, 2010), or broadcast search (Jeppesen & Lakhani, 2010), are defined as time-limited competitions arranged by an organization seeking an innovative solution whereby they call on the general public or a specific target group to make use of their expertise, skills or creativity and work toward a particular task (Adamczyk, Bullinger, & Möslein, 2012). In part due to new information and communication technologies, these types of innovation

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contests are especially popular in Information Technology (IT) fields (Adamczyk, Bullinger, & Möslein, 2012; Boudreau, Lacetera, & Lakhani, 2011; Brunswicker & Chesbrough, 2018), scientific research and development (Jeppesen & Lakhani, 2010), and engineering projects such as space exploration (Kay, 2013). For host organizations of innovation contests, they can generate excitement and attract attention from participants and media, particularly if the prize money is significant. Netflix garnered attention for announcing a \$1 million (USD) prize for developing movie recommender algorithms (Hallinan & Striphos, 2016), while Google's Lunar X Space Prize offered a total of \$20 million (USD) (Kay, 2011).

Given the potential organizational benefits (e.g. unforeseen external innovation) as well as costs (e.g. upfront financial commitment, resources to manage the contest), there has been significant academic interest examining various facets of these contests. First, many researchers have focused on the design and structure of these contests, examining differences in who can participate, types of problems/incentives, length of contest, etc. (Adamczyk, Bullinger, & Möslein, 2012; Bullinger, Neyer, Rass, & Möslein, 2010; Morgan & Wang, 2010). Often these structural components of innovation contests are seen as variables within a controlled environment to test certain economic or behavioral propositions. Studies have looked at how attributes of innovation contests work to attract and motivate highly qualified candidates (Adamczyk, Bullinger, & Möslein, 2010; Brabham, 2009; Leimeister, Huber, Bretschneider, & Krcmar, 2009), the relationship between eligibility rules and the size of the participant pool (e.g. likelihood of winning) and participants' willingness to enter the contest (Afuah & Tucci, 2013), how the size of the award incentivizes certain participant behaviors, and how it affects the heterogeneity and makeup of the participant pool (Archak, 2010; Boudreau et al., 2011; Terwiesch & Xu, 2008).

While contest structure is an important factor, scholars have also noted that these single tournament studies tend to assume that these structures are independent, static, and determinative variables, and that contestants will respond rationally to those. Researchers have also observed that innovation contest communities can behave counterintuitively, especially in instances where the contest structure is part of a more long-term project (Hutter, Hautz, Füller, Mueller, & Matzler, 2011). In these instances, participants may assume various roles that operate in between total competition and total collaboration (Füller, Hutter, Hautz, & Matzler, 2014). Additionally, researchers have found that certain structural factors may not work as intended in these environments, such as economic rewards becoming less effective at motivating participants (Antikainen, Mäkipää, & Ahonen, 2010). Innovation contests can also motivate destructive and unethical community behaviors and practices such as criticizing, attacking, sabotaging, and stealing ideas if the prize incentives are high enough and rival groups form (Faullant & Dolfus, 2017; Hutter, Füller, Hautz, Bilgram, & Matzler, 2015).

Given the wide range of participant behaviors and outcomes across innovation contests, a third important factor emerged, which was the active role that organizations play in hosting, executing, and governing these contests. Organizations often have complex goals when deciding on innovation contests, and those come to the forefront when they make decisions related to the execution of contests (Felin & Zenger, 2014; Lüttgens, Antons, Pollok, & Piller, 2012; Nickerson, Wuebker, & Zenger, 2017). Scholars taking a more host-centric approach to understanding contests have found that certain stages of a contest such as announcements and judging are particularly important, when organizations can take steps to elicit productive suggestions (Dahlander & Piezunka, 2014) and utilize different forms of structured feedback to ameliorate some of the inevitable rejection that contestants feel (Piezunka & Dahlander, 2019; Wooten & Ulrich, 2017). This line of work has advocated for more process-oriented approaches to understanding the interrelationship between structure, organizational action, and participant behavior and how they unfold throughout a contest (Faullant & Dolfus, 2017).

This study focuses on the case of Google's Android Developers Challenge (ADC), a series of innovation contests held to initiate and sustain an Open Source Software (OSS) developer community. Google announced that they would be holding two successive and independent challenges that would run over several years, called the ADC1 and ADC2. The format of both the ADC1 and ADC2 were also the same in that they both had two stages. The first stage was an open submission phase where anyone could submit, followed by a selective submission stage where a set number of finalists were chosen to compete for the grand prize. The contests were to be operated independently – participation in ADC1 was neither a prerequisite nor a disqualification to participate in ADC2 (with the exception of previous ADC1 winners). The contest incentives were \$10 million (USD) dollars in prize money, while at the same time Google billed the contests as OSS development by calling ADC the first complete, open, and free mobile platform and releasing the user-space software infrastructure through open source approved licenses (Apache License).

This case offers a unique opportunity for understanding important interrelationships between contest structure, organizational execution, and participant responses. For one, it is important to study long term contests that last months or even years (Bullinger, Neyer, Rass, & Möslein, 2010), because participants build up a particular relationship with each other as well as the host organization that can play a role in the success of the contest. Additionally, there is a need for research that examines recurring contests, because the promise of future contests can shape participant actions in earlier contests and over time the execution of previous contests can influence their perceptions and participation in future contests (Hofstetter, Zhang, & Herrmann, 2017). Third, this case allows us to study many different phases and periods of transition between the successive contests, where participants were alternating between active and inactive competition periods. Lastly, this case also attempted to initiate Open Source Software (OSS) development through the contests, which combines two distinct methods of open innovation (innovation contest and OSS collaboration), while also acknowledging that certain direct and indirect incentives would shift over time.

With all of these structural, organizational, and temporal components in play, examining any one of them as a static construct would overlook the complex interrelationships and shifts between them. In order to capture the dynamic nature of this contest, this study takes a process-oriented approach to understanding how the ADC unfolded and moved across various phases of the innovation contest (Faullant & Dolfus, 2017). In the earliest stages, where the prize incentive was the strongest and the community was first forming, we examine how the innovation contest affected OSS community interactions and what kinds of work practices emerged

over time. We then examine how these dual incentives systems shift across multiple phases, as the contest moved from the first open submission phase to a selective submission phase, from the judging to the rewarding phase, and from an inactive contest phase back to a second contest cycle. The process approach also identified several instances where the host organization played an active role in changing the contest parameters and subsequent participant responses (Faullant & Dolfus, 2017). By following the ADC through various phases, we can begin to see how participants respond to the presence of multiple systems of short-term and long-term incentives simultaneously, and ultimately how certain tensions are exacerbated and alleviated by the progression of the contest and the actions of the host organization.

2. Structure of innovation contests

Innovation contests for spurring IT innovation are increasingly being utilized and growing in size, number, and variety (Hutter et al., 2011). The large cash prizes may draw the headlines, but that is only one part of the larger organizational and managerial decisions that are necessary to run these contests (Boudreau & Lakhani, 2013). Innovation contests can vary widely in terms of rules, tools, goals, and execution that materially affect the nature of the competition. One important mapping of innovation contest structure examines a number of key attributes that competitions can have and a range of decisions that organizers can make (Fig. 1).

These ten design elements are an important starting point for understanding the structure of any given innovation contest, as well as ways of distinguishing one contest from another (Bullinger, Neyer, Rass, & Moeslein, 2010). Building on this initial list of components, more novel variations are identified in other contests – attraction (how the contests are advertised and announced), facilitation (moderation and support of participants), sponsorship (organizational partners), contest phases (number of rounds), and replication (frequency of subsequent contests) (Adamczyk, Bullinger, & Moeslein, 2012).

Much of the research that focuses on structure and innovation contests originated from behavioral economics, specifically by isolating one structural variable such as prize size or entry rules and assessing its effect on the motivation/behavior of contest participants. Studies examined whether contests that were open to large numbers of participants would decrease participant motivation in the contest (Boudreau et al., 2011) or how awards should be structured to encourage highly qualified participants (Terwiesch & Xu, 2008). Others have examined relationships between the structure of innovation contests and project outcomes, such as how to get a heterogeneous pool of applicants to avoid redundant work (Boudreau & Lakhani, 2013; Leimeister et al., 2009) and under what conditions they will be able to arrive at a crowdsourced solution (Afuah & Tucci, 2013; Blohm, Riedl, Leimeister, & Krcmar, 2011). Some have theorized that the way innovation contests are designed should depend on the specific levels of task specificity the problem requires (e.g. low, medium, high) and also the degree of elaboration the hosts are looking for from their submissions (Jeppesen & Lakhani, 2010; Liu, Geng, & Whinston, 2007; Sieg, Wallin, & Von Krogh, 2010; Spradlin, 2012). These studies isolate individual factors to understand how certain innovation contest designs might lead to certain economic, behavioral, and project outcomes.

While these are important findings, they tend to focus on one-time contests where structure is more determinative (Connelly, Tihanyi, Crook, & Gangloff, 2014; Dechenaux, Kovenock, & Sheremeta, 2015) or contests such as the Netflix Challenge or TopCoder where the level of task specificity is high (Archak, 2010; Boudreau et al., 2011; Khasraghi & Aghaie, 2014). Studies that examine the effect of contest structure on participant behavior, motivation, and other project outcomes tend to assume that the variables related to contest structure remain static (Adamczyk, Bullinger, & Moeslein, 2012). There has been less work that examines the inter-relationship between contest structures, as well as instances where contest structures become dynamic over a long period of time. For example, in the case of the ADC, Google announced it as a pair of contests, each with multiple phases, huge monetary prize incentives, and with the goal to facilitate long term OSS platform development. The nature of these contests offered participants a changing mix of short-term and long-term goals, as well as competing monetary, reputational, and social incentives.

3. Competitive/collaborative innovation contests communities

While narrowly bounded innovation contests with huge prizes garner much of the academic attention, recent surveys have shown that organizations prefer utilizing contests in coordination with other long term efforts because one off contests have more unpredictable participation, offer lower returns on investment, and are harder for organizations to guide in terms of community outputs (Brunswick & Chesbrough, 2018). Instead, innovation contests are often viewed not as an end unto itself, but as a strategy for continuous innovation and community building. Rather than pitting contestants against one another, contest organizers are increasingly trying to encourage collaboration by providing certain community functionalities for interactions between contestants (Bullinger et al., 2010), particularly online functions like listservs, chatrooms, and code repositories (Brabham, 2009; Leimeister et al., 2009; Piller & Walcher, 2006).

How innovation communities respond to the tension that comes from simultaneously encouraging competition and collaboration is a central question for open innovation researchers (Boudreau, 2012; Majchrzak & Malhotra, 2013). Some existing work has found that large prize incentives can play a role, and that when contest awards cross a certain size threshold, collaborative team-building become more prevalent because the cost of losing rises for each individual contestant (Afuah & Tucci, 2013; Deng & Joshi, 2016). Scholars have also found the presence of certain practices termed as ‘Communitation,’ or “elements of competitive behavior without disabling the climate of community-based collaboration (Hutter et al., 2011; p. 16).” These studies have identified certain user types within these communities. The first are pure competitors whose primary motivation is to win the contest and not inclined to collaborate. The second are co-operators, who actively engage in commenting and encouraging others' ideas. The third type are communitors who engage in competitive as well as cooperative behaviors, and lastly there are observers who rarely submit ideas or

Design element (synonyms): definition	Attributes					
1 Media (-): environment of innovation contest (IC)	Online		Mixed		Offline	
2 Organizer (-): entity initiating IC	Company	Public organization		Non-profit	Individual	
3 Task/Topic specificity (problem specification): solution space of IC	Low (Open task)		Defined		High (Specific task)	
4 Degree of elaboration (elaborateness, eligibility, degree of idea elaboration): required level of detail for submission to IC	Idea	Sketch	Concept	Prototype	Solution	Evolving
5 Target group (target audience, target participants, composition of group): description of participants of IC	Specified			Unspecified		
6 Participation as (eligibility): number of persons forming one entity of participant	Individual		Team		Both	
7 Contest period (timeline): runtime of IC	Very short term	Short term		Long term	Very long term	
8 Reward/motivation (-): incentives used to encourage participation	Monetary		Non-monetary		Mixed	
9 Community functionality (community application, communication possibility, tools): functionalities for interaction within participants	Given			Not given		
10 Evaluation (ranking): method to determine ranking of submissions to IC	Jury evaluation		Peer review		Self assessment	Mixed

Fig. 1. Ten key design elements for innovation contests, Bullinger, Neyer, Rass, & Möslein, 2010.

comment but view the discussion (Füller et al., 2014). Cultivating these teams is essential, as innovation contests that can foster positive experiences can encourage more frequent participation which in turn produces higher quality submissions (Füller, Hutter, & Faullant, 2011). Of course, there are those who do not want to collaborate, and instead act in competitive, antisocial, and even unethical behavior (Hutter et al., 2015). With a diverse pool of participants, emerging research has focused on how organizations can most effectively encourage collaboration through structural inputs and incentives, and what factors predict team performance (Riedl & Woolley, 2017).

While innovation contests have only recently started to explore the possibility of simultaneous collaboration (Majchrzak & Malhotra, 2013; Riedl & Woolley, 2017), OSS innovation communities represent an alternate development model that is foundationally built on collaboration. Since OSS was first articulated, much has been written about the organizing practices and norms within OSS communities (Feller, Finnegan, Fitzgerald, & Hayes, 2008; Lerner & Tirole, 2002; Raymond, 1999). First, OSS communities typically rely on a gift economy culture to organize social relations, particularly around practices of helping, sharing, and

communal evaluation (Bergquist & Ljungberg, 2001, Bruns, 2008; Raymond, 1999). In OSS development, mutual help takes many forms, such as users responding to direct questions and providing tutorials (Lakhani & Von Hippel, 2000), reviewing code to detect bugs (Raymond, 1999), offering feedback and ideas (Bergquist & Ljungberg, 2001), and working collaboratively on code that other people shared (Lerner & Tirole, 2002; Raymond, 1999).

Collaboration is not just an essential element of the development process, but also the socialization process. Much of the early work in OSS development focused on why people would freely reveal their ideas, with many participants reporting that the recognition from peers for their work was more motivating than the promise of monetary incentives (Fielding, 1999; Lakhani & Von Hippel, 2000; Lerner & Tirole, 2002; Raymond, 1999). Because the motivation behind OSS participation is often not monetary, scholars have identified a more complex system of incentives based on reputation, social interactions/relationships, and the creative energy and fun of working on projects (Duchenaud, 2005; Hertel, Niedner, & Hermann, 2003; Lakhani & Wolf, 2005). These practices of help and sharing are also how OSS communities select their leaders, with the idea that communal evaluation of everyone's work is the best way to select informal leaders, typically “determined through the continuous communal evaluation of participants and their ideas, and through the degree of community merit they are able to build in the process (Bruns, 2008; p. 26).” Within this environment, participants have been found to assume roles such as project leaders, core members, active/peripheral developers, bug fixers/reporters, readers, and passive users (Ye & Kishida, 2003). Although OSS communities are not necessarily free of competition (Franke & Shah, 2003), how they would respond to direct monetary disincentives to engage in some core work practices is an open question. Hence our first research question poses:

RQ1: What types of competitive and collaborative work practices emerge in successive, multi-phase, open source innovation contests with large monetary rewards?

4. A process approach to understanding open source innovation contests

Beyond the apparent ideological contradiction of an open source innovation contest, the many subsequent stages of the ADC1 and ADC2 presents another line of inquiry. Specifically, it allows us to examine how some of these practices and responses change throughout the contest, both as the contest transitions to non-contest periods and as the host organization makes certain decisions about how to execute the contest. Although there is a great deal of research on mechanisms for how organizations might initiate and govern OSS communities (Markus, 2007; O'Mahony & West, 2005; Shah, 2006; Sharma, Sugumaran, & Rajagopalan, 2002), the literature on governing innovation contest communities is relatively sparse (Felin & Zenger, 2014; Nickerson et al., 2017). In particular, there has been little work that “considers explicitly the overall process of crowdsourcing competitions from a contestant's perspective (Faullant & Dolfus, 2017; p. 1110).” Because long term and recurring innovation contests have been studied less (Hofstetter et al., 2017), how to manage contest communities that are also engaging in OSS development raises unique questions.

Although open innovation scholars have identified the possibility of utilizing both innovation contests and collaborative approaches at different times (sometimes called a mixed/nested approach), there is still a critical gap in our empirical and holistic understanding of how these approaches play out, beyond a recognition that it is risky: “mixed and nested approaches typically come with significant costs and considerable risks, and they should be deployed only with much caution and the appropriate attention to governing mechanisms (Boudreau & Lakhani, 2009, p. 76).” The risks for organizations are two-fold: 1) these systems have different incentive structures, which makes the community unpredictable and difficult to govern, and 2) contests necessitate a certain progression that will shift the assumptions and incentives for the community, the outcome of which is largely unknown.

As innovation contest studies have recognized that contests are a series of moving and interrelated parts, process based approaches have broadly identified three common phases for contests: Phase 1 of the process model highlights the announcements and entry into the innovation contest, while phase 2 identifies the time span for which the innovation contest is scheduled, and phase 3

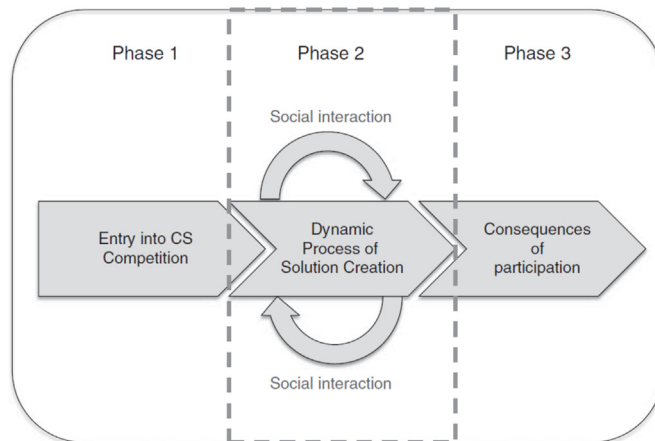


Fig. 2. Process model for innovation contests. From Faullant & Dolfus, 2017

documents the consequences of participation (Fig. 2).

The process model notes that each phase is not just important in isolation, but as a progression when host organizations transition between phases. Because these moments of transition are often places where the priorities of the host organization are made evident, these are critical moments for shaping participants' experience and responses. One area of focus has been on the move between phase 1 and phase 2, or how to move from the initial entry into contest to actually facilitating creative social interactions amidst competition. Researchers have explored the order in which organizations structure collaboration/competition and the impact that has on community relations and output, specifically the effectiveness of starting with collaboration first e.g. encouraging large-scale brainstorming, paired brainstorming, or individual work before moving into competition (Gillier, Osman Kazakci, & Piat, 2012). Other contests that lead with competition first have to then transition from that environment to a more collaborative environment. Phase 2 has been studied extensively but typically through the lens of understanding it as a product of innovation contest structure. Studying this phase as a process, however, can reveal several ways that host organizations can affect social and work practices. One such study found that adding real-time rankings during phase two led certain participants to take more calculated risks during the contest, as they know what they have to do to move up the leaderboard (Straub, Teubner, & Weinhardt, 2016).

Another area of research looks at the critical transition between phase 2 and phase 3, or how to end the innovation contest. Deadlines are an important temporal component that marks the transition between phase 2 and 3, one that researchers have found can spur team action to strategically allocate efforts during innovation contests around the deadline to maximize their chances of winning (Dissanayake, Zhang, Yasar, & Nerur, 2018). Once the submissions are in, the evaluation process has also been found to be an important flashpoint in innovation contests. Contest evaluation can take the form of self-report, peer review, a jury of experts, or some combination therein, each of which has certain tradeoffs for the outcome as well as perceptions of the contest (Ebner, Leimeister, Bretschneider, & Krcmar, 2008; Haller, Bullinger, & Möslein, 2011). Perceptions of unfairness can potentially undo the benefits of hosting the contest, as participants become disillusioned with the host organization (Faullant, Füller, & Hutter, 2017). Relying on community evaluation can further encourage participation, but may not yield the desired outcome of the contest host (Haller et al., 2011).

Phase 3 of innovation contests also represents an endpoint, where the organization distributes rewards and the community into winners and losers. The way that organizations do this is critical, and some examples where organizations prioritize certain contestants have been found to discourage people from continuing to engage with the company (Faullant et al., 2017). Some recent research has highlighted the importance of feedback and the critical role it can play in ameliorating the sting of losing a competition and sustaining participant motivation (Piezunka & Dahlander, 2019; Wooten & Ulrich, 2017). For platform development in particular, organizations have to balance their own interests while also negotiating the boundaries of platform resources (Ghazawneh & Henfridsson, 2013).

While the process approach identifies key stages that all contests go through including entry, contest, and conclusion phases, the original model only takes into account a single contest (Faullant & Dolfus, 2017). Because the ADC was announced as two successive contests (ADC1 and ADC2), this study builds on the existing model as a more complicated contest structure that is more long term and moves between contest and non-contest phases. Furthermore, while existing research has focused on particular points of transitions in the existing process model, there is less work that attempts to understand the ways that organizations can execute those transitions as well as how those decisions affect participant responses over time. Hence, this study asks the following research questions:

RQ2: How does the organizational structure of successive, multi-phase, open source innovation contests affect short-term and long-term incentives for participants over time??

RQ3: How does the organizational execution of successive, multi-phase, open source innovation contests affect participant responses toward the host organization?

5. Research design and methods

On November 12, 2007, Google publicly announced that they would be hosting the Android Developer Challenge (ADC). Because the research questions presented are about the reactions of an innovation community as they responded to changing circumstances over time, a single case study approach is employed (Yin, 2003). Although quantitative measures are useful for identifying specific phenomena, qualitative case studies are more appropriate for understanding emerging practices, tensions, and subsequent developments within innovation contests (Adamczyk, Bullinger, & Möslein, 2012). The process approach to studying innovation contests is particularly important in unpacking details about the perspectives, practices, and interactions of the participants over time, through multiple sources of data (Faullant & Dolfus, 2017). The structure and execution of the ADC provided a naturalistic, real-life context in which a particular set of occurrences represented an intervention (Yin, 2003).

5.1. Data collection

The data collected for this study (see Table 1) come from a variety of sources: 1) direct observation of listserv communication and interactions, 2) semi-structured qualitative interviews, and 3) official documents about the contest itself from Google, ADC organizers, and Google advocates on the listservs. The majority of the data comes from the official online listservs that Google set up to facilitate communication and provide support amongst the community, which became central places where developers would discuss key issues and solicit help. Our primary data sites were the Android Challenge and Android Discuss listservs, where developers would post discussion threads and interact about issues related to the ADC1 and ADC2. This Android Challenge listserv was composed of 6635 posts covering the first contest phase of the ADC1 from November 2007 to June 2008, when the listserv shut down. The

Table 1
Data sources.

Data type	Data
Listserv Communication Semi-structured qualitative interview Contest documents	11,620 posts in total from Android Challenge listserv and Android Discuss listserv 12 phone interviews recruited from Android Discuss listserv and AndDev.org Announcements, contest criteria, and official statements from Google and ADC Organizers

discussion then moved to the “Android Discuss” listserv, where 405 posts were collected until the overall winners were announced and the ADC1 was officially brought to a close in August 2008. When ADC2 was formally announced in May 2009, another 4580 posts were collected from the “Android Discuss” listserv until the close of the ADC2 competition in November 2009. Observation of these listservs during these discrete phases of a contest (e.g., entry phase, contest phase, evaluation phase) offers a systematic way of observing not only the specific types of communication taking place, but also how community responses emerged and changed (Faullant & Dolfus, 2017).

We also collected data in the form of semi-structured, in-depth interviews (Lincoln & Guba, 1985). We left recruitment messages to solicit interviews on the Android Discuss listserv, the official listserv run by Google and also [AndDev.org](#), a user-run site that claimed to be the largest independent community of Android developers.¹ Phone interviews were conducted with twelve informants. Interviews ranged in length from thirty to more than ninety minutes and were audio-recorded and transcribed to ensure the accuracy of participants' statements.

Of the twelve participants, eight were Android developers participating in the contest, three were Android bloggers, and one was a Google engineer. Because semi-structured interviews allow for a deeper understanding of the underlying motivations for particular practices, the interview guide included a uniform set of questions supplemented with follow up questions. Questions addressed the following issues: 1) How interviewees moderated their practices due to the competition, 2) How interviewees felt the competition was affecting community norms and working practices 3) How interviewees perceived certain organizational decisions made in executing the contest and 4) What reactions interviewees had to key points of transition between contest phases. Pseudonyms are used unless confidentiality was waived.

Finally, we gathered data from primary documents such as the Google ADC call, criteria, and feedback emails from the contest. We also gathered statements posted by Android advocates, or members of the Google development team on the official listservs that either clarified questions or explained the procedures for judging after the contest ended. These documents were added to the corpus of data and provided insight into Google's perspective and its attempts to communicate with the community. The source of the data is noted after each quotation below.

5.2. Data analysis

This study draws upon the data analysis approach outlined by Yin (2003). The corpus of the data set was analyzed using the qualitative software Dedoose. First, we engaged in within-case analysis, by reading all of the posts in the data set. From there, we identified a distinct timeline of events that demarcated key phases within the contest, which formed the basis of our findings and directed us to code for certain responses (see Fig. 3).

There was the initially announced ADC1 open submission phase, followed by a period of debate over the contest deadline extensions. Subsequently, there was the ADC1 submission deadline, followed by a judging/evaluation/rewarding phase for ADC1. After the finalists were selected, most of the community transitioned into a non-contest phase, before the ADC2 was announced again and entering the ADC2 contest phase and judging/evaluation/rewarding phase. These sequential categories helped break down the corpus of data, while also elevating certain categories of analysis.

After sorting the case data into distinct periods, we did a second round of coding for questions relevant to each period. For RQ1, we were interested in participants' competitive and cooperative work practices. While existing research has identified certain roles that people play in collaborative innovation communities (Hutter et al., 2011), we engaged in open, iterative coding as opposed to applying a predetermined set of codes because we believed that the unique circumstances of the ADC1 could inspire distinctive practices. Several of our iterative codes came from certain in vivo practices, specifically instances of ‘partial-revealing for team building’ and ‘full-revealing.’ We also tagged responses that referenced open source practices, to understand how participants were responding to tension of competing/collaborating. Lastly, we tagged posts where participants would discuss the contest criteria and their goals and projections for Android, to understand how participants were reacting to the various performance incentives during the contest.

To understand the interaction of contest execution and participants' reactions over time, we focused on distinct phases in the contest and periods of transition between them, namely the transitions between the initial announcement, the scheduled contest period, and the deadline and awarding period of the contest (Faullant & Dolfus, 2017). During the course of the contest there were also organizational interventions, when the host organization took steps that altered the structure of the contest and the ways that participants were rewarded. After dividing the contest into several distinct phases, we further identified different types of practices and reactions that emerged specific to various contest periods such as evaluation/judging and rewarding contest winners. In this

¹ Permission to recruit participants was granted by Google listserv moderators and [AndDev.org](#) administrators

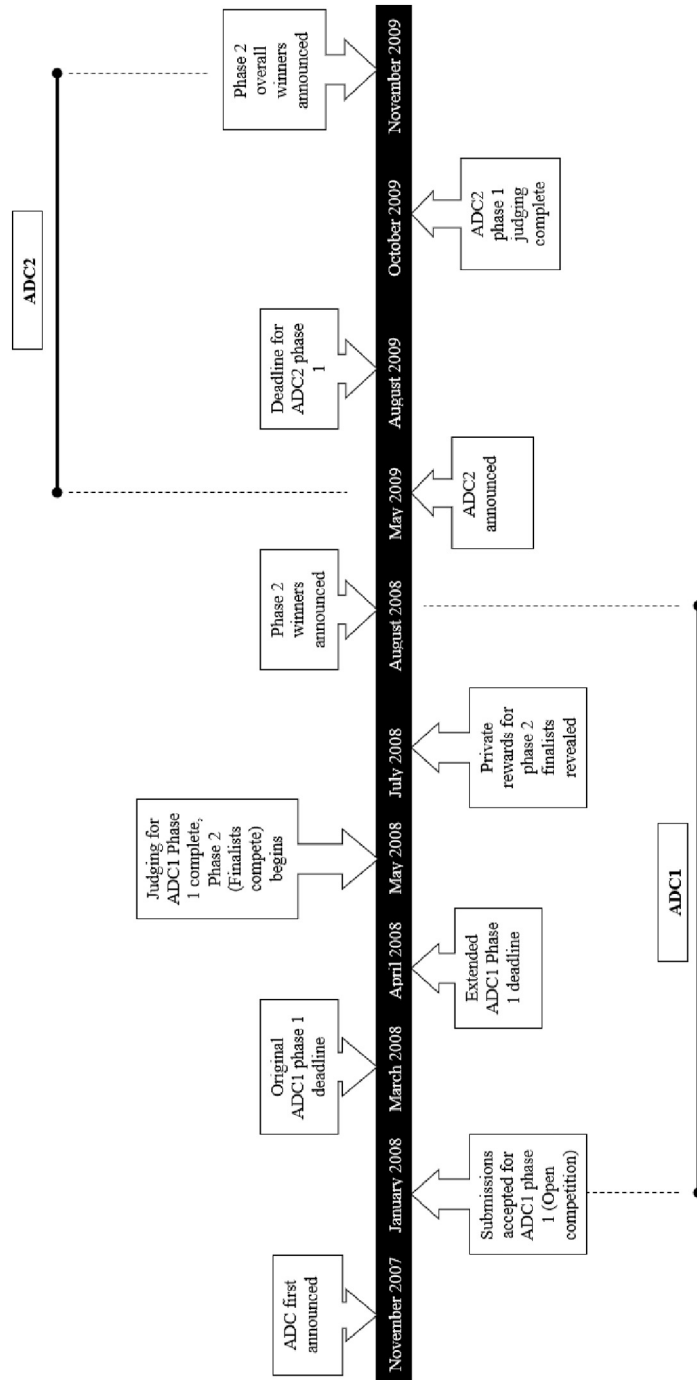


Fig. 3. Timeline of Events in the Android Developer Challenge.

phase of the competition we coded for reactions and statements about the evaluation process, with themes emerging related to questions of fairness, transparency, and feedback/justification for the results. In particular, after the contest ended, there were a number of discussions about the identity of open source communities and how people reconciled the contest period. Lastly, we coded the posts during ADC2 period, particularly with regards to the changes in the contest and people's reactions to those (see [Table 2](#)).

After completing the coding and reanalyzing those posts, we took memos of the in-depth qualitative interview for each distinct phase to analyze and link phenomena together ([Emerson, Fretz, & Shaw, 1995](#)). These memos allowed us to group certain messages and provide important context behind certain practices and responses. Specifically, writing up in-depth qualitative memos allowed us to identify themes and patterns, link messages together, and provide explanation for some of the posts. Lastly, these memos served an analytic purpose. Comparing the same phenomena across time periods, as well as looking at the buildup of different tensions and frustrations over a long period of time allowed us to tie certain responses to transition decisions made by the host organization. These memos form the structure and the basis for our findings.

6. Findings and analysis

6.1. Phase 1: ADC1 open contest period (originally November 2007–March 2008)

After the initial announcement of the ADC, Google took steps to implement the tools for the community to interact. They created several official listservs where participants could discuss the contest, share codes, as well as a repository where coding could be shared with other people. Once the contest period officially started, there were high levels of uncertainty surrounding what people would do with those listservs and tools. Many participants immediately took note of the disconnect between the large monetary reward and typical collaborative OSS practices. In an early thread about protecting application ideas, one person advises: “Don't tell anyone, just because you have some ideas doesn't mean other people have them too (Challenge listserv, 22 November 2007).” The tension between OSS and competition was even explicitly identified by participants, along with a prescribed solution: “As mentioned by others this contest is completely contrary to the nature of open source development. [...] Help your friends, deceive your opponents, make profit (Challenge listserv, 21 November 2007).” This lack of self-revealing became the norm within the community, as several posts a couple months into the contests commented on how little code was being posted to a repository site called Open Android: “Open Android's page has about a dozen applications listed so it seems most people don't want to let others in on what they're doing (Challenge listserv, 12 February 2008).”

This hesitation to reveal ideas was evident in another practice of OSS communities, which was forming teams. Whereas in OSS communities, teams form naturally, based on self-revealing and participants volunteering and self-selecting into projects, the contest complicated that calculus. In response, one practice that people began engaging in was to solicit help through ‘partial revealing,’ where they would simply ask for skills:

I am looking for fellow experienced java coders who are seriously interested in developing some killer apps [...] I have several very strong ideas for products that would work very well in an Android world. I [...] need help to get others developed in time for the challenge (Challenge listserv, 24 November 2007).

Some of these calls listed a vague idea about their projects, such as multiplayer online gaming or music applications, while others were more secretive and only indicated that they had a cool idea. Others listed the skills they were looking for like Java, XML, and sometimes English language was a requirement.

Although self-revealing of code and ideas was limited, there was evidence that some members of the innovation community did not just isolate their actions to their team. There was a group of contestants that tried to foster an atmosphere of helping and belonging. As people started to explore the software development kit (SDK) and pilot some ideas, contestants started utilizing the listserv as a resource for asking questions. Most of the time, direct inquiries were quickly answered and sometimes by multiple people in the thread. During the open contest period, there were 540 threads that posted questions to the community. While some were unanswered (94), the vast majority of them (446) got at least one response. This atmosphere and expectation of mutual help was confirmed by participants: “It's pretty rare that I can't find the answer to a technical question [...] There are a few people who seem very helpful (Eric, contest participant, interview).” Michael, the founder of [GoogleAndBlog.com](#), also described a general atmosphere of mutual help: “There was a lot of helping and assistance and kudos and compliments, [...] from my perspective in talking to developers everyone was helping each other out as opposed to animosity or ultra-competitiveness (interview).” In these ways, participants adhered to one of the key practices of OSS communities by helping each other, providing feedback, and posting tutorials in order to build reputations and to act as if they were still part of an OSS community.

Shortly after the contest started, one of the participants proposed a unique workaround solution to the tension between competition and collaboration. A group of developers decided to undertake a project called OpenIntents. OpenIntents was a project started for developers to post code and components for others to use in their projects. One of its founders called for developers to participate:

Many of us have great ideas for the Android Challenge, but [...] people may end up implementing same or similar functionality over and over again, thereby slowing down all Android projects. In the end none of the applications from the challenge are likely to work with each other. The problem is, we don't (and shall not!) know of each other's secret work! [...] Let us each keep our award-winning ideas secret, but let us get together for these common features that will be required in many applications. We will develop open interfaces and intents that go beyond those basic intents that Android defines [...] All of our projects would benefit

Table 2
Sample codes, and representative quotes.

Practices	Codes	Representative quote or evidence
Collaborative Behavior: Helping Behaviors	#1 – Answering Questions	Total number of thread subjects ending with a question (540), number of threads answered (446)
	#2 – Posting Tutorials	I created 3 Android tutorials (blog.pocketjourney.com) and can see how many people visit the site each day since it went live & how many downloaded the tutorial .zip files. Well...actually I see page views not visits but anyway... I have been surprised how many visits I've been getting to each tutorial. Tutorial 1 has been getting the most hits consistently even though it's been up for a month. Tutorial 1: average 30 page views & 7 downloads each day since March 15. Tutorial 2: 10 page views & 4 downloads each day since March 19. Tutorial 3: 3 page views & 3 downloads each day since April 4th.
	#3 – Providing Feedback/Suggestions	Great work on your app! I couldn't help but notice that it might be very similar to QR codes used in Japan. They've been using it in Japan for awhile now and it's pretty popular for adverts, special promotions, coupons, etc..... Here's the wiki: http://en.wikipedia.org/wiki/QR_Code Here's an article: http://tips.webdesign10.com/search-engine-optimization/japanese-internet-marketing At the comments section someone mentions that Google has started using it as well. Hopefully this isn't a downer for you. Just wanted to give you a heads up just in case. Good luck with the Challenge!!
Combined Collaborative and Competitive Behaviors: Self-Revealing Practices	#1 – Partial revealing for team building	I am looking for fellow experienced java coders who are seriously interested in developing some killer apps [...] I have several very strong ideas for products that would work very well in an Android world. I [...] need help to get others developed in time for the challenge
	#2 – Partial revealing of ideas	Our skill-based game follows the rules of poker but is a very different game with player card selection replacing random dealing. It is a game that appeals to all types and ages and is ideally suited for Android. Its current form possesses major improvements and new features over earlier incarnations.
	#3 – Full Revealing	I decided to make my submission public. Submission Info: http://allbinary.axspace.com/ The 2 games: http://allbinary.axspace.com/AllBinaryArcadeAndroidApplication.apk I bet I have the best individual submission and probably one of the best games, but I will keep making updates. I have more ideas than I know what to do with as usual.
Participant reactions	Codes	Representative quotes
Leveraging Short-term and Long-term Incentives:	#1 – Tensions	Here they were trying to promote the idea of open source and then - they have this contest where potential collaborators and people who are sharing with one another are now competitors. [...] I can't understand what made sense there, either you want to do a contest or you want to foster some kind of sense of community (interview).
	#2 – Adherence to open source	It has not been received well that SDK updates are available to only few under NDA, selected by the challenge, without letting anybody know. [...] Right now the developer community seems to fall apart. This post-Challenge period left an impression with many that we're considered Google roadkill. All the way through spring this year we accepted to build our apps at-risk (no established platform). Fine, but we did not expect getting dropped like a hot potato. This has pushed me over anyways. Summer of no code here
Reactions to Organizational Judging Decisions	#3 – Creation of OpenIntents as alternative solution	Submitting the open source project OpenIntents with a great team and wonderful community support:-) Find the info here: http://www.openintents.org and here: http://code.google.com/p/openintents/
	#1 – Questioning qualifications	Google admit that after they happen to pass the application to judges (who are not techy) things are out of their hands. They couldn't even ask them to reset etc. the emulator. So I wont be surprise if some Soccor mom [...] couldnt test my app
	#2 – Emphasizing Openness and transparency	It was really smart in that they provided people with a judging app [...]. It makes it seem more collaborative as opposed to Google being the arbiter of what really the best app or the winner. [...] For better or worse, at least it's the community judging as opposed to Google handpicking the top apps to show. [...] You need more of the people's voice in it so it seems like a true contest and feel like we get a true winner, or winner in the people's view. [...] People just wanted to have a say, didn't want [to] basically be dictated to from a select few
	#3 – Calling for Feedback	Is it really all that helpful to have 100+ different judges scoring 1788 applications on a 10-point scale in 4 different categories? How much better is

(continued on next page)

Table 2 (continued)

Participant reactions	Codes	Representative quotes
Reactions to Unexpected Release of New SDK	Expressing Dissatisfaction and Anger	this than, say, asking each judge to award 1 to 5 stars? A simpler scoring system would allow more judges to rate more applications in less time, and is probably just as fair and meaningful (if not more so). Give feedback. You could tell people what gate they reached and consider telling them their average rating, too. Otherwise it feels like all our efforts have disappeared into a black abyss.
Reactions to Organizational Decision on ADC2	Engaging in OSS again with lower levels of tensions	Google has failed to keep its word to the fullest extent possible. [...] Never again, Google! It was really smart in that they provided people with a judging app [...]. It makes it seem more collaborative as opposed to Google being the arbiter of what really the best app or the winner. [...] For better or worse, at least it's the community judging as opposed to Google handpicking the top apps to show.

from well-defined open intents and interfaces, and our applications could work together in a smart way and share data right from the start! [...] I'm waiting for your second-class ideas! (Keep the first-class one by yourself!). [...] (Challenge listserv, 5 December 2007).

The creation and maintenance of OpenIntents revealed a key tension of the competition format, but also demonstrated that developers recognized a long-term need to cooperate for both practical and social reasons. OpenIntents emerged as a work-around solution for collaborating, whereby participants could share lower-level operations such as components while acknowledging the need for and maintaining secrecy at the conceptual level. The contest community was generally supportive of the OpenIntents call, and it did gain some traction amongst certain members. People began posting lines of code for activating certain features within an application (e.g. how to access an address book feature within an application).

In the end OpenIntents was also practically successful, as at least one of the finalists in ADC1 acknowledged utilizing functions posted to the OpenIntents repository.

6.2. Phase 2: Contest deadline extension and updated SDK (January 2008 to April 2008)

About halfway through the contest period, Google began a thread to ask developers if they wanted to have more time with their submissions and whether they should extend the deadline. This became one of the most heated threads on the listserv, as some developers voted yes on an extension and expressed gratitude for the extra time, while others voted no and were furious for giving competitors and latecomers more time. In the end, Google made an announcement on January 28, 2008 that they were pushing the round 1 deadline back from March 3, 2008 to April 14, 2008 because they were going to release an updated SDK with user interface improvements that could ultimately improve contest submissions. Debate continued about the merits of this extension, with participants heatedly arguing about what it did to the legitimacy of the contest and whether it was fair to change the rules midway through the competition. This transition elevated some tensions between fairness in the contest and the collaborative feature in the OSS community. Some viewed an extension as a zero-sum tradeoff and opposed any move that would lower their chances of winning the contest. Others were more receptive because they were using the contest as a first step to build a better application and a better platform to gain long term experience.

Despite Google employing the logic of OSS goals to justify the extension and taking a longer-term view of development beyond the contest, a somewhat unexpected response came from the founder of OpenIntents, who was not supportive of the extension:

I have to say I have lost faith in a fair competition. [...] Those who voted "no" have been slapped in their face: They have helped to improve the SDK by uncovering shortcomings, reporting errors and bugs, struggling with the current implementation, helped to build tools and community forums. [...] Building an application now with all the help and code available is *much* easier than it was three months ago. Thank you to all the people who despite the spirit of the competition helped each other in the developer forums, who struggled together to where we are right now. [...] I really want to bite my ... when I see that "early birds" like us have helped to build great tools like the OpenIntents SensorSimulator [...] Now any company with decent designers can easily implement and test applications that use the accelerometer and create applications that look much better than any application a lonely fighter can create. Those who helped to build tools like this have now much less probability to win anything in this competition. I really can't hide how I feel right now - I'm really disappointed (Android Challenge listserv, January 29, 2008).

Many others echoed this sentiment, which points to the complex nature of OSS innovation contests. It again reflects the tensions between participants' pursuit of long-term collaboration and short-term contest incentives. Even as OpenIntents advocated OSS principles of interoperability and quality as justifications for creating and participating in this group and the deadline extension relied on some of those same logics, it was participants' perception that Google made a decision that changed the underlying conditions for their collaboration and exploited their collaboration to benefit potential newcomers. While they were willing to help one another, they still viewed the deadline extension as a move that directly affected their chances of winning the contest by increasing the potential contestant pool. It also surfaced a new tension, between the early actors in the community and the later arriving contestants, who might benefit from the advances that the OpenIntents participants had made and get a 'free ride' from their work.

6.3. Phase 3: ADC1 judging/evaluation period (April 2008–August 2008)

After the extended deadline passed in April, Google reported that there were 1788 eligible submissions. Certainly, the ADC1 accomplished the goal of motivating developers. It was only after phase 1 ended, however, that the extent of the non-revealing practices was clear:

I have to say that I'm very suprised [sic] that the number of submissions is as high as 1788, since the number of applications with publicly available information is still very low (< 100). Why is everyone keeping it a secret what they are doing: is (almost) everyone afraid that their idea will be stolen? (Challenge listserv, 18 April 2008).

With the contest period for open submission over, all the attention shifted to Google and their partners, who had the responsibility of evaluating the community's work and publicly announcing 50 finalists. This became a highly scrutinized position for the host organization given the number of applications submitted, the months of work many developers and teams put into their applications, as well as the monetary stakes involved. While the judging structure had been announced at the beginning of the contest, it was only at this moment that it became an important indicator for how the innovation community perceived Google to be executing the contest.

The public announcement of the 50 ADC1 finalists was an important event that validated certain practices and triggered a wide range of reactions. In the lead up to the announcement of the finalists, people started receiving scores from Google, given in quartiles for a variety of criteria. People took to the forums to discuss the judging, which they felt amplified and revealed several key tensions during the transition from the contest phase to non-contest development. Wang, a longtime member of the community, called into question the execution of the criteria and the qualification of the judges:

I thought the challenge judging process was unfair. The criteria was [...] poorly executed. Many judges were not qualified since they are from hardware/manufacturing industries, not software. There were a few good selections for ADC I finalists, but there were a lot more interesting projects that got rejected, partially due to the above reason (interview).

Finally, many of the complaints centered around the scores the contestants received and the lack of feedback from the judges:

Do you call that 'quartiles' a FEEDBACK ? LOL :) [...] It is something like 'you got score about 0 to 100%'. It tells NOTHING. Besides, no judging comments, no position in ranking, no "raw" score based on four criteria. This is joke and confusion to all of us (Challenge listserv, 19 May 2008).

Shortly after the finalists were announced for the ADC1, a thread advocating a boycott of the ADC2 was initiated, with many contestants from the ADC1 posting criticisms about the lack of transparency in the process:

Justice is the very fundamental element in any competition or challenge. It cannot be ignored or forgot. Unless the ADCII is significantly improved, our developers will think twice if it worths [sic] the efforts. At least, the judges, their qualifications, and the judging process should be published before the challenge starts. [...] Most developers went into to the challenge without knowing exactly who, how and when their months of efforts would be judged [...]. (Challenge listserv, 18 May 2008).

The theme of transparency came up repeatedly as competitors reconsidered their participation in future contests and questioned the legitimacy of the results. While with all innovation contests there will inevitably be some element of disappointment with the outcome, the way that Google structured the contest placed heightened scrutiny on the jury making the decision. By assuming sole responsibility for judging, Google became the arbiter for making the decision about submission quality. This contrasted sharply with how OSS communities tend to communally evaluate code submissions, select their own leaders, and judge the performance of the community. People who submitted applications that were not selected were also reading other participants' reactions to Google's evaluation to decide whether to continue working on Android and try again in the second contest.

6.4. Phase 4: Rewarding finalists of the ADC1

After the judging of the open submission phase of the contest concluded, the majority of the innovation community (with the exception of the 50 finalists) had now fully transitioned to a non-contest period. In the midst of this, however, some unintended revelations about how Google was rewarding the winners generated significant community backlash. On July 14, 2008, an Android advocate at Google accidentally emailed an announcement intended only for the 50 finalists to a public listserv. This message implied that the finalists of the ADC1 would receive a private download of a new SDK with new updates and tools for the next phase of the competition. The finalists were contacted about the new SDK but could not comment because they had signed Non-Disclosure Agreements (NDAs). The next day, the Android advocate sent an apology for the mistake and for any "annoyance" the message might have caused.

However, for the many developers who spent months working with the initial SDK, which many felt was buggy and clunky, the revelation of tiered access to updates was more than an annoyance. Reactions ranged from aggravation, with one programmer suggesting that the company was taunting the losers of the ADC, to open hostility from many developers feeling cheated and betrayed: "Now we discover it isn't even closed source, it is top secret (Discuss listserv, 23 July 2008)." Some felt that the company's revelation and the way they found out about the private SDK was so egregious that they threatened to stop programming for Android altogether. One programmer wrote: "Google has failed to keep its word to the fullest extent possible. [...] Never again, Google! (Discuss listserv, 21 July 2008)" As one contestant wrote:

Wonder how many of us would have actually gotten behind Android if we knew that they were going to only cater to the top 50. Definitely feel betrayed.... [...] Obviously the winners have a leg up now and I'm sure they know much more than the rest of us, but that's all because of Google (Discuss listserv, 15 July 2008).

The NDAs being added onto the updated SDK also angered OSS developers on a political level, given that some of the first manifestos about free software decried NDAs as a tool for companies to exert proprietary control of information (Stallman, 1985). One poster writes:

It has not been received well that SDK updates are available to only few under NDA, selected by the challenge, without letting anybody know. [...] Right now the developer community seems to fall apart. This post-Challenge period left an impression with many that we're considered Google roadkill. All the way through spring this year we accepted to build our apps at-risk (no established platform). Fine, but we did not expect getting dropped like a hot potato. This has pushed me over anyways. Summer of no code here (Discuss listserv, 11 July 2008).

Given the amount of time participants invested in the contest and the amount of work they had done identifying key issues and bugs in the platform that likely helped Google make their SDK update, many were angry that the benefits were now being transferred to a select group. Carl, a prominent leader in the Android community, said this about the impact of the private SDK release:

I view it as a major blunder. While Android development has continued despite the "Summer of Silence," it set the stage for a lot of on-going anti-Google sentiment and sapped community interest right at a time when the community should have been forming a more robust ecosystem (interview).

Wang was similarly blunt about it: "The release of a private SDK to a selected few violates its claimed openness/fairness. Some developers gave up Android and went to iPhone (interview)."

The number of participant responses noting a loss of motivation and leadership in the post contest period demonstrates the riskiness of this rewarding decision.

6.5. Phase 5: ADC2 contest period and judging/evaluation/rewarding (May 2009–November 2009)

After the ADC1 officially ended, there was a gap between the contests where several important developments occurred. The first was that a functioning Android phone was introduced to the market in October 2008. Along with the release of the phone came the launch of the app market, which meant that developers had their own mechanism for publicizing and distributing their applications outside of the contest. With a functioning marketplace that served as an incentive, there was even speculation about whether Google would hold the ADC2. In the end, Google moved forward with the ADC2, but it became more of an example of how Google learned from some of the issues in ADC1 and dealt with them through structural changes to the contest.

For one, they had to reconcile the tradeoffs of opening up another innovation contest alongside a growing application market. There was a concern that the ADC2 would create artificial competition with the application market: "I can see a number of people focusing on ADC development and the stream of apps entering the market suddenly dropping (Android Discuss listserv, May 27, 2009)." One way they reconciled this was to significantly lower the prize money from the previously announced \$5 million (USD) to just over \$2 million (USD). To avoid redundancy, Google also changed the eligibility rules for the ADC2 contest to be open only to applications that had not been made publicly available through the Android Market prior to August 1, 2009. This rule change meant that entrants would not have to compete against apps that were already in the market, and that Google would only receive new ideas.

Besides lowering the financial incentive, Google made changes with the criteria and guidance of the ADC2 by listing 10 specific categories of applications they would be taking submissions in: Education/Reference, Games (Casual/Puzzle), Games (Arcade/Action), Social Networking, Lifestyle, Productivity/Tools, Media, Entertainment, Travel, and Miscellaneous. They also implemented a notable rule change for the evaluation of ADC2, with 40% of the judging in the second challenge decided by public voting.² Here Google was changing the structure of the contest from the ADC1 to the ADC2 from a pure jury evaluation to a mixed jury/community evaluation.

The notable changes regarding the clarification of the criteria helped lessen some of the criticisms about judging and the decisions that Google made ADC1 in terms of why one application got selected over another. Michael, the founder of GoogleAndBlog.com noted that the process was much improved "[ADC1] was pretty broad and that's why in the second one they defined it a lot better." The other important change was in the structure of the judging, which made the tension between competition and collaboration less extreme. Unlike the ADC1 where there was very minimal self-revealing, the public nature of the voting in ADC2 incentivized several people to make announcements about their application, in hopes of attracting positive reviews, publicity, and votes for their application. Observers noted that these changes made it easier for participants to engage in practices that aligned with the identity and performance expectations of OSS communities:

It was really smart in that they provided people with a judging app [...]. It makes it seem more collaborative as opposed to Google being the arbiter of what really the best app or the winner. [...] For better or worse, at least it's the community judging as opposed to Google handpicking the top apps to show. [...] You need more of the people's voice in it so it seems like a true contest and feel

² Android users were able to download a judging application, test out the applications, and rate them.

like we get a true winner, or winner in the people's view. [...] People just wanted to have a say, didn't want [to] basically be dictated to from a select few (Michael, [GoogleAndBlog.com](#), interview).

In the ADC2, some of the core tensions between competition and collaboration were still present but were made less extreme by lowering the prize money and engaging public judging, and as a result of historical and market developments. The first round of the ADC2 closed in October, and then 20 finalists were selected in each category. Final winners were announced in November, closing out the ADC2, which was far less eventful and controversial on the listservs than ADC1.

7. Discussion

As a case, the ADC represents a combination of several extremes in terms of developmental philosophies (innovation contest versus OSS communities), incentives (monetary versus reputational), distribution of rewards (individual versus collective), and time frames (short term versus long term). This study found that each of these factors played a role in how contestants responded during the contests and also how these practices and responses shifted over time as organizational decisions and structures changed their decision calculus. Early on participants navigated the tension between innovation contests and OSS communities by either not revealing, partially revealing to form teams, or invoking OSS incentives and future interoperability concerns to push for lower level collaborations. As the contest progressed, a series of organizational decisions to extend contest deadlines, give judges sole authority to determine winners, and reward finalists over other contestants further magnified and pulled apart some of the competing logics that contestants were trying to navigate. Google learned from the initial contest to change some of the criteria and judging decisions for ADC2, to bring it more in line with OSS development and also provide incentives for contestants to self-reveal their work while participating in the contest. The various structural and organizational factors that shaped participant responses over time reveal a much more complex process for successive, multi-phase, open source innovation contests (Fig. 4).

The contest structure complicated OSS practices in other ways. The lack of self-revealing of even ideas throughout the contest represents a significant disruption of OSS practices. In typical OSS communities, developers may choose to self-reveal to increase their reputation in the community, to become a community leader, or possibly reap future financial rewards (Von Hippel, 2005; Von Krogh, Spaeth, & Lakhani, 2003). The contest changed that calculus, as the direct monetary prize and public announcement of the winners represented another avenue by which developers could achieve greater reward, recognition, and reputation within the community. This non-revealing practice is significant because the disruption creates technical and social barriers to OSS development. When source code was not shared, practices that typically leverage the peer production of OSS communities – reviewing bugs within the code, improving/building on existing projects, and working out alternate solutions – could not occur (Benkler, 2006; Raymond, 1999; Ye & Kishida, 2003). Similarly, the social mechanisms for establishing a leadership structure based on ad hoc meritocracy were disrupted because people were not self-revealing their work for communal evaluation (Bruno, 2008).

Despite the contest strongly incentivizing non-revealing, several practices emerged where people tried to collaborate while still working within the constraints of the contest. As studies have found a preference for team building in contests with large prizes (Afuah & Tucci, 2013), partial revealing of their ideas or code became one way that people found collaborators and formed teams. OpenIntents was another initiative that emerged as a workaround to the competition, where developers organized an independent effort to attain long term OSS development goals and work toward the benefit of the community in the post-competition phase.

Earlier studies of open innovation identified a group of participants known as communititors, defined as individuals that simultaneously collaborate and compete (Hutter et al., 2011). The emergence of OpenIntents empirically builds on our understanding of that theoretical category. For one, the group formed organically not as a result of organizational directives, but as response to contest structure. They explicitly acknowledged the competing directives of the contest structure, and justified their participation by appealing to the long-term development goals of OSS (e.g. interoperability) while also recognizing the short-term financial incentive as a core constraint. Second, they acknowledged incentives outside of the contest, as part of their persuasive appeal for participation in OpenIntents so that participants could attain some of the practical and social benefits of revealing that OSS communities practice (Duchenaud, 2005; Hertel et al., 2003; Lakhani & Wolf, 2005). Even in its naming, participants were leveraging the benefits and expectations of OSS development to initiate a particular form of communitition. Third, while communitition studies have found people engaging in distinct competitive and cooperative behavior during the same period of time (Hutter et al., 2011; Füller et al., 2014), OpenIntents represents a practice that bundles communitition into a single action. Lastly, OpenIntents was founded on the recognition that there is a clear hierarchy on areas where participants are willing to compete and collaborate. In this case, communititors specified known domains where they are going to compete (first order ideas and applications) and areas where they were hoping to collaborate (second order components). Mapping this hierarchy of communitition where people privileged competition over collaboration adds another important dimension to that practice, particularly given that most OSS communities exhibit the opposite calculus of emphasizing collaboration over competition (Raymond, 1999; Von Hippel, 2005).

This desire to be open and adhere to certain OSS practices helps explain why an organizational decision to extend a contest deadline was met with resistance. For one, it was an active change in the contest structures that they initially set up midway through the contest. Deadlines not only set the expectations and parameters for the community but also determine the strategy for participants for maximizing their chances (Afuah & Tucci, 2013; Dissanayake et al., 2018). Thus, a decision to extend the deadline has implications for both active participants as well as potential entrants. In this case, the decision to extend the deadline was most acutely criticized by those who had already engaged in communitition during the contest (Hutter et al., 2011; Füller et al., 2014). For members of OpenIntents who shared their components, the extension increased both the potential pool of applicants and the amount of time their contributions might be helpful to newcomers, which changed the short term and long term calculations they had made

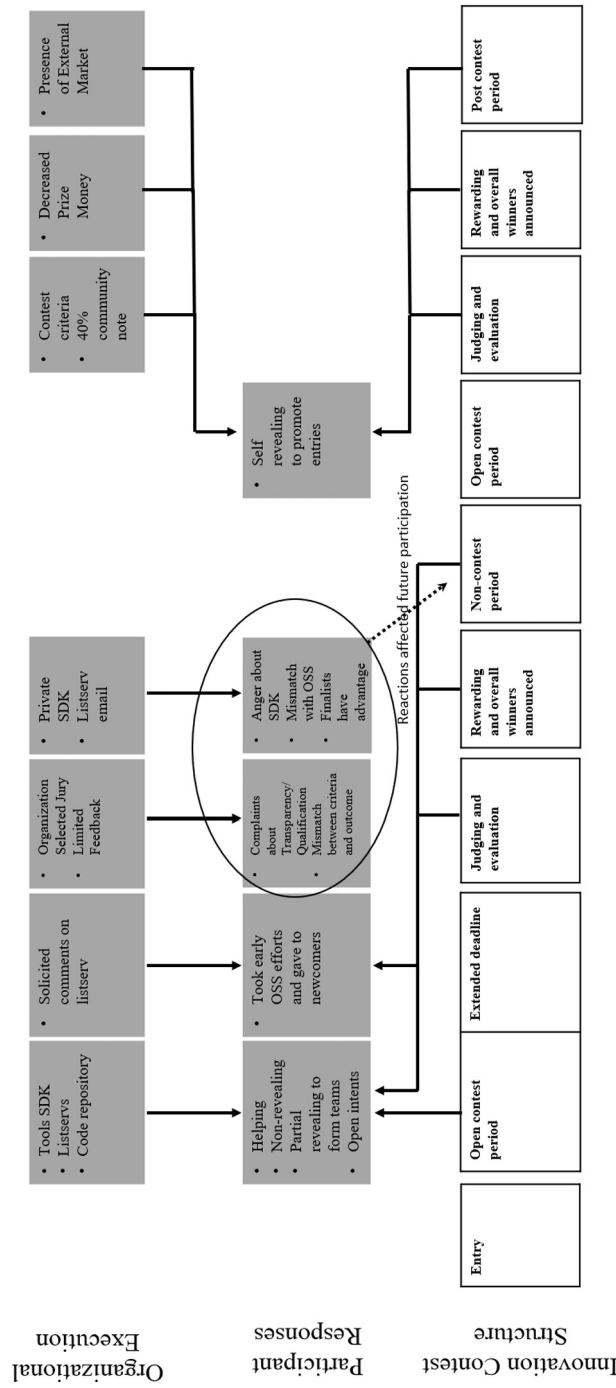


Fig. 4. Process model and interrelationships between organizational execution, structure, and participant responses.

when deciding to reveal their code and participate in OpenIntents. It also changed the perceived beneficiaries of their revealing in ways that exacerbate a key tension commonly observed within OSS projects – between people working and sharing in the OSS community and the concept of ‘freeriders,’ or people who benefit without contributing. In most OSS communities, developers choose to share because other motivations to reveal their work such as reputation building, social interactions, and skill building outweigh the presence of freeriders (O’Mahony, 2003; Von Hippel & Krogh, 2003).

For a host organization to solicit contributions to build community functionality and then give late comers more time to capitalize on the efforts of early contributors was received quite negatively. The deadline extension illuminates how a process approach can reveal unforeseen organizational actions during the contest and also how those actions can alter the strategies and assumptions made by certain participants. While process models have identified key progressions between contest phases (Faullant & Dolfus, 2017), there has been less attention paid to the implications for organizations that attempt to intervene and execute certain transitions (Lüttgens et al., 2012).

After the deadline passed, the judging period began. Judging is a critical period of transition, and perceptions of unfair judging can cause participants to lose faith in the organization (Ebner, Leimeister, Bretschneider, & Krcmar, 2008; Faullant et al., 2017). In this case, the host organization’s decision about contest structure played a disproportionate role in the perceived fairness of the contest. Even though it was announced early on in the contest, it was at this moment that it became most pressing. Many raised questions about the representativeness of the judges, their qualifications, and how they would apply the criteria. At the core these complaints were about the transparency of the process, and how it was fundamentally at odds with OSS practices. Because reputation building and meritocracy is such an important element in determining the leadership of OSS communities (Bruns, 2008; Raymond, 1999), the closed jury evaluation amounted to having leaders selected for the community. People felt they were being dictated to, and questions regarding the legitimacy and communication of the judging exacerbated negative feelings associated with losing. In terms of evaluation, the organization also did not take steps to ameliorate these feelings. The quartile feedback that was provided only served to assess but not improve the project, which limits the potential of feedback to further build connection to the organization and guide future development (Piezunka & Dahlander, 2019; Wooten & Ulrich, 2017).

Touting OSS as a strategy can help attract participant support and encourage collaboration, but it also raises the threshold for organization expectations which can later constrain decisions (Fitzgerald, 2006). The incident with the accidental email and rewarding the finalists with a private SDK illustrates this point well. Rewarding finalists with private tools and enforcing them through NDAs changed people’s perceptions of the OSS nature of the contest, gave certain participants the impression that they would not be able to compete on the market level with certain fast tracked applications, and resulted in threats of leaving the community. These actions, in addition to the way they were communicated, ran directly counter to OSS expectations: “Managers must implement governance mechanisms that are transparent. Without a sense of fairness, motivation among organizational members may diminish” (Sharma et al., 2002; p. 20). At a transition period in the middle of the ADC where the organization could have been validating and supporting some of the long term goals of the community, they instead engaged in an action that made people question the organization’s commitment to OSS development and their willingness to continue working on the project after the contest ended.

After many contentious months of the ADC1, several structural changes were made in the ADC2 to avoid some of these issues (e.g. reduced prize incentives, mixed jury and community judging, categories for submission and higher levels of task specificity, etc.). While contest structure is typically thought of as the first step toward organizing and the independent variable in open innovation studies (Adamczyk et al., 2010; Afuah & Tucci, 2013; Boudreau et al., 2011; Terwiesch & Xu, 2008), this study examines how the structure can be viewed as a response to and an outcome of prior processes.

Existing bodies of literature about innovation contests and OSS communities tend to treat these as distinct strategies precisely because of these reasons: “Innovation contest communities differ substantially from OSS, consumption communities, and other online knowledge-sharing communities (Füller et al., 2014; p. 277).” Even as their combination is recognized as a possibility, scholars have given conflicting predictions for what might happen amidst mixed/nested conditions where different phases of development are marked by competition and collaboration (Boudreau & Lakhani, 2009). Hence, this study first builds on innovation contest and OSS literature by understanding what can happen and how participants may respond when both types of incentives are in full effect.

Secondly, this study builds on our theoretical understanding of innovation contests by combining structure, process, and organizational execution as analytic frames to understand how these open source innovation contests play out. Whereas literature identifying contest structures has tended to view them only as descriptive characteristics or distinguishing factors (Adamczyk, Bullinger, & Möslein, 2012; Bullinger et al., 2010) this study places those structures onto a process model to understand how different attributes become important at different times. Similarly, while process models for innovation contests have broken down the progression of contests into various stages (Faullant & Dolfus, 2017), it has not explicitly examined how certain phases and participant responses are shaped by contest structures that impose certain short term and long term considerations. Lastly, while host organization actions have been found to play a role in the governance of innovation contests (Felin & Zenger, 2014; Nickerson et al., 2017), their actions have not been explicitly analyzed in relation to the announced contest structure and how their moves alter the preexisting structure. Host organization actions also do not exist in a vacuum, but are directly related to the temporal progression of various contest stages in which their actions can change the prior and future assumptions that participants are operating under.

In addition to understanding structure as dynamic, this case helps build on the process model by broadening its conception of time. While existing models have conceptualized time as a linear progression that simply moves the contest from one phase to another (Faullant & Dolfus, 2017), this study finds that participants’ understanding of time is an important analytical lens for assessing what happens during the contest. It was an integration of future OSS development goals and short-term contest constraints that gave rise to OpenIntents. Later, it was in part because participants had tried to collaborate and be open during the contest period that they objected to subsequent decisions like the deadline extension, jury evaluation, and private SDK. After the ADC1 ended, the immediate

contest barrier to self-revealing was removed, but people still did not do so because of the future prospect of the ADC2. Lastly, some of the structural changes announced in ADC2 helped alleviate tensions, in particular the decision to change the judging from jury evaluation to 40% community vote. That decision about the future judging process affected practices during the contest period, because it incentivized people to share and promote their ideas prior to the deadline now that the community was itself part of the judging. This study demonstrates why the process model is important for understanding innovation contests beyond just examining structures and outcomes (Afuah & Tucci, 2013; Blohm et al., 2011; Jeppesen & Lakhani, 2010) and how the process can reveal certain temporal calculations and interrelationships that can alter both the structure and outcomes. By integrating time more explicitly into the process model (George & Jones, 2000), future researchers can better understand time as not simply a progression, but an active variable that participants perceive, navigate, and make calculations about in ways that directly affect their actions in these communities.

8. Conclusion

The case of the ADC is an instructive one for scholars and policymakers alike, because it represents a more complex development model than a single innovation contest. For organizations that are considering hosting open source innovation contests, this study has practical implications and recommendations for how to structure the contest in ways that are more aligned with OSS principles. First, the finding that participants in the ADC community organically decided to create OpenIntents, voluntarily contributed to it, and ultimately helped improve winning applications has important implications for host organizations. Scholars have long argued for the importance of these collaboration leaders in an innovation community: “Communitors in particular need to be attracted, as these users embody the necessary combination of competitive as well as co-operative behavior to support the creation of high-quality, new ideas, which are ultimately the goal of idea and design contests (Hutter et al., 2011; p. 16).” For managers and organizations considering implementing open source innovation contests, formally supporting repositories similar to OpenIntents and emphasizing the importance of post-competition community building during the competition phase could provide an outlet for developers to self-reveal and collaborate in the community for social and technical reasons. Second, this study shows certain implications of organization decisions such as deadline extensions, and how they can complicate participants' perception of fairness and attitudes toward newcomers. Lastly, the study demonstrates that the judging and rewarding of open source innovation contests is paramount. Jury selection and private rewards that run counter to OSS principles are heavily criticized, while changes toward more communal evaluation may both ameliorate some of those concerns and also facilitate self-revealing practices during the contest. Some of the outcomes were influenced by temporal/structural contest changes, while others occurred after host interventions that had important intended and unintended consequences within the community.

Our findings and analysis of this case, which occurred 10 years ago, are relevant today as many organizations attempt to organize open innovation to foster external innovation and problem solving. Pairing that with a contest is appealing because a contest can garner attention and attract participation, but executing contests effectively is far more difficult than it seems. As long as organizations keep trying, however, scholars need to understand some of the conditions that give rise to certain collaborative and cooperative work practices. Of note here, Google recently revived the Android Developer Challenge in 2019. The lessons from their first attempt can be instructive not just for Google but more broadly for innovation contests of all types across technological, engineering, scientific, and medical fields. Studying these examples helps us better understand innovation contests as a process, and some of the challenges that arise when executing multiple innovation contests. For marketers, managers, and policymakers, understanding this case and some of the pitfalls of the ADC could help inform future successful innovation contests and innovative open partnerships.

Authorship statement

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before its appearance in *Information and Organization*.

Authorship contributions

Category 1

Conception and design of study: T. Liao

Acquisition of data: T. Liao

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Category 2

Drafting the manuscript: T. Liao, K. Xu

Revising the manuscript critically for important intellectual content: T. Liao, K. Xu

Category 3

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