

## Boundary Reinforcement in Multisided Platforms: A Configurational Analysis of External Conditions

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### Abstract

*This article contributes to the discussion on the governance dynamics of platform ecosystems. We take a broad perspective to understand how the environment beyond the platform ecosystem (i.e., external conditions) shapes the actions of the platform and its various actors in reinforcing platform boundaries. Prior work explored how external influences, such as societal norms and national and local regulations, influence platform ecosystems, including external competitive pressures. But studies on the broader set of potential influences from external conditions are lacking; in particular, a study of such conditions and their influence across platforms in light of boundary reinforcement is called for. Boundary reinforcement is critical for the identity and legitimacy of a platform and for longer-term platform sustenance. Using a fuzzy-set qualitative configurational analysis (fsQCA) method with input coded from 271 peer-reviewed research articles covering 29 platforms, we offer a model detailing how external conditions influence a platform's boundary reinforcement actions.*

**Keywords:** Boundary Reinforcement, fsQCA

### 1. Introduction

How do digital multisided platforms manage their boundaries in a platform ecosystem (Gawer, 2020; Parker et al., 2021)? A platform ecosystem is defined as "a set of actors with varying degrees of multilateral, nongeneric complementarities" (Jacobides et al., 2018: 2264) that are linked in terms of their learning and power structures through a sociotechnical assemblance (Eaton et al., 2015). Prior research focused on the inner layers of a platform ecosystem—particularly on the platform provider and two or more distinct but interdependent groups of actors on the

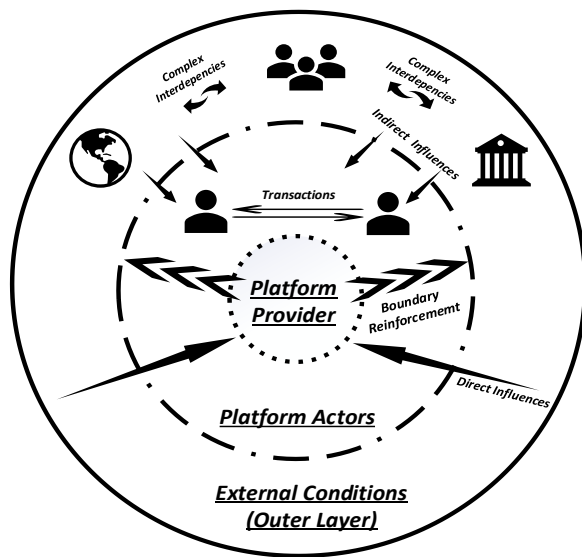
platform. Such actors transact with each other for services, such as information and infrastructure (Leong et al., 2019; Van Alstyne et al., 2016), and the platform provider coordinates actions and enforces rules of transaction on them (Altman et al., 2022).

We build on Dawes et al. (2016) and Bonina et al. (2020) and focus on the *outer layer* of the platform, which comprises the influences in the external environment (e.g., regulatory institutions, social movements, technology disruptions). This layer exemplifies conditions in the environment that are affected by interdependencies among conditions and that create cross-boundary impacts on the platform. As a result, the platform providers generally respond with boundary reinforcement. We define these external conditions, relying on Aguilera et al. (2015), as being constituted by influences that operate directly or indirectly on the platform actors and that are out of their immediate control.

Boundary reinforcement is an aspect of boundary management that defines, expands, and protects platform resources; it is used to manage relationships with external stakeholders to achieve organizational goals (Jarvenpaa and Lang, 2011). Boundary reinforcement strategies include a platform provider's inward-facing boundary activities that modify the form of technology, shift human activities, revise goals, and adjust its own social or political relations, as well as those of its actors (Langley et al., 2019; Faraj and Yan, 2009; Barrett et al., 2012). Such strategies are critical for ecosystem orchestration capabilities, fundamentally affecting the platform's identity and legitimacy and, consequently, its long-term viability. Figure 1 demonstrates our conceptualization of boundary reinforcement in a platform ecosystem. The outer layer represents the external environment containing conditions.

Reinforcement of boundaries entails not only the platform provider's response to the flow of information and resourcing from the external environment but also the actors' engagement in the collaboration and

inclusion activities. For example, platform providers may intentionally invest in their platform actors' (e.g., complementors') capabilities, competence, and creativity (Van Alstyne and Schrage, 2016). The case of Android OS demonstrates how a platform provider responded to mobile app users' heightened need for privacy by designing and promoting particular ways of reinforcement and the actors' responses to it. This action, in isolation, may have been interpreted as the platform's attempt to demarcate itself from society by using custom controls. But in its boundary reinforcement actions, Android OS also provided training to platform complementors who develop apps, increasing their technical skills (Shilton and Greene, 2019). Some might argue that, in enacting boundary reinforcement, Android had a positive societal influence by strengthening skills in the labor market. However, such training also created dependencies and potentially reduced the complementors' flexibility.



**Figure 1. Platform boundary reinforcement**

Boundary reinforcement has rarely been a focus of prior work in organizational or information systems (IS) literature, including platform ecosystems. However, we do know that technical, social, political, and spatial components can evolve internally in relation to the dynamics among the platform provider and actors (Leong et al., 2019; Bonina et al., 2020). Meanwhile, the dynamics of the outer layer of the ecosystem -the area outside the platform provider and platform actors- and how these dynamics influence platform ecosystem boundaries continue to require a closer examination. This need forms our research question: *How do external conditions (in the outer layer) influence a platform's boundary*

*reinforcement—that is, the platform actors' responses?*

In our study, we leverage extensive literature across academic fields on platform ecosystems. We created a corpus of peer-reviewed research articles that addressed one or more multisided transactional platforms wherein each platform constitutes a case. For our study, these cases are input to a fuzzy-set qualitative comparative analysis (fsQCA) method—a configurational approach that can shed new insights on external environment conditions and boundary reinforcement. A configuration is a set of conditions that are analyzed together to understand their influence on an outcome of interest (Ragin, 2008). A fsQCA approach allows us to examine interdependencies and configurations indicating how the external environment influences platforms by leading to equifinal boundary reinforcement (Ragin, 2008).

Our findings highlight a variety of external conditions, including regulation and collective action, that influence boundary reinforcement. We demonstrate the complexities of the interdependent external conditions at play in influencing platforms. For example, we highlight how technological advancements, as an external condition, are sufficient but not necessary to boundary reinforcement. Many influences go unexplored when platform boundary reinforcement is studied with a narrow focus on technological conditions, without considering the presence of and interactions with the broader social and political conditions. Our findings have implications for platform providers, particularly when planning for growth, entering a new market, or responding to changes in the external environment. Societally, our findings call for external actors to collaborate across boundaries in light of their joint interests and to understand configurations of external conditions in ways that give them more influence.

## 2. Boundary Reinforcement and Multisided Digital Platforms

In conceptualizing boundary reinforcement in a platform ecosystem, we build on the configurational boundary concept of Langley et al. (2019). In this work, a configurational boundary "involves people acting at a distance (from outside) directly or indirectly to influence the boundaries affecting others—the locus of agency is at a higher level" (Langley et al. 2019, p. 718). Such actions can involve "collective action, while allowing participants to remain behind their preferred established boundaries, and thus deliberately sustaining both competitive and collaborative boundary relations" (Langley et al. 2019, p. 723). Yet, these boundary reinforcement responses

need to ease the external pressures. Otherwise, the organization and participating actors can become estranged from the broader environment, creating communication and legitimacy concerns, among others (de Vries et al., 2022).

In platform ecosystems, the external influences are often at the collective, industry, or societal levels. Here, we consider platform boundary reinforcement activities to include the platform provider's and platform actors' responses to the configurational boundary. Barrett et al. (2012) describe such activities as a modification to the material form of technology, shifts in human activities, revision to goals, and adjustments in the social or political relations associated with the innovation.

Faraj and Yan (2009: 607) note how inward-facing "boundary reinforcement represents a new and unstudied type of boundary work." In a traditional team context, they explain how "reinforcing team boundaries entails generating a sufficient and sustained centripetal or attracting force that stabilizes the perimeter of a team's space" (2009, p. 607). Boundary reinforcement activities are critical for negotiating and buffering boundaries to maintain power and legitimacy. In addition, the reinforcing activities can decrease resource loss, create new complementarities, and open up new opportunity spaces while enhancing a greater "sense of belonging and identity" (2009, p. 608).

Boundary reinforcement is part of boundary management, which has been studied in the platform literature from a platform-centric perspective (Chen et al., 2021). This work shows that an ongoing negotiation between platform actors and providers shapes the boundaries of a platform. The evolution of a platform boundary is interactive and involves compromises between platform providers and platform actors. For example, where platform actors form communities, increased negotiation power of the crowd may lead to more compromises from the platform provider (Bremner and Eisenhardt, 2021). In other situations where the platform provider can lock in the platform actors by increasing switching costs (reputational mechanisms, user base, SDKs that are not easily portable to other platforms, etc.), platform actors yield to the platform provider and agree on compromises (Gawer, 2020; Hannah and Eisenhardt, 2018).

While the literature on platform boundary management informs us on the evolution of platform boundaries, particularly in terms of outward-oriented boundary spanning in response to the interactions between actors and providers, it has remained limited in increasing our understanding of inward-oriented boundary reinforcement in response to external

conditions. Furthermore, when the focus has been on external influences such as societal values and regulations, the focus has been on a specific platform (e.g., Uber, Garud et al., 2022) without examining the patterns across a broader set of platforms.

### 3. Research Design and Methods

The research follows a multi-step research application of fsQCA. The approach allows a deep analysis of the qualitative platform cases, leveraging the existing rich empirical literature while seeking out systematic patterns across the cases toward a concise theory (Liu et al., 2017; Paré et al., 2015; Eisenhardt and Graebner, 2007). In addition, calibration is a crucial component of the method. During calibration, qualitative causal variables are transformed into quantitative set membership (presence) groupings, with values ranging from full non-membership (0) to full membership (1) (Misangyi et al., 2016). Calibration permits more granularity in comparing cases across conditions by assigning qualitative thresholds to set membership groupings.

#### 3.1. Data Collection

We collected published research articles on a wide range of multisided transactional platforms. Such platforms allow observability of a transaction between two or more platform actors in which a provider charges a price for joining or using the platform (Filistrucchi et al., 2014). We chose transactional multisided platforms as the "cases" because of their economic significance and the availability of empirical academic articles, rendering a rigorous empirical analysis feasible. We selected 37 platforms with the greatest (i.e., most dominant) international market share for the industries listed in the 2021 U.S. Bureau of Labor Statistics report.

We used Web of Science, Ebscohost, Google Scholar, ResearchGate, and SSRN to locate research articles from refereed journals and international conferences. The articles were included if they referred to external conditions described in the environment framework of Aguilera et al. (2015).

To ensure high-quality input material, we included articles only if they met the following criteria: (i) the journal's impact factor is greater than or equal to 2.0; and (ii) they were among the most cited articles on the platform. To achieve a diverse representation of platforms across the articles, we dropped platforms from the sample when our search resulted in fewer articles than the median of the initial sample (6 articles per platform). Table 1 lists the selected platforms structured by sub-category

**Table 1. Platforms used in the sample**

Category	Platform (Number of articles)			
Travel and Hospitality	Airbnb (12)			
Arts, Crafts, and Fashion	Etsy (9)	Threadless (6)		
B2B Software Innovation	Salesforce (8)	SAP (9)		
C2C Software Innovation	Android (11)	Apple iOS (10)		
Gaming	Steam (9)	Twitch.tv (11)		
Music	SoundCloud (10)	Spotify (11)		
MOOC	Coursera (9)	EdX (7)	Udacity (6)	
Workforce Resourcing	Amazon MTurk (9)	TaskRabbit (7)	Upwork (11)	
E-commerce	Alibaba Taobao (11)	Amazon Marketplace (13)	eBay (9)	Groupon (9)
Finance	GoFundMe (9)	Prosper (7)	PayPal (9)	Kickstarter (7)
Urban Mobility	BlaBlaCar (11)	DidiChuxing (10)	Lyft (8)	Uber (13)

industry, with the number of articles in parentheses next to the platform's name. Further details of the individual platform articles can be obtained from the authors upon request.

We used the non-platform literature from Aguilera (2015) to identify six initial conditions: legal system, market for corporate control, external auditing, rating organizations, stakeholder activism, and media. We then adapted these conditions to the multisided platform context. Articles from a range of platforms with the most citations (used as a proxy for impactfulness) were used to identify additional conditions unique to platforms.

We stopped after articles repeated the conditions we had already identified. To create a parsimonious list of conditions, we conceptually combined similar conditions. For example, cyberbullying, discrimination, health disparities, and fraud collapsed into a condition termed Social and Economic Concerns (S&E). Table 2 lists the seven conditions (full name and abbreviations) found to be salient in the multisided platform's external environment.

### 3.2. Data Preparation

Building on Basurto and Speer's (2012) fsQCA guidelines, we synthesized the collected articles and sought insights as input data in fsQCA analysis.

First, the commonalities among external conditions were triangulated with the literature and used to develop definitions of fuzzy-set groupings based on abductive reasoning (Park et al., 2020). For example, the Stakeholder Collective Action (CA) condition was built using concepts from Faraj et al. (2011) on social mobilization and the importance of passion driving participation and collective focus. Conditions were iteratively identified and defined by probing the articles. Based on the level of detail available across all articles, four fuzzy-set groupings


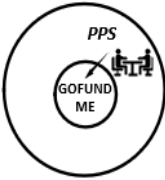


were deemed appropriate: 0 (fully out), 0.33 (more out than in), 0.67 (more in than out), and 1 (fully in).

Next, we adopted Crilly et al.'s (2012) approach for the coding lexicon. The approach ensured consistency in the coding across heterogeneous research articles (e.g., case studies, empirical studies, and experiments). A degree of inductive reasoning was still required to identify conditions and boundary reinforcement actions in the context of each article.

### 3.3. Data Analysis: "Platform Case"

The platform was our unit of analysis. Articles on the platforms were coded and scored independently by four research assistants and the first author. For a boundary reinforcement condition to be present, at least two articles had to have scores for it. The highest scores of the two or more articles became the input for external condition scorings on the platform. For platforms with fewer than two articles reporting on boundary reinforcement, we coded the boundary reinforcement as 0 (fully out). In this case, the highest fuzzy set values for external conditions would be selected from the articles that did not have the outcome of boundary reinforcement. The approach generated 29 cases on platforms showing evidence of the presence (set membership) of the seven external conditions that influence the platform.

Figure 2 depicts how we coded the articles and calibrated the insights for fsQCA analysis. Four platforms across three conditions are shown. For illustrative purposes, we show two cases in which the boundary reinforcement outcome occurred (fully in) and two without the presence of the outcome (fully out). The S&E condition shows one platform for each one of the two outcome values. In column 2, we show how each platform case is compiled from the calibrations of the outcome and conditions of individual sampled articles. To calibrate, we used lexicon guidelines and definitions to evaluate the

Boundary Reinforcement (BR) Outcome	External Condition and Articles Coding	Condition Membership & Calibration	External Condition Exemplary Quotes	BR Calibration & Exemplary Quotes				
BR – Fully in (1)	 Existing Laws and Regulations (LAW) <table border="1" data-bbox="446 283 657 430"> <tr> <td>0</td> <td>0.33</td> </tr> <tr> <td>0.67</td> <td>1</td> </tr> </table>	0	0.33	0.67	1	<b>LAW Definition: The set of structures and processes used for interpreting and enforcing the law or regulation</b> <b>0.67 – More in than out</b> * Multiple keywords used throughout the article (in context of external environment): <i>lawful, legal, property rights, recourse, enforcement, employment</i> * At least 1 key concept of LAW is present and discussed in sufficient depth: <i>legal right to privacy, employment governance</i>	<b>Article 1:</b> "There should be limits to collection of personal data and any such data should be obtained by lawful and fair means" <b>Article 2:</b> "MTurkers participation agreement grants employers full intellectual property rights over submissions regardless of rejection, workers have no legal recourse against employers"	<b>Reasoning for BR coding:</b> Provider reduces tensions with applicable actors by exploring policies to protect those actors. Recognizes external regulation causes conflict between platform actor groups, takes action internally. <b>Article 1:</b> "Calls for more protection for MTurk workers to create more dependable and safe ways to conserve private worker data"
0	0.33							
0.67	1							
BR – Fully out (0)	 Presence of Partnerships (PPS) <table border="1" data-bbox="446 504 657 651"> <tr> <td>0</td> <td>0.33</td> </tr> <tr> <td>0.67</td> <td>1</td> </tr> </table>	0	0.33	0.67	1	<b>PPS Definition: A working relationship that reflects a long-term commitment and a sense of mutual cooperation, with shared risks and benefits, and participatory decision making</b> <b>0.33 – More out than in</b> * Few keywords, occasionally used in the article: <i>partners, partnership</i> * A key concept related to PPS, but sparsely discussed, nor a relationship established with BR: <i>mention of the use of other entities to enhance value of GoFundMe, but lacks enough details.</i>	<b>Article 1:</b> "GoFundMe partners with non peer-campaign platforms, for example with public relations firms to spread the word about trending campaigns. Or develops a corporate partnership with the San Diego Union-Tribune to run news stories linked to GoFundMe campaigns."	<b>Reasoning for BR coding:</b> No evidence that GoFundMe responds to conditions in the external environment, for example: - Lacks intention to design system elements to improve relationship with actors, or between actors. - Altering its mission to foster better conditions on the platform.
0	0.33							
0.67	1							
BR – Fully in (1)	 Social and Economic Concerns (S&E) <table border="1" data-bbox="446 745 657 892"> <tr> <td>0</td> <td>0.33</td> </tr> <tr> <td>0.67</td> <td>1</td> </tr> </table>	0	0.33	0.67	1	<b>S&amp;E Definition: The informal rules that direct behavior in groups or society but are not upheld or are unfairly applied, leading to disparate distribution of resources and the potential for harm</b> <b>1 – Fully in</b> * Extensive discussion of 1 or more S&E concepts and establishes a link with a BR concept: <i>Discrimination affects actors (e.g., drivers). Suggests ways to strengthen boundary against S&amp;C.</i> * Possible use of variables in article's method related to S&E: <i>demographic protected classes were used as independent variables in the study.</i>	<b>Article 1:</b> "In the case of BlaBlaCar, the results show a closed user profile influenced by age, educational level, life as a couple or urban environment." <b>Article 2:</b> "There is a clear driver discrimination based on perceived biases. Arabic named drivers set prices that are 21 cents lower. Further, drivers with an Arabic-sounding name earn 1.1 euros less."	<b>Reasoning for BR coding:</b> Provider takes active steps to modify elements of platform to protect its actors against discrimination. Also, takes into account the unique demographics and background of its actors to create policies that are supportive of the actors (not just the drivers) <b>Article 2:</b> "Suggestions for BlaBlaCar to identify drivers by UserIDs without pictures to remove discrimination."
0	0.33							
0.67	1							
BR – Fully out (0)	 Social and Economic Concerns (S&E) <table border="1" data-bbox="446 976 657 1123"> <tr> <td>0</td> <td>0.33</td> </tr> <tr> <td>0.67</td> <td>1</td> </tr> </table>	0	0.33	0.67	1	<b>0.67 – More in than out</b> * Multiple keywords used throughout the article (in context of external environment): <i>reputation, uncertainty, status, price</i> * At least 1 key concept of S&E is present and discussed in the paper in sufficient depth: <i>external uncertainty directly impacting platform actors.</i>	<b>Article 1:</b> "Salesforce is a leader in marketing technology and innovation, and its reputation for excellence enhances the status of the badges with recruiters." <b>Article 2:</b> "The uncertainty factors from the external environment are high for the SMEs as they are normally price takers and have a limited customer base in which they operate."	<b>Reasoning for BR coding:</b> Despite the presence of the S&E condition, the articles do not demonstrate any actions of Salesforce responding to the condition. For example, by using its reputation in the external environment to assist SMEs to overcome pricing concerns would have been an activity that warranted the presence of BR.
0	0.33							
0.67	1							

**Notes:** Red File Symbol represents articles in which BR outcome was Fully out (0). Those in black, BR was Fully in (1).

**Figure 2. Examples of calibration and coding of platform cases**

strength of the insights from the article on the condition (column 3) and the outcome (column 5). Column 4 displays exemplary quotes from articles to support the calibration of the external condition, and Column 5 does so for the boundary reinforcement outcome.

### 3.4. fsQCA Analysis: Necessary Conditions and Sufficiency Analysis

We used the fsQCA 3.0 software to assess causality, analyzing the necessity and sufficiency of the external conditions on boundary reinforcement. To yield insights from the sufficiency analysis, we provide examples from the intermediate instead of the parsimonious solution (Fiss, 2007). For the sufficiency analysis, the consistency cutoff was set at 0.9, higher than the recommended value of 0.8, because we preferred fewer configurations with higher consistency (Misangyi et al., 2016). We chose the

sufficiency analysis to consider only present conditions (Ragin, 2008) because of the limitation of our study: the authors of the articles in our data set could have omitted information on external conditions we aimed to capture in the study (intentionally or not).

**Table 2. Analysis of necessary conditions**

Condition	Consistency	Coverage
S&E (Social and Economic Concerns)	0.911	0.922
~S&E	0.089	0.698
MEDIA (Traditional and Social Media)	0.488	0.904
~MEDIA	0.512	0.889
CA (Stakeholder Collective Action)	0.371	0.879
~CA	0.629	0.907
LAW (Existing Laws and Regulations)	0.616	0.889
~LAW	0.384	0.909

CD (Competitor Dynamics)	0.603	0.854
~CD	0.397	0.969
PPS (Presence of Partnerships)	0.461	0.878
~PPS	0.539	0.913
TECH (Technological Advancements)	0.731	0.891
~TECH	0.269	0.913

Table 2 depicts results from our analysis of necessary conditions for the presence of boundary reinforcement. The gray highlighted S&E condition is a necessary condition for the occurrence of a boundary reinforcement outcome based on a cutoff of 0.9 (Park and Mithas, 2020). Furthermore, the high coverage suggests that it is not a trivial finding (Park and Mithas, 2020). From the configurational perspective, the S&E condition must be present in any platform case involving the boundary reinforcement outcome. However, as shown in the sufficiency analysis results in Table 3, the S&E condition is not sufficient because five configurations also include other conditions. The coverage assesses the extent to which a configuration with the outcome occurs (Liu et al., 2017). The higher the coverage is, the higher the confidence in the configuration is expected to be (Ragin, 2008).

**Table 3. Analysis of sufficiency conditions**

Boundary Reinforcement Configurations					
Conditions	C1	C2	C3	C4	C5
S&E	●	●	●	●	●
MEDIA			●		
CA	●				
LAW		●		⊗	⊗
CD	⊗	⊗	⊗		
PPS					⊗
TECH	●	●	●	⊗	
<i>Consistency</i>	0.929	0.953	0.945	1	1
<i>R. Coverage</i>	0.166	0.255	0.217	0.179	0.294
<i>U. Coverage</i>	0	0.013	0.026	0.026	0.013
<i>Key Platforms</i>	Steam, Task-rabbit, Threadless	Etsy, Task-rabbit, Upwork	Soundcloud, Coursera, Etsy, Steam	Kick-starter, Groupon, Udacity	Kick-starter, BlaBla-Car, Groupon, Soundcloud, Steam, Threadless
<i>Solution Consistency</i>	0.972				
<i>Solution Coverage</i>	0.436				
<i>Black circles indicate the presence of a condition: circles with "X" indicate its absence, blank spaces indicate "does not matter/irrelevant to a configuration"</i>					

## 4. Results and Interpretation

We discuss three themes emerging from the analysis. First, we discuss the presence of a necessary condition for boundary reinforcement. The identification of necessary conditions is a significant finding from a fsQCA perspective because many studies often lack such a condition (Park and Mithas, 2020). From a platform perspective, we believe it can help explain actors' behaviors. Second, we explore three theoretically relevant configurations. Third, we discuss the key insights from the sufficient but not necessary condition of technological advancements (TECH) on platform actors.

In the calibration and coding step, we defined all the external conditions. For demonstrative purposes, we provide definitions for two external conditions. First, the technological advancements (TECH) condition is a digital technology that, to a certain degree, can disrupt the performance trajectory of platforms when adopted by them (Danneels, 2004). Second, the social and economic concerns (S&E) condition is defined as the informal rules that direct behavior in groups or society but are not upheld or are unfairly applied, leading to disparate distribution of resources and the potential for harm (Elster, 1989). As we discuss our findings, the external condition definitions used in calibration will continue to serve as conceptual grounding.

Lastly, the illustrative cases we detail in the discussion are part of the platform case sample and prominently featured in the configurations (see the row labeled "Key Platforms" in table 3), with a fuzzy set score higher than the halfway point (0.5).

### 4.1. Social and Economic Concerns Necessary for Platform Boundary Reinforcement

The overall finding on S&E shows that platforms are reactive and may respond to their outer environment only under external pressure. From the analysis of articles, we found only two platforms that did not have evidence of boundary reinforcement actions: GoFundMe and Salesforce. Still, both platforms had some presence in the S&E condition. For example, in the case of GoFundMe, we observed that platform actors themselves heavily focused on addressing S&Es—likely the reason we observed no inward-facing platform boundary reinforcement stemming from the provider. In the case of Salesforce, organizations are the actors in many cases, such as consultancies or smaller specialized system implementers. We believe these organizations may have internal functions responsible for responding to S&E pressures.

The most illustrative cases of S&E and platform boundary reinforcement were in the multisided platforms belonging to categories of music, gaming, workforce resourcing, massive open online courses (MOOCs), and arts, crafts, and fashion. These platforms often were established to overcome existing S&E inequalities in the traditional markets. Hence, S&E issues are salient and multifaceted. The strong S&E influences demanded boundary reinforcement response to maintain platform legitimacy and the actors' sense of belonging.

Across all cases, four types of boundary reinforcement actions stood out: growing actors' capabilities, improving safety on the platform, creating policies, and strengthening communications between the platform provider and actors. These actions decreased the platform's potential to become estranged from its external environment.

Apple iOS is a unique case because of its minimal occurrences of boundary reinforcement. The minimality is likely related to the power it holds over the participating actors as a proprietary platform. Yet, we observe that social and cultural norms of autonomy and freedom, which programmers value, can clash with the platform's strategy. For example, Apple iOS addresses this concern by creating opportunities for developers to acquire additional knowledge and skills that then likely also benefit the user side of the platform. Hence, reinforcement actions benefit the platform provider by aligning it better with its external environment and also increase the various actor capabilities in multisided platforms (Alstyne et al., 2016).

Other notable boundary reinforcement cases are Twitch.tv and Steam gaming platforms. S&Es, such as gaming addiction, social anxiety, and depression, affect platform actors' ability to engage fully in the ecosystem. For example, the so-called geek culture associated with gamers has often caused them to feel excluded from market transactions. They have anxiety that the same could happen on the platform. As a result, Twitch.tv responded by improving the safety of actors on the platform, engaging in content moderation to remove vulgar comments and chats that targeted underrepresented communities. In another example, Didi-Chuxing, a Chinese vehicle-for-hire company, adopted and provided more advanced location-sharing services and safety-related features for passengers because of the increased crime rate in neighborhoods and the drivers' frequent criminal behavior. However, these types of services also risk leading to profiling and bias.

Further, both cases demonstrate exclusion as a recourse in boundary reinforcement. Certain actors or groups of actors (e.g., criminal drivers, discriminating

gamers) can be excluded from participation for the benefit of the platform. Reinforcement responses can involve complex tradeoffs that have differential effects on the various sides of the platform.

In the case of Upwork, we observed an interaction between fraud and other S&Es (economic concern related) that drove not only workers' pay but also an increase in scams. These interactions could drive independent workers to take jobs that might result in a scam. Upwork responded with a boundary reinforcement action, setting up a payment protection policy to mitigate the adversarial effects of scams on its actors. Similarly, PayPal created a seller protection policy that allowed actors who were victims of fraud to receive a refund of up to \$5,000 annually. In the e-commerce category, eBay demonstrated strong boundary reinforcement actions when facing S&Es. Although eBay, as an early entrant, engaged in varied reinforcement actions against fraud, fraud continued to adversely impact the seller and buyer experience on its platform. The most effective platform response seemed to be providing forums where different actors could communicate directly with each other. As eBay faced legal cases from rampant fraud, it intensified its efforts not just to be responsive to fraudulent behaviors that had already occurred but also to be proactive in reaching out to both sellers and buyers to help defend themselves against fraud.

#### **4.2. Equifinality in Platform Boundary Reinforcement: Three Key Configurations**

A key challenge of the configurational approach is determining which of the empirically identified configurations are theoretically meaningful (Park et al., 2020). Therefore, we first evaluated the robustness of each configuration and then labeled them in a manner that provided conceptual clarity, resulting in labels for configurations C1, C2, and C3. These three configurations suggest that as long as S&E and TECH are present, either CA, MEDIA, or LAW would produce boundary reinforcement.

*C1: Social concerns tied with tendencies for actors to "speak out" in an environment of technological advancements*

Steam has an external environment in which TECH is reflected through modding, the ability to modify the structure and look of the game. Modding allows anybody with access to a computer to legally create customized content for a digital game. Steam created a digital space where actors could take advantage of this form of creativity. When Steam announced its plans to commoditize modding, significant pushback emerged as actors saw this move as exploiting the free labor of platform actors. With

meritocracy perceived to be at risk, it became S&E that drove CA. The response by Steam was one of boundary reinforcement: The CEO actively sought to strengthen communications with platform actors—for example, by requesting input through Reddit on how the platform should proceed with modding commodification. Steam offered end-user license agreements that helped to sustain meritocracy. Other platforms, such as Threadless, have faced CA when the platform provider either fails to address or worsens S&E conditions. Overall, technological advances that allowed actors to create content but not necessarily to appropriate value from such content propagated meritocracy concerns to the point that actors were influenced by collective actions to "speak out."

*C2: Regulations to address social needs in an environment of technological advancements*

Existing Laws and Regulations (LAW) is an external condition that created much uncertainty in TaskRabbit and Upwork over how to classify employees and employers, particularly regarding employment law and the protection of working time. The rapid technological changes created challenges in applying the existing laws. To mitigate uncertainties that platform actors experienced from LAW, TaskRabbit made concerted efforts to establish a collective identity within its inner layer. TaskRabbit listened to its independent contractors to construct a platform identity around their desired working style. Further, it changed its policy around the required frequency of tasks and the pricing model to create fairer compensation schemes.

In another example, Etsy relied on its platform actors to report violations of the site's ethics code. However, the ethics code only partially covered the platform actors' concerns. For example, the code did not regulate discrimination or disparaging comments devaluing actors' work. Actors had no recourse to address such social concerns; meanwhile, it did cover other social and economic concerns related to fraudulent activity or copyright infringement. Etsy started to use advanced security technology to detect copyright violations and threatened actors with litigation for copyright infringement.

*C3: Close intertwining of media and technology advancements; breaching concerns of social and economic "barriers"*

SoundCloud's external environment highlights an interesting interplay between MEDIA and TECH conditions. Its reinforcement actions strengthened its identity of inclusiveness with actors from multiple platform sides (e.g., musicians and listeners).

Social media had become a crucial tool for independent musicians to grow their audience globally. Social media platforms also became an

important source for users to learn about new music. SoundCloud artists that failed to promote their content on social media platforms would not only forgo the benefits of broadening their fan base but also be questioned by fans for their inactivity. To make interacting with their fan base easier for musicians, SoundCloud improved the links between its platform and social media platforms and actively promoted new features that social media platforms had introduced for their actors. But technological advancements also introduced social bots to SoundCloud. Because social bots are controlled by algorithms that mimic human behavior to influence users, they are not seen as contributing but as crowding out space meant for human comments. SoundCloud sought to improve actors' experiences by rendering human comments more identifiable and ensuring that only human comments would be used to rank content. The actions reinforced boundaries by reaffirming relationships with different sides of the platforms and strengthened the platform's legitimacy and identity.

External conditions also vary by different regions of the world. As SoundCloud allowed music creators to be judged solely on their music and its quality, biases that existed in the offline world, such as gender or religion, played less of a role on the platform. For example, in Beirut, people's access to music performers depends heavily on their social class. This inequality and limitation of potential income for musicians have contributed to SoundCloud's popularity in Beirut. However, the platform is not bias-free. For example, language has been a barrier in spreading music to users in some countries, resulting in communities on SoundCloud walled off by a language. Also, some music genres were tied to location, which discriminated against artists not from a specific location.

### **4.3. Technology Advancements Sufficient to Boundary Reinforcement, but not Necessary**

Researchers have argued that technology advancements engender the evolution of platform boundaries (Kapoor, 2018; Hannah and Eisenhardt, 2018). Yet, the current study finds that this evolution does not necessarily include boundary reinforcement. Several platforms demonstrate that TECH facilitates boundary reinforcement as a sufficient condition but not a necessary condition (e.g., C4 and C5). Alibaba provides insight into this finding. The platform provider helped expand its sellers' customer reach by accommodating (offline) pop-up stores. Alibaba collected valuable data via its Internet of Things (IoT) technologies to enable its sellers to understand better their customers' needs and behaviors. A crowdfunding

platform, Kickstarter, faced slow manual screening processes for new campaigns. Kickstarter responded by automating and increasing the efficiency of the screening process.

The findings also suggest a "dark side" to TECH as it interacted with S&E and LAW. TECH can ease S&E, as highlighted above. Yet, TECH can fuel further S&E and LAW concerns, as seen on Uber and TaskRabbit. To illustrate, Uber used advanced algorithmic technology to supervise drivers that increased S&Es, such as a lack of work autonomy, thus prompting boundary reinforcement from the platform actors, including collective action against the platform. Inward boundary reinforcement can introduce both competing and collaborative boundary relations (Langley et al., 2019).

Because of the double-edged nature of TECH, our results suggest that TECH is a sufficient but not necessary condition.

## 5. Contribution and Future Work

Platforms face increasing regulatory pressures. In Japan, for example, government authorities made cyberbullying punishable by one year in prison (Yueng and Benzoza, 2022). The example illustrates LAW and S&E in action that can significantly influence the platform's inward-facing activities with its participating actors.

The current work extends boundary management theory (Langley et al., 2019; Barrett et al., 2012) to the outer layers of the multisided platform ecosystem context. Our study is unique in its external perspective as well as how we integrate work on multisided platforms across a wide range of siloed academic disciplines. By connecting the "dots" of external conditions studied in different articles across different disciplines, we have been able to advance unique configurations that shape multisided platforms. The use of configurational analysis along with qualitative case illustrations are important strengths of this study.

Yet, the study also has limitations that need to be considered. For example, the findings should be viewed as preliminary and not considered generalizable beyond the sample of the study. The current study limited its outcomes to boundary reinforcement actions. While we advanced potential consequences of such reinforcement actions, particularly in terms of identity and legitimacy, neither identity nor legitimacy were systematically coded in the cases. While coding was rigorous and involved different individuals, considerable subjectivity was still required in interpreting the configurations.

The current findings have implications for platforms and policymakers. Platforms can be

proactive in easing social and economic concerns, especially in planning boundary reinforcement activities. We highlight how technologies are pivotal to advancing platforms in addressing S&E concerns, but these advances can also deepen the concerns and evoke collective action. The unique configurations identified in this paper allow policy-making entities and interest groups to learn and consider how external conditions influence platforms. External actors can work jointly to increase the influence on platforms. An important result of this study is the importance of interactions and interdependencies between conditions and configurations.

Our future work involves a more refined treatment of external conditions and more explicit use of institutional theory (Hinings et al., 2018) and resource dependence theory (Hillman et al., 2009) in interpretative analyses. Future work is encouraged to explore the boundary reinforcement conditions not captured in the current study. Potential consequences need to be examined beyond platform identity and legitimacy, including platform drifting and ecosystem fragmentation. The current study at the platform level can be enriched with a micro-analysis of specific platform actors and the resulting cross-level and longitudinal effects from configurations of external conditions. Overall, there is a need to move beyond the conventional approaches to new ways to look at multisided platform ecosystems that include both their outer and inner environments.

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