

SELF-ORGANIZATION AND GOVERNANCE IN DIGITAL PLATFORM ECOSYSTEMS: AN INFORMATION ECOLOGY APPROACH¹

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This research investigates the interplay of top-down control and bottom-up self-organization within digital platform ecosystems (DPEs), focusing on the formation and management of complementor coalitions. Although these coalitions can increase a DPE's generativity, they can also threaten its integrity. We investigate this tension by employing information ecology (IE) theory, which allows us to examine complementor coalitions as holons that navigate between self-assertiveness and integration within the structural hierarchies of DPEs. Utilizing an inductive, embedded case-study approach, we analyze the interplay between top-down control exerted by platform owners and the bottom-up self-organization of complementors in two enterprise software platform ecosystems. Our findings identify three distinct interaction modes—mandated, supported, and autonomous self-organization—each presenting hierarchical trade-offs between platform owner control and complementor autonomy. Our findings extend the prevalent owner-centric theory of platform governance by highlighting the significant impact of bottom-up self-organization on the governance and evolution of DPEs. We propose an integrated theory that accommodates these new dynamics, suggesting soft power as an effective governance mechanism. This study contributes to a deeper understanding of the complexities in governing DPEs and offers practical insights for managing top-down control and bottom-up self-organization in the evolving landscape of enterprise software DPEs.

Keywords: Digital platform ecosystem, platform governance, information ecology theory, holons, self-organization, soft power

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Introduction

The enterprise software landscape has significantly evolved, transitioning from a model where customers had to choose between “end-to-end” integration and “best-of-breed” functionality to digital platform ecosystems (DPEs)² that can provide both (Ceccagnoli et al., 2012). Pioneered by platform owners like SAP and Salesforce, this transformation has been enabled by autonomous complementors, including independent software vendors (ISVs) and consulting firms that develop software modules that enhance the platform (Sarker et al., 2012; Tiwana et al., 2010). The platform owners have established guidelines to ensure the integration of these modules while granting complementors the autonomy to develop specialized solutions (Wareham et al., 2014). This approach to platform governance offers customers the best of both worlds: integration and functionality. However, as DPEs have expanded, complementors have begun to collaborate outside these guidelines, leading to new tensions.

As DPEs have expanded, complementors have started to self-organize into coalitions that can bolster the platforms’ generativity—the ability to produce unprompted, prescribed outcomes (Tilson et al., 2010). On its face, this seems desirable for platform owners: coalitions can self-organize and build novel capacities that can address demand in the DPE that individual complementors cannot address on their own (Jacobides et al., 2024). However, while this self-organization can enhance the DPE’s generativity, it also risks the integrity of the DPE’s normal functioning as maintained by platform owners. For example, coalitions between powerful complementors may crowd out smaller complementors or circumvent platform governance by using their networks to develop competing solutions (Karhu et al., 2018).

Such self-organization leads to a conundrum for platform owners, as restricting the formation of coalitions can lead to a situation where the capacity to meet a demand in the DPE exists but is underutilized (Hausman, 1981), forgoing value creation opportunity and harming all actors in the DPE. Consequently, platform owners are facing the challenge of balancing the encouragement of coalitions to increase the generativity of the DPE to meet this demand against the imperative to maintain its integrity, a balancing act that introduces complex challenges in platform governance.

Research on platform governance has focused on owner-centric governance, assuming centralized interactions top-down (Chen et al., 2022a; Tiwana, 2015). These governance models balance the tension between integration and

generativity by, for example, providing coding libraries that promote customizability while securing quality (Wareham et al., 2014). However, bottom-up self-organizing complementor coalitions present a conundrum that traditional governance models are not designed to handle. These coalitions emerge organically and unpredictably, operating outside traditional owner-centric governance, thereby introducing a new layer of complexity in balancing integrity and generativity (Cenamor, 2021; Wang, 2021). These observations punctuate the need for a new theory to help to make sense of *how these self-organized coalitions form, can be governed, and influence DPEs*.

We employ information ecology (IE) theory as an analytical lens to answer these questions. Based on this lens, we identify coalitions as holons, self-organizing entities with self-assertive and integrative tendencies (Koestler, 1968; Wang, 2021). This duality accentuates the hierarchical tension between top-down control and bottom-up self-organization. Analyzing coalitions through IE theory reveals the necessity for governance mechanisms that can influence bottom-up self-organization. Based on these considerations, we introduce soft power as a mechanism to govern self-organization (Nye, 1990), concluding with a comprehensive framework for understanding how to govern self-organizing coalitions and balance the dual imperatives of maintaining DPE integrity while fostering its generativity.

We conducted an inductive, embedded case study of complementor coalition formation and its impact on DPEs in the enterprise software industry. As our case sites, we selected two well-established enterprise software DPEs: CRMCo (CR) and ESMCo (EM). Both govern growing DPEs of complementors, allowing us to observe the formation of coalitions (Benbasat et al., 1987; Yin, 2014). The cases show differences in managing the integrity-generativity tension, allowing us to identify effective governance mechanisms that work bottom-up. Following an inductive approach (Gioia et al., 2013), we collected and analyzed 61 interviews with platform owners and coalition members from 2020 to 2022 to capture and describe self-organization and platform governance as a dynamic and emergent phenomenon.

The results reveal three interaction types between complementor coalitions and platform owners: *mandated*, *supported*, and *autonomous*. Mandated interactions indicate that platform owners prioritize the DPE’s self-assertive tendencies, ensuring integrity through top-down control over value creation but limiting generativity by stifling the self-organization of complementors. Supported self-organization

² For the sake of conciseness, we use the term DPE instead of enterprise software DPEs.

illustrates the platform owners' use of platform design to strike a balance, maintaining integrity while fostering generativity by indirectly controlling self-organization. Finally, while maximizing generativity, autonomous coalitions can only be controlled through soft power, as they operate largely outside owner-centric top-down control. These interactions reveal a trade-off between integrity and generativity, underscoring platform owners' governance challenges in managing self-organizing coalitions.

We extend the prevailing owner-centric theory of top-down platform governance (Chen et al., 2022b) by offering evidence of novel governance mechanisms that affect self-organization bottom-up. Represented by complementor coalitions, bottom-up self-organization influences the governance and evolution of DPEs, providing a better explanation for why and how DPEs succeed (Jacobides et al., 2024). We present three types of self-organizing governance modes that help manage the integrity-generativity tension and provide implications on DPE scalability and resource investment by the platform owner (Huber et al., 2017). Using IE theory, we develop a theory that reveals the underlying interdependencies and implications of top-down platform governance and bottom-up complementor self-organization.

Theoretical Background

First, we synthesize the literature on DPEs and platform governance to articulate the tenets of the dominant perspective of platform owners as central, top-down planners. Second, we contrast this perspective with the literature on self-organization and the emergent phenomenon of bottom-up self-organizing complementor coalitions. Third, we use IE theory to conceptualize the integrity-generativity tension considering platform owner-centric top-down control and bottom-up complementor self-organization based on part-whole relationships between the platform owner and complementor coalitions. Finally, we introduce the concept of soft power as a potential mechanism to govern self-organization.

Digital Platform Ecosystems and Platform Governance

Digital platforms orchestrate interactions between complementors representing the supply side and consumers representing the demand side of an ecosystem (Parker et al., 2016). These interactions are based on a digital platform that describes "an extensible codebase to which complementary third-party modules can be added" (de Reuver et al., 2018,

p. 117). Hence, platforms provide a solution for systemic innovation failures by maintaining integrity while encouraging generative behavior in the DPE without requiring direct input from the central authority—the platform owner (Cennamo & Santaló, 2019; Jacobides et al., 2024).

Structurally, DPEs are hierarchical entities comprising actors at the local level that collectively contribute to the formation of the global-level ecosystem (Hurni et al., 2022; Kathuria et al., 2020). These actors contribute to and derive benefits from the co-created value that permeates the entire DPE. For instance, video game developers as complementors contribute to and gain from the overall attractiveness of the gaming console to consumers (Cennamo et al., 2018). The platform owner centrally governs these interactions at the local level. This control is often called a "benevolent dictatorship" (Tiwana, 2015, p. 279), as the platform owner employs *direct control* (Boudreau, 2010; Zhang et al., 2022), defines the *platform design* (Ghazawneh & Henfridsson, 2013; Wareham et al., 2014), and *manages direct relationships* with ecosystem actors (Huber et al., 2017; Sarker et al., 2012).

A core governance challenge involves balancing the integrity-generativity tension to ensure stability while evolving the DPE (Cennamo & Santaló, 2019; Wareham et al., 2014). Here, platform owners can employ direct control by setting ground rules to control inputs and outputs in the DPE. These rules ensure the DPE's integrity (Kretschmer et al., 2022; Tiwana et al., 2010) while incentivizing generative behavior (Cennamo & Santaló, 2019; Chen et al., 2022a). As platform owners centrally define the rules for participation and interaction, they have "the power to prohibit, compel, and coerce" (Chen et al., 2022a, p. 153).

In addition, platform owners provide *boundary resources*, such as application programming interfaces (APIs) or software development kits, through a platform design that shapes interactions among actors (Foerderer et al., 2019; Ghazawneh & Henfridsson, 2013). These resources represent arm's length control that restricts complementor behavior so that new software modules can meet certain quality standards and be integrated while also providing complementors with enough freedom to develop their own solutions (Ghazawneh & Henfridsson, 2013; Wareham et al., 2014). Although literature acknowledges that boundary resources are co-created with DPE actors, platform owners are central to "defining and redefining the boundary resource" (Eaton et al., 2015, p. 237).

Complementing these two governance mechanisms, platform owners employ *relational governance* to establish trust between themselves and their constituent DPE actors.

Self-reinforcing mechanisms such as building mutual trust are especially important in DPEs where partner managers work closely with complementors (Sarker et al., 2012). Through partner managers, owners again centrally control dyadic relationships with complementors (Ceccagnoli et al., 2012). When emphasizing shared values, these relations can catalyze generative behavior and the DPE's evolution or, if perceived as illegitimate, undermine its integrity and stability (Huber et al., 2017).

All three platform governance mechanisms underscore the dominant platform owner-centric perspective. Although prior work provides a helpful foundation for understanding how different mechanisms facilitate interactions in DPEs (Chen et al., 2022a), it cannot explain the emergence and effects of self-organized complementor coalitions, as they emerge and operate outside central top-down control. Hence, there are unresolved questions about how complementor coalitions form, whether and how they can be governed, and how this might affect the integrity-generativity tension in DPEs.

Self-Organization and Platform Governance

In the presence of these three mechanisms, complementors have started to self-organize into coalitions, escaping the central top-down governance employed by platform owners. Self-organization is a dynamic process that emerges from local, autonomous interactions among actors to achieve complex tasks without centralized control (Kauffman, 1993; Massa & O'Mahony, 2021). It follows on the premise that decision-making and coordination at the local level enable the achievement of higher-level goals, such as the formation of relationships to develop solutions in response to unmet demand (Fjeldstad et al., 2012; Krancher et al., 2018).

In this regard, self-organization could be vital to increasing the generativity of the DPE to identify and address otherwise unmet demand (Jacobides et al., 2024). This could explain why complementors, whether ISVs or consulting firms, have started self-organizing by using their networks and forming coalitions outside traditional top-down control. These coalitions can increase the DPE's generativity by recombining capabilities (Zhang et al., 2022) but also threaten its integrity by circumventing traditional platform governance (Karhu et al., 2018). Both examples illustrate that self-organizing complementors affect the integrity-generativity tension and introduce novel complexities in governing DPEs.

Research has investigated self-organization in hierarchical contexts such as teams within organizations (Krancher et al., 2018; Lee & Xia, 2010) and in open or semi-open settings, including open collectives (Massa & O'Mahony, 2021), open-source communities (O'Mahony & Karp, 2022) or

entire business ecosystems (Tan et al., 2020). However, while few researchers refer to "self-organization" in DPEs (Williamson & De Meyer, 2012), they remain ambiguous about the underlying processes, instantiations, and consequences.

In sum, self-organization introduces a novel layer of complexity into platform governance. While self-organization has been studied in various settings, its role in DPEs remains underexplored (Williamson & De Meyer, 2012). This is also reflected in recent calls for future research on how platform owners can govern collective action and collaborative relationships among complementors (Constantinides et al., 2018; Kretschmer et al., 2022). Answering these questions has unique implications for understanding the integrity-generativity tension in light of self-organizing complementor coalitions.

Information Ecology Theory and Tensions between Top-Down Control and Bottom-Up Self-Organization

We use IE theory as a lens to conceptualize the integrity-generativity tension in light of platform owner-centric top-down control and complementor-driven bottom-up self-organization (Koestler, 1968; Wang, 2021; Wareham et al., 2014). Viewing DPEs through the lens of IE theory provides new perspectives on how complementor coalitions form, can be governed, and influence DPEs across structural hierarchies (Cenamor, 2021; Wang, 2021).

IE theory proposes that ecosystems are wholes composed of parts (Wang, 2021). These parts, in turn, are wholes formed from smaller parts, resulting in a hierarchy of part-wholes and their relationships across multiple levels. IE theory refers to holons for part-wholes, denoting "nodes on the hierarchical tree which behave partly as wholes, or wholly as parts" (Koestler, 1968, p. 48). This duality is reflected in a holon's top-down-directed self-assertiveness, giving it intrinsic value and emergent capacities to preserve its autonomy as a whole. In addition, holons have bottom-up-directed integrativeness, providing extrinsic value for the higher-order level by integrating into a larger whole as a part. Hence, holons are connected in a holarchy of autonomous entities that emerge from subordinate, lower-level holons and integrate with others to form a superordinate, higher-level holon (Koestler, 1979; Wilber, 2017).

Holons emerge through self-organization, where new structures or behaviors are manifested at a level of complexity not present at lower levels (Koestler, 1968). This process draws on IE theory, which defines digital (platform) ecosystems as holons

composed of parts that constitute distinct value propositions (Adner, 2017; Wang, 2021). Accordingly, the higher-level value proposition of a DPE includes value derived from lower-level holons that emerge from the interactions of DPE actors. Within this holarchy, complementors self-organize into coalitions as a new holon between the DPE and lower-level actors to address otherwise unmet demands (Jacobides et al., 2024). However, these coalitions also assert their own agendas, potentially conflicting with the platform owner’s vision or control mechanisms.

This conceptualization of IE theory illustrates how the integrity-generativity tension faced by platform owners corresponds to hierarchical trade-offs between top-down control and bottom-up self-organization in DPEs. Given that platform owners must balance the DPE’s integrity and generativity, they become vulnerable to the self-organization of complementors as a new self-assertive holon in the holarchy. As lower-level entities, complementors use their autonomy to self-organize and integrate into coalitions that can act outside of top-down control, allowing them to influence integrity-generativity tension from the bottom up (see Figure 1).

Soft Power as a Novel Means to Govern Digital Platform Ecosystems

Against the backdrop of traditional top-down control, we propose the concept of soft power—originally formulated in international relations (Nye, 1990, 2021)—to offer novel insights for governing bottom-up self-organization in DPEs. Soft power diverges from hard power that uses coercive techniques that restrict behavior or uses rewards or punishments by leveraging normative frameworks (Mechanic, 1962; Pettigrew, 1972). Soft power subtly persuades actors to align their behavior with desired outcomes, often without explicit awareness of being

influenced (Cialdini, 2004). As Nye (2021, p. 6) summarizes: “Hard power is like brandishing carrots or sticks; soft power is more like a magnet.”

Nye (1990) identifies three primary facets of the governance mechanisms of soft power: cultural diplomacy, political ideals and policies, and foreign policy conduct. These facets underpin the ability to attract and co-opt rather than coerce, use force, or give money to persuade. The essence of soft power lies in its ability to shape the preferences and behaviors of actors in a subtle, often unobtrusive manner, thus facilitating a conducive environment for self-organization and collaborative interactions (Nye, 2021).

While the application of soft power remains largely unexplored in the context of DPEs, its utility becomes evident when considering its implementation in economic settings. Examples are start-ups that use stories and deception to gain superior positions in nascent markets (Santos & Eisenhardt, 2009), firms that share information and a joint vision (Yoffie & Kwak, 2006), and firms that use influencers for competition (Lashley & Pollock, 2020).

As a complement to IE and platform governance, soft power can offer insights into a key blind spot overlooked by traditional DPE literature: describing how self-organizing entities that naturally escape central control can be governed. In contrast to traditional platform governance mechanisms that mostly resemble hard power to restrict extrinsic values, we propose soft power as a novel means to influence self-organizing complementor coalitions by appealing to their intrinsic values. By leveraging soft power, platform owners could foster a bottom-up governance dynamic that promotes the generativity of these coalitions, thereby catalyzing innovation and collective engagement within the ecosystem. At the same time, platform owners subtly safeguard DPE integrity, contrasting the more coercive measures of the traditional platform owner-centric governance (Chen et al., 2022a; Li et al., 2022).

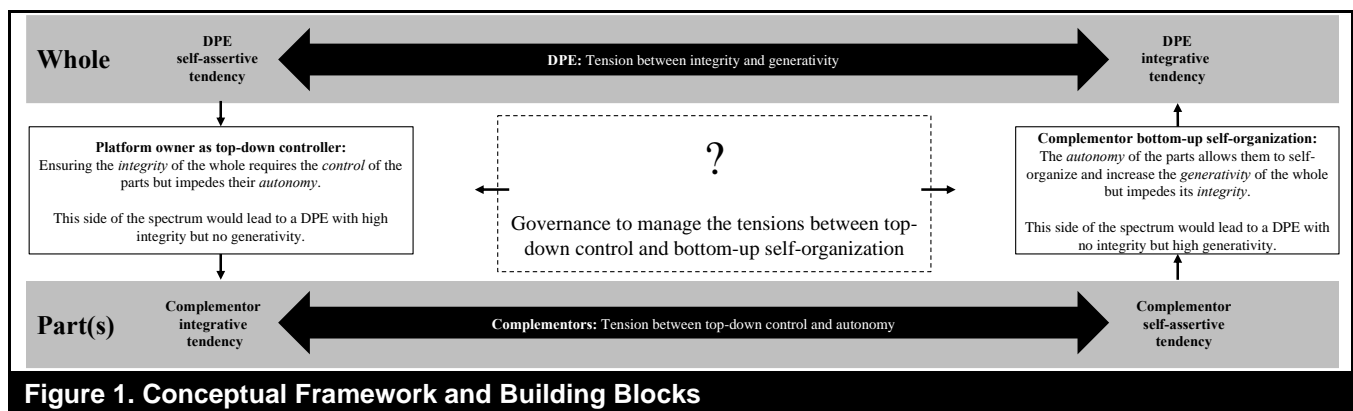


Figure 1. Conceptual Framework and Building Blocks

Table 1. Overview of the Interview Data					
Platform	Interview partner	Alias	Total interviews	Unique firms	Avg. duration (mins.)
CR	Platform owner	CR-PO.#	5	1	53
	ISV complementors	CR-I.#	18	16	44
	Consulting complementors	CR-C.#	10	10	
	ISV and consulting complementors	CR-IC.#	7	7	
EM	Platform owner	EM-PO.#	5	1	48
	ISV complementors	EM-I.#	2	2	53
	Consulting complementors	EM-C.#	3	3	
	ISV and consulting complementors	EM-IC.#	11	9	
Total			61 *	49	2891 minutes

Note: *A detailed overview of interviewees and their roles can be found in Appendix A.

Method

We conducted an inductive, embedded case study on complementor coalition formation and its impact on the integrity-generativity tension in DPEs using two case sites (Yin, 2014): CR and EM. We used an inductive qualitative research approach to capture and describe the dynamic and emergent interactions among actors in DPEs (Flick, 2018; Gioia et al., 2013). Observing these interactions is consistent with our goal of exploring complementor self-organization in coalitions and its implications for the DPE.

The study involved 61 interviews, 40 in the CR ecosystem and 21 in the EM ecosystem, comprising 2891 minutes of interview recordings (Table 1). We supplemented the interviews with 145 documents. Both interviews and archival data helped us to examine the dynamic nature of self-organization in DPEs. We iterated between empirical data, reflection, and the literature to develop a nascent theory (Strauss & Corbin, 1990) of platform governance in light of self-organizing coalitions. Our inductive study applied IE theory to analyze, describe, and explain the bottom-up self-organization of coalitions as holons in top-down controlled DPEs.

Research Context, Unit Selection, and Description

From 2021 to 2022, the spending on enterprise software grew by 168.46 billion USD (Statista, 2023). Enterprise software companies face complex customer problems in many industries, with single transactions worth millions of dollars. This environment requires deep knowledge of

business processes and IT integration, demanding customization and close collaboration among multiple parties to deliver the promised value (Sarker et al., 2012). Hence, more and more enterprise software companies, such as Microsoft and SAP (Schrieck et al., 2021), are adopting platform strategies to attract complements and ensure customer loyalty.

We chose CR and EM as our case sites because they are well-established DPEs. Both have vibrant ecosystems where complementors must collaborate to solve customer problems (Benbasat et al., 1987), allowing us to study self-organization. In addition, both follow a different approach to governing their DPEs. Although both use formal control and platform design, CR also employs a normative approach to governing its DPE through its unique ecosystem culture, resonating with soft power. Following a cross-case analysis, we wanted to see if and how these differences affect complementor self-organization and the integrity-generativity tension in the DPE. Table 2 provides an overview of both case sites.

Data Collection and Analysis

Our research unfolded in three stages: Initially, interviews within the DPEs uncovered unexpected self-organization, challenging the view of platform owners as central planners (Chen et al., 2022a). Next, we delved deeper into self-organization, uncovering tensions between integrity and generativity and the contrasting dynamics of top-down control versus bottom-up coalition formation. Finally, we synthesized our insights through IE theory (Koestler, 1968; Wang, 2021), constructing a framework to interpret these interactions (see Table 3).

Category	CRMCo (CR)	ESMCo (EM)
Focus	Customer relationship management	Enterprise service management
Complementors	Development partners, consulting partners	Development partners, consulting partners
Partners	Over 5000	Over 1000
Apps	Over 5000 apps	Over 800 apps
Short description	CR provides a market-leading customer relationship management platform for businesses. The platform includes a range of cloud-based products, such as marketing, sales, e-commerce, and service solutions. In addition, CR has acquired several technology companies, expanding the complexity of its technology.	EM is the market leader in cloud-based platforms that enable organizations to create and manage digital workflows. EM is often positioned as a platform that connects IT systems across the enterprise. The flexibility of EM's technology enables customers to automate workflows that require in-depth knowledge of IT systems and processes.
Perspective on complementor ecosystem	The success of CR hinges on the continued support from third-party developers and technology providers to create applications and offer integrations, data, and content that enhance our services. If this development and provision slow down, it could make their services less appealing to both existing and potential customers, potentially affecting their future sales.—Based on a CR annual report	EM benefits from a robust and expanding partner ecosystem that boosts their customers' digital transformation efforts and delivers value on a large scale. A growing share of their revenue comes from their network of partners, such as managed service providers and resellers. Both EM and their customers are increasingly dependent on these partners for professional services.—Based on an EM annual report.

Acts	Act 1: In-field problematization	Act 2: Iterative data collection, analysis, and theorizing	Act 3: Enriching concepts to glean meaning
Timeline	01/2020 – 07/2020	08/2020 – 08/2021	09/2021 – 03/2022
Focus and key activities	<p>Focus:</p> <ul style="list-style-type: none"> Gain an overview of enterprise software DPEs Understand the structure and activities of CR and EM <p>Key activities:</p> <ul style="list-style-type: none"> Basic research on context and case sites Conduct and analyze the first set of interviews 	<p>Focus:</p> <ul style="list-style-type: none"> Uncover, describe, and organize self-organization instances Identify the platform owner's role in complementors' self-organization <p>Key activities:</p> <ul style="list-style-type: none"> Second set of interviews Familiarization with literature on self-organization and part-whole relations 	<p>Focus:</p> <ul style="list-style-type: none"> Create an integrated theory Derive implications for DPE research <p>Key activities:</p> <ul style="list-style-type: none"> Integrate empirical and theoretical insights Reinterpret DPE research through the integrated theory to derive implications
Sampling strategy	<p>Sampling strategy:</p> <ul style="list-style-type: none"> ISV complementors Platform owner representatives with complementor-facing roles <p>Interviews in Act 1:</p> <ul style="list-style-type: none"> Complementors: 14 CR, 7 EM Platform owners: 4 CR 	<p>Sampling strategy:</p> <ul style="list-style-type: none"> ISV/consulting complementors Complementors that openly communicate partnerships Platform owner representatives with complementor-facing roles <p>Interviews in Act 2:</p> <ul style="list-style-type: none"> Coalition member: 18 CR, 6 EM Platform owners: 5 EM 	<p>Sampling strategy:</p> <ul style="list-style-type: none"> Platform owner representatives with complementor-facing roles Complementors that openly communicate partnerships <p>Interviews in Act 3:</p> <ul style="list-style-type: none"> Coalition member: 3 CR; 3 EM Platform owners: 1 CR
Reasoning	Inductive	Inductive & deductive	Inductive & deductive
Insights	<ul style="list-style-type: none"> Complementors add value beyond core products/services Many interactions happen without interference by or notice from the platform owner Observation of self-organization among complementors and scant attention by DPE research 	<ul style="list-style-type: none"> Complementors self-organize and establish coalitions with peers Platform owners can interfere with complementors' self-organization through soft power Identification of three interactions between bottom-up self-organization and top-down governance 	<ul style="list-style-type: none"> The integrated theory adds bottom-up self-organization to top-down owner-centric governance theory Trade-offs between interaction modes on integrity, generativity, scalability, and resource investments by the platform owner

Act 1: In-Field Problematization

We entered the field to explore whether and how complementors collaborate to increase generativity in the DPE and how this collaboration can be governed (Jacobides et al., 2024). We engaged with CR due to its complex customer demand and its large number of third-party services (approx. 0.75 per partner), indicating collaboration and DPE generativity. We contrasted this case with EM, which has significantly fewer third-party services (approx. 0.47 per partner), indicating lower collaboration. Both cases also incorporate important differences in how these interactions can be governed, showing a more normative approach of CR that resonates with soft power and EM's lack of (vocality about) such an approach. We interviewed ISVs and consulting firms as complementors, the primary developers of third-party services, along with platform owner representatives to understand the governance of these interactions.

While investigating the interactions through 25 semi-structured interviews, two authors took notes and discussed emerging concepts and possible categories. We found that many interactions, such as informal meetings and information exchanges, occurred without interference and sometimes even without the notice of the platform owner: "We work together with [another complementor] and exchange information regularly, even if we don't have joint projects every day, but we are in close contact with them." (EM-IC.2). We supplemented the interviews with archival data such as industry reports, websites, blogs, partner programs to triangulate our findings and gain additional information about coalition formation.

The interviews made us question the assumption that platform owners govern all interactions across DPEs with complementors responding to the central impulses. Consequently, we formulated our open-ended research question. We focused our empirical investigation on the emerging notion of bottom-up self-organization and the formation of complementor coalitions outside of traditional top-down control.

Act 2: Iterative Data Collection, Analysis, and Theorizing

Based on the insights from Act 1, we returned to the literature and familiarized ourselves with work on the self-organization of collectives. We found that research on self-organization focuses on contexts without managerial control, such as open

source and online communities (Nan & Lu, 2014; O'Mahony & Ferraro, 2007) and on cases with hierarchical organization, such as supplier networks (Gulati et al., 2012). However, we found no clear focus on the tension between bottom-up self-organization and top-down control in DPEs. As a notable exception, IE theory describes similar tensions between parts of an ecosystem and their contribution to an overarching whole (Wang, 2021). While not explicitly referring to self-organization, IE theory mirrored our observations of bottom-up integration of complementors as parts and top-down control by the platform owner of the whole.

Building on these insights, we adjusted the interview guidelines³ and conducted 29 more interviews to identify and explain the formation of coalitions. We coded these and prior interviews according to first-order terms, second-order themes, and aggregate dimensions⁴ using MAXQDA. In this data, we looked for statements indicating a mutual value proposition between complementors, such as partnering, collaboration, knowledge sharing, and joint projects, as instances of self-organization. We analyzed these instances considering the influence of platform governance on coalition formation (i.e., partner managers, app store). Again, two authors iterated between data collection and analysis, comparing results to guide the process.

We inductively derived *formation triggers* that describe the influence of top-down owner-centric control and bottom-up self-organization on coalition formation. Formation triggers corresponding to direct top-down control, allow the platform owner to ensure integrity by mandating interactions between complementors to address unmet needs in the DPE. Another top-down trigger is platform design, where the platform owner supports self-organization by balancing integrity and generativity. At the other end of the spectrum, we identified autonomous self-organization, where complementors form coalitions bottom-up outside the sphere of top-down control. In addition to formation triggers, we derived formation responses, such as complementors' compliance or noncompliance with top-down control, and formation outcomes, such as coalitions' potential for DPE integrity, scalability, and generativity and the resource investments required to govern self-organization.

Based on this data structure, we compared the formation triggers, responses, and outcomes between the two cases (Yin, 2014). During this cross-case analysis,⁵ we identified similarities: Both owners utilized their platform design to create conditions for supported self-organization. However,

³ A summary of interview guidelines for all three acts can be found in Appendix B.

⁴ The coding structure according to Gioia et al. (2013) can be found in Appendix C.

⁵ More details regarding the cross-case analysis can be found in the results section and Appendix C.

we also identified differences in terms of autonomous self-organization. While CR established a DPE-wide culture that influences autonomous self-organization (formation trigger) and the sentiment of coalitions in response to top-down control (formation response), we found less emphasis on a common culture in EM's ecosystem.

The iterations between data collection, analysis, and theory, as well as the cross-case analysis, guided our research (Gioia et al., 2013) and formed our understanding of how complementors self-organize inside and outside the sphere of top-down control by platform owners. We used constant comparison, visualization, and ongoing internal validity checks throughout this process as we added more data. We also used theoretical sampling to identify complementors as potential respondents who openly communicated their partnerships through their websites (Strauss & Corbin, 1990). Finally, we discussed and extrapolated the implications of our findings for self-organized coalitions as novel parts of the fabric of DPEs.

Act 3: Enriching Concepts to Glean Meaning

After collecting additional data and readjusting and narrowing our research focus, we arrived at the uncharted terrain of our research context. In the final theorizing step, we synthesized the empirical and theoretical findings with extant literature to make sense of self-organization in DPEs. Drawing on IE theory and the concept of holons (Koestler, 1968; Wang, 2021), we integrated bottom-up self-organization into top-down controlled DPEs. By moving back and forth between data, existing codes, and the proposed implications (Strauss & Corbin, 1990), we extrapolated implications for complementors, platform owners, and the DPE. As a postscript, we challenged our findings with seven additional interviews and ended this iterative data collection and analysis process when we reached theoretical saturation (Eisenhardt, 1989).

Results

The results describe three salient modes of interaction between the DPE governed by the platform owner and complementors that lead to coalition formation: mandated, supported, and autonomous self-organization. Each interaction includes a formation trigger, response, and outcome (see Figure 2). Each mode presents hierarchical trade-offs between owner-centric top-down control and bottom-up self-organization governing the integrity-generativity tension. These are summarized in the cross-case comparison between EM and CR (see Table 4).

Mandated Interactions: The Absence of Self-Organization

The first interaction mode refers to platform owners mandating interactions between complementors that lead to the formation of mandated coalitions. This interaction is driven by the tendency of platform owners to ensure the integrity of the DPE. Platform owners use direct control to define the input, involving complementors interacting to form a coalition, and the output by defining and evaluating their outcomes. This formation process reflects the absence of self-organization, as coalitions are formed only when complementors comply with top-down control and give up autonomy. When platform owners control interactions and outcomes, they prioritize the DPE's integrity at the expense of self-organization and generativity.

Top-Down Mandated Coalition Formation

Platform owners mandate interactions to facilitate the formation of complementor coalitions that operate with a predefined goal. The trigger for formation is the willingness of platform owners to orchestrate interactions among complementors that can build novel services or ensure the quality of high-profile projects. Platform owners mandate interactions to ensure and assess the quality of the output of these coalitions to protect the integrity of the DPE. After identifying complementors that can fulfill this requirement, platform owners secure the desired outcome through regular reviews to ensure that a predefined goal is met.

Although CR and EM engage in mandated interactions to some extent, we observed more instances in the EM ecosystem. The reason is that CR has more supported and autonomous self-organized coalitions that can autonomously address unmet customer demands in the DPE. In contrast, EM has fewer supported and autonomous coalitions and needs to substitute for them by mandating coalitions that can address these demands.

Despite these differences, both platform owners engage in mandated interactions to ensure the quality of high-profile projects where individual capabilities are insufficient. A manager of EM explains:

Imagine you have a large customer with a major transformation project. This means that technology is not enough. There are organizational factors ... There are [industry-specific] structures within the company. Based on those considerations, I need [partners] who understand the [industry] and have access to the board members. (EM-PO.3)

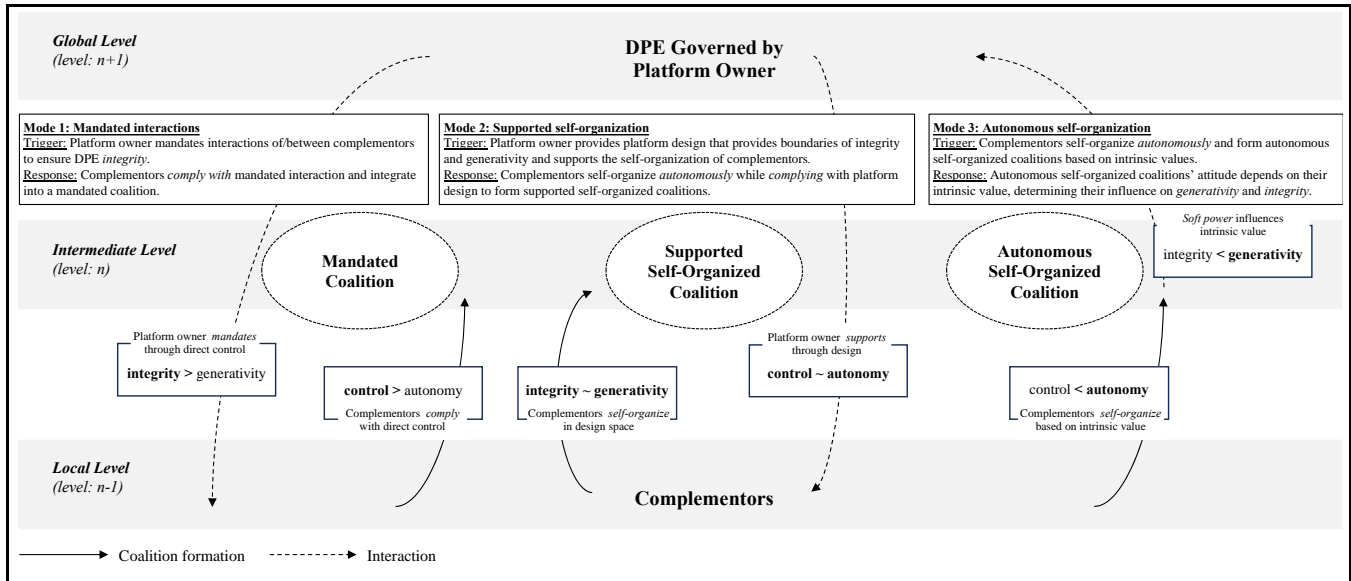


Figure 2. Three Interaction Modes that Lead to Complementor Coalitions

Table 4. Comparative Analysis between CR and EM

Type	CR	EM
Mandated interactions (top-down)	<p>The platform owner selectively mandates interactions to form coalitions that can ensure the quality of prestige projects for the DPE.</p> <p>Platform owner mandates:</p> <ul style="list-style-type: none"> compliance and alignment within mandated coalitions by facilitating their formation outcome control to ensure DPE integrity through regular reviews 	<p>The platform owner mandates interactions to form coalitions that can address unmet demands.</p> <p>Platform owner mandates:</p> <ul style="list-style-type: none"> coalitions to address specific customer demands by facilitating their formation
	<p>Hierarchical trade-off: The platform owner mandates coalition formation through hard power to ensure integrity by directly controlling coalitions and outcomes but stifles self-organization</p>	
Supported self-organization (top-down)	<p>Both types of platform owners design the platform scaffolding to support complementor self-organization. However, CR has more instances of supported coalitions than EM.</p> <p>Platform owner supports:</p> <ul style="list-style-type: none"> complementors to meet, collaborate, and self-organize into coalitions through the platform scaffolding that comprises events and boundary resources such as the marketplace the self-organization process through the design of the platform scaffolding <p>Hierarchical trade-off: The platform owner uses platform design to determine the bounded space for supported self-organization. This space sets the boundaries for generativity and integrity.</p>	
Autonomous self-organization (bottom-up)	<p>Complementors autonomously form coalitions driven by unmet demands and intrinsic value under the influence of a DPE culture.</p> <p>Complementors self-organize:</p> <ul style="list-style-type: none"> complementors use internal and external ties to form coalitions that contribute to the DPE autonomous coalitions internalize the DPE's values as part of their intrinsic value formation 	<p>Complementors autonomously form coalitions driven by unmet demands and intrinsic value without platform owner intervention.</p> <p>Complementors self-organize:</p> <ul style="list-style-type: none"> complementors use internal and external ties to form coalitions to satisfy their own needs autonomous coalitions develop their own intrinsic values and maximize value capture
	<p>Hierarchical trade-off: The platform owner uses soft power to influence self-organization bottom-up. Under the influence of soft power, autonomous coalitions increase the DPE's generativity at minimal governance cost. However, if not managed through soft power, these coalitions risk compromising the DPE's integrity.</p>	

Regarding selection criteria, partners should have “certifications,” “successfully implemented technology in such a way that it brings value,” “executive access” to get an “in-depth understanding of customer’s challenges,” and “show competency” (EM-PO.3, EM-PO.4, CR-PO.5). It is important to note that the coalition members are only shortlisted based on their capabilities to deliver the expected quality and still need to agree and form a coalition: “We play only the role of matchmaker and then let [the proposed coalition] talk.” (EM-PO.3)

The quality and impact delivered are of utmost importance for each coalition initiated by the platform owner. EM-PO.1 illustrated this: “With the decision in favor of [EM], which is very often based on business value assessments, there is also a responsibility for us to make sure the promised business values ... are delivered.” EM ensures this quality through dedicated departments that are “involved in a presales phase ..., in the post-sales phase and ... in measuring success [of coalitions].” In this case, EM conducts “proof of design” (EM-PO.1) workshops to ensure the solution is feasible and can deliver the promised impact. This process aims to ensure output control and the DPE’s integrity because negative spillover effects would ripple through the whole DPE if high-prestige projects are unsuccessful.

Bottom-up Responses to Mandated Interactions

Complementors respond to mandated interactions by complying with the direct control exercised by platform owners or by deciding not to join the coalition. When complementors do not comply, coalitions are not formed. The main reason for noncompliance is that complementors do not trust one another or are in competition (EM-IC.8). When complementors comply with mandated interactions, they follow the (quality) standards platform owners set. Reasons for joining are reputation by “working on high-profile projects,” “monetary reasons,” and “not having all the resources [required by the project]” (EM-IC.2, EM-IC.6, CR-I.8, CR-IC.7). As platform owners set the goals of mandated coalitions, the interviews did not indicate self-organization outside of delivering the set outcome. In addition, most mandated coalitions only exist for the duration of a specific project.

First, complementors comply with mandated interactions for monetary reasons and to increase their business reach. EM-C.2 recalled a project where the platform owner was interested in complementors with experience in a geographic region into which they wanted to expand. In addition to projects related to regional expansion, complementors also engage in mandated interactions to work on projects that each coalition member could not handle alone. EM-C.1 explains this process: “In principle, [EM] does the cold calling and selects suitable partners from the partner ecosystem. They then establish

contact with us, and we also take part in the next steps, which means sales and pre-sales, where things become a bit more technical.”

Another motive for complementors to engage in mandated coalition building is to improve their position in the DPE—for example, through novel services. CR-I.8 recalled that “[CR] actually came to [us] and said, we’ve bought this company and this tool, but it doesn’t generate very high-quality quotes. [Could you help develop a] solution?”

Complementors engage in mandated interactions and form a coalition based on these motives. During this process, complementors “show up together at [the client],” work on joint presentations, and “are a team.” The coalition works toward presenting their “solution in close alignment with [CR]” (CR-I.5). CR-C.8 explained this process in more detail:

We are usually involved as a partner at a very early stage ... This means that an initial discovery took place [by CR]. This is followed by a partner presentation, where we introduce ourselves and our project approach. Another scoping begins, followed by a joint demonstration, a project approach or project effort estimate, and then hopefully the closing.

Outcomes of Mandated Interactions

The outcome of mandated interactions depends on the specifications provided by platform owners. Because platform owners specify the outcome, for example, through proof of design, coalition members adhere to this control to ensure quality goals. They do not self-organize but rather work along the guidelines set by platform owners, ensuring integrity and commitment toward the DPE at the expense of generativity. In addition, mandated interactions lead to high governance costs as platform owners must conduct regular reviews to ensure each coalition’s integrity, making this formation approach more costly and less scalable.

Within the Defined Playing Field: Supported Self-Organization

The second interaction describes the self-organization of coalitions supported by the platform’s scaffolding. Platform owners design the scaffolding through APIs, marketplaces, events, and partner managers. The scaffolding design allows platform owners to balance the integrity-generativity tension resulting from self-organization. By setting constraints that determine the space for self-organization, platform owners establish the boundaries for coalition formation and how they can impact the DPE’s generativity and integrity.

Top-down Supported Coalition Formation Support

Platform owners design the platform's scaffolding through technology in the form of APIs and application marketplaces and by creating opportunities for social interactions among complementors through events or relational governance through partner managers. Through the scaffolding's design, platform owners influence, for example, how complementors can use APIs to interact and whom they can meet at industry-specific events.

Technical Design Through APIs and Application Marketplaces

CR and EM use APIs to provide standardized interfaces that allow complementors to join and work on projects that ensure interoperability between enterprise software systems. CR-IC.1 observed that coalitions built on the interoperability between CR and other systems are "API-triggered." By defining what connectors are available, such as "providing a WhatsApp interface," CR designs and controls APIs that spur interactions (CR-IC.1).

Consequently, the availability, functionality, and stability of APIs are important formation triggers. The interviews indicated that CR does a particularly good job providing an "API first strategy whereas [competitors] follow a GUI [Graphical User Interface] first strategy" (CR-I.3). Complementors often start with APIs and, from there, identify potential partners (CR-IC.4). In addition, APIs must be stable enough to trigger coalition formation. Mutual projects and coalitions cannot form if the API landscape is unstable: "Sorry, an API just blew away, we will see if we can find out what it is.' You can't sign an SLA [service level agreement] or build a foundation [for a coalition] on this" (CR-I.3).

The platform owners' *application marketplaces* are another part of the scaffolding that complementors use to identify potential coalition partners. The public marketplaces of both DPEs are designed to provide comprehensive information about complementors in both the consulting and ISV roles. These marketplaces help complementors find and evaluate their peers. According to EM-IC.5, information such as customer ratings, successful projects, and platform-certified employees helps identify potential partners. EM-IC.5 explained that they were

checking [the marketplace], ... what sector they're in, looking at what partner status they have, ... which [Customer Satisfaction] level they have, which project size they have and in which area they have their strengths. ... And now my customer would like to have cloud management. And then I see that [partner in list] can't do that.

Social Design through Events and Platform Contacts

CR and EM organize multiple *events* throughout the year and across regions, providing opportunities to form and maintain coalitions. For example, in 2019, CR's flagship event attracted over 150,000 attendees over several days, while more than 20,000 attendees participated in EM's conference in the same year. By organizing conferences, both platform owners enable complementors to connect, share experiences, and find common ground. CR-I.8 reported impressions from events organized by CR: "One of the great things is that there are so many events. ... we look for customers; we look for partners. ... we sell licenses, work with partners on implementation, and give credit to [CR] for the revenue that we generate." However, complementors still need to utilize the scaffolding to form coalitions: "As far as conferences go, [EM] just provides a platform, and we need to leverage it ourselves" (EM-I.1).

CR, for example, purposefully designs industry-focused events, such as in the construction sector, to trigger discussions to "discuss the combination of ... partner offerings with customers," which are "extremely helpful" (CR-I.16). By specifying the context of such events, including "training and learning opportunities" (EM-IC.7), owners purposefully design them to "help partners to identify whitespaces" in the DPE (CR-PO.2).

In addition, *platform contacts* provided by CR and EM help partners find each other, which triggers and facilitates coalition building. As part of the platform design, these contacts include partner managers, sales reps, solution engineers, and account executives. They are the primary interaction points for complementors for any inquiry, often leading to close relationships and allowing platform owners to shape complementors' self-organization.

These platform contacts can even "trigger" (CR-I.15) when and which coalitions are being formed. CR-I.15, for instance, offers an application for video-based support. When CR-I.15 asked for new opportunities, the partner manager introduced them to a specialist, who offered a knowledge management application. Since then, the two complementors have been talking and have formed a "very successful" coalition by integrating their applications.

Bottom-Up Responses to Supported Self-Organization

The scaffolding design determines how and where complementors can self-organize into supported coalitions, setting boundaries on how these coalitions can affect the DPE's generativity and integrity. As a formation response,

complementors use the design space and autonomously self-organize into coalitions to identify and address otherwise unmet demands, as shown in the construction industry. Based on the scaffolding's design, supported self-organized coalitions can increase the DPE's generativity, scalability, and interoperability but may also threaten its integrity. In addition, supported self-organization has lower governance costs, as the scaffolding only supports coalition formation, foregoing the need for direct supervision.

Complementors use the APIs, application marketplace, events, and partner managers as opportunities to meet, interact, and form coalitions that find and address unmet customer demands. Unlike mandated coalitions, supported self-organized coalitions require autonomy and self-organization to identify and address these demands. If and how supported coalitions self-organize is determined by the scaffolding's design, set by platform owners.

An example of this maneuvering between complying with the design and using the scaffolding autonomously is industry-specific events organized by platform owners. During these events, complementors meet, interact, and form coalitions to solve industry-specific challenges they cannot solve individually. As intended by platform owners, these coalitions comply with the scaffolding and develop novel solutions in a specific industry.

However, they also increase the DPE's generativity, as the outcomes are not specified. For example, EM-IC.7 described industry-specific events as "one of the most important, if not the most important event because [they] offer training ... and make you see] all the experts on-site." Because of the inherent customer problems presented at these events and the training provided by platform owners, these events bring together complementors who can address industry-specific needs that individual complementors cannot. A similar example can be found for CR, where CR-I.16 emphasized the importance of industry-specific events:

[CR] itself appeared with selected partners, and we had a very intensive opportunity to discuss the combination of these partner offerings with customers or potential customers. And I found that extremely helpful. We did this in the construction sector, for example, and that's how we got in touch with [coalition member] in the first place and saw what they were doing for customers and to see where common customers were.

The design can also ensure the DPE's integrity by using APIs to trigger the formation of coalitions that work on

projects to increase system interoperability. CR-PO.3 explained that by providing APIs, complementors begin to interact and work on projects to develop solutions—for example, the interface between CR and AWS (Amazon Web Services)—in a "straightforward" and "very simple way." Although CR defines the design space through specific APIs, they encourage the formation of coalitions because "more innovation [is] coming from [coalitions]" (CR-PO.1).

Complementors maneuver in this design space by developing "a joint go-to-market strategy with [their] partner[s]." This joint go-to-market strategy is necessary because coalition members have different skills and capabilities. Without it, "the partnership does not take off" (CR-I.12). CR-I.6 illustrated this need: "[Coalition member A] does not know our software, [coalition member B] does not know retail, and we do not know [the required] [CR] modules."

Outcomes of Supported Self-Organization

Supported self-organized coalitions help increase the generativity of DPEs by identifying and addressing unmet customer demands. As platform owners do not specify the outcome for each coalition formed, they do not need to monitor them, making them less costly to govern. Another consequence is that these coalitions increase the DPE's scalability and interoperability while potentially threatening its integrity. These consequences affect not only the coalitions but also the DPE as a whole, as increased generativity, scalability, and interoperability lead to DPE growth and increased customer retention. However, negative effects, such as compromised integrity, can also ripple through the whole DPE.

First, supported self-organized coalitions can increase the DPE's generativity. CR-I.16, a sales support application provider, used a CR industry-specific event to initiate discussions with another pricing software provider. These discussions led to a coalition in which both parties integrated their solutions to create a more "complete offering" for their customers in the construction sector. CR-PO.1 highlighted the increased generativity:

[Complementor coalitions] increase the amount of innovation ... to our customer[s] significantly. And, of course, they are creating a much, much better experience for our customers by substantially extending specific functionality to our product. And that's great, you know, we are much closer to our customers; you can much better fulfill the individual requirements either from an industry or from a functional point of view.

Second, these coalitions use the individual strength of coalition members to win new projects that increase the DPE's *scalability*. EM-PO.5 illustrated the scalability and importance of complementor coalitions: "[Coalitions are] very important to preach that there is more than [the platform], that they pitch the platform on the platform, and that they help to close deals." EM-PO-1 even suggested that they incentivize this behavior: "There is a point system, and a lead generated by the partner is simply worth more and gets more points."

Third, supported self-organized coalitions can increase the *interoperability* of solutions within the DPE and lead to lock-in effects for customers. CR-I.12 explained that solutions from coalition members are interwoven, and customers are "sticking to the [solution of coalition member A], which is connected to [the solution of coalition member B], and both again are built on [CR]." Ultimately, customers "think twice if they want to replace [CR]." (CR-I.12)

We also observed *adverse effects* of self-organized coalitions that became more autonomous and threatened the DPE's integrity. The majority of these cases occurred in the EM ecosystem and only in coalitions that became more autonomous. We also identified soft power as a bottom-up control mechanism employed by CR, which may explain why we observed less adverse coalition behavior. Because supported self-organized coalitions can grow more autonomously and avoid redundancies, we describe adverse effects in the next section.

From Rules to Values: Autonomous Self-Organization

The third mode of interaction describes the bottom-up formation or evolution of complementor coalitions outside the control of the platform owner. In contrast to mandated interactions and supported self-organization, this formation process is driven by the autonomy and intrinsic value of complementors and their networks. Triggered by the inability of individual complementors to meet existing demands in the DPE, complementors activate their network inside and outside the DPE to form or evolve into autonomous, self-organized coalitions. As autonomous coalitions evade traditional top-down control, the only way to govern them is bottom-up through soft power that influences their intrinsic value. By complying with a DPE culture, these coalitions address otherwise unmet demands in a scalable way and increase the DPE's generativity without compromising its integrity.

The difference between coalitions that increase the overall value of the DPE and those that threaten its integrity can be seen between CR and EM. The cross-case analysis reveals

that the extrinsic values of CR's ecosystem culture are internalized by autonomous coalitions acting according to these values. In turn, the absence of a common culture in EM's DPE shows that these coalitions tend to act more selfishly, compromising their integrity. Examples are direct bargaining, circumvention of DPE solutions, and increased intraplatform competition.

Bottom-Up Autonomous Complementor Coalition Formation

Autonomous self-organization involves interactions among complementors outside the control of the platform owner. In contrast to mandated interactions and supported self-organization, where the platform owner either directly or indirectly triggers the formation of coalitions, autonomous self-organized coalitions form or evolve from the bottom up, i.e., from the complementor level. Complementors use their connections inside and outside of the DPE to form coalitions to "extend [their] own expertise," "share resources," and build new capacities to increase their and the DPE's competitive advantages (CR-IC.3, CR-IC.5). As the formation relies on personal ties within and outside the DPE, it requires awareness, trust, and a profound understanding of partners.

Ties Inside and Outside the Digital Platform Ecosystem

The motivation for autonomous self-organization is similar to that of supported self-organization. Complementors from CR and EM self-organize and form autonomous coalitions to find and address demands that individual complementors cannot (CR-IC.5, CR-IC.1, CR-I.6, EM-IC.2). CR-C.6, who has 20 years of experience as a CR consultant explained how demands changed: "In the beginning, you knew everything about [CR], but today that is no longer possible. ... You have to specialize." This increasing complexity illustrates that customer problems became progressively more demanding, requiring complementors to combine their capacities in autonomous coalition formation. However, in contrast to supported self-organization, complementors do not rely on the platform scaffolding to identify and form coalitions but build on their network within and outside the DPE to partner with complementors who have the required skills (CR-I.10, EM-IC.9).

CR-C.7, who developed several innovative solutions with coalition members, explained how autonomous coalitions form "the same way that other relationships are formed: One person you meet at an event, another you are asked to meet because there is a customer and they can't help him or don't have enough resources. ... And at some point, this leads to—

I would say—preferred partnerships.” Based on these ties, complementors can engage and develop as they “have met in person somewhere, understand each other well—perhaps think similarly and complement each other” Out of coalitions that often start by providing generic solutions: “I don’t have the resources right now, do you have any?” can evolve innovative partnerships: “I cannot cover this alone, let us work together” (CR-C.7). As a result, these trusted coalitions take longer to form, but they are also more stable. CR-C.7 explains that these coalitions are stable “because [they] work best for the customer.”

Unmet Customer Demands as Triggers for Coalition Formation

The emergence of autonomous coalitions in DPEs is a response to the increasing complexity of customer demands. CR-I.12 described these demands as one complementor “trying to offer only the tires of a car, and one ... trying to offer the engine of a car and other [complementors] offer the rest of the thing, then if we combine it, we can make an end-to-end solution for the customer.” These coalitions have become increasingly relevant as both DPEs experienced significant growth, evidenced by a revenue surge of at least 24% annually in the five years preceding 2022. This growth has catalyzed customer demands surpassing individual complementors’ capabilities, necessitating collaborative approaches.

One illustrative example is CR-I.14, where the formation of an autonomous coalition was “customer-driven in terms of, hey, there’s a customer demand out there [and] we have a gap that we know we can’t fulfill by ourselves.” Driven by this demand, CR-I.14 engaged with a “consulting partner [that] has experience with the [CR] technology” and “ha[s] experience with us too.” CR-I.14 summarized that the underlying motivation for these autonomous coalitions hinged on three key questions: the ability to fill a gap, the potential for mutual profitability, and the enhancement of customer satisfaction.

Similarly, complementors from the EM ecosystem also recognize the potential to meet these increasingly complex customer demands in a situation of fast market growth. Their approach, however, exhibits a more cautious stance towards forming autonomous coalitions, acknowledging competition among partners. EM-IC.5 described this rationale as: “Sometimes it is necessary to get involved in a project with a competitor because you do not have the skills.”

A comparative analysis of CR and EM ecosystems reveals differing perceptions toward market growth. In the EM ecosystem, complementors view this growth as a competitive battleground, a “war for talents,” prompting a strategic shift towards forming autonomous coalitions to meet the challenges

of rapid market expansion (EM-IC.9). Conversely, the CR ecosystem perceives this growth more positively, viewing the DPE as a collaborative space where mutual support prevails, as expressed by CR-I.8.

Bottom-Up Control of Autonomous Self-Organization

Although autonomous self-organized complementor coalitions form or evolve outside the control of the platform owner, the cross-case analysis reveals differences in the frequency and outcome of these coalitions. While autonomous self-organized complementor coalitions appear to be more prevalent in the CR DPE, we also have evidence that they increase the generativity and scalability of the DPE while requiring no cost to govern. In contrast, the interviews indicate fewer autonomous coalitions and a higher likelihood that these coalitions will lead to adverse effects such as fragmentation in the EM DPE. These differences can be explained by CR’s ecosystem culture. This culture influences complementors’ intrinsic values and guides them through coalition formation.

The Influence of Culture on Autonomous Complementor Coalitions

First, we observed that autonomous coalitions conceive a collective identity among their participants that manifests as intrinsic values. This identity emerges from “mutual goals” (CR-IC.7) but also from “the personal level” (EM-IC.5), including trust and reciprocity. “Positive connections” among partners emerge within coalitions (EM-C.2). They can then evolve toward more autonomous interactions where the collective starts to build a “unique value proposition” within the DPE (CR-C.7). In turn, the absence of a shared identity or “DNA” can lead to the disintegration of coalitions: “We wanted to work with [a partner] when [a client] needed their skills. [The coalition] did not last because of a mismatch in DNA” (CR-C.9).

Although the shared identity emerges from the personal level, we observed a cultural aspect reflected in coalition members’ intrinsic values. For example, during the interviews with coalition members in the CR ecosystem, we found several occasions where coalition members mentioned an “almost cult-like status [that] ... creates an exciting environment” or a “community spirit [that] engages other people” (CR-I.8, CR-I.9). CR-I.8 refers to their coalition as being part of a superordinate DPE: “We sell licenses, we work with partners on implementation and give credit to [CR] for the revenue that we generate—that creates an environment where everybody is kind of looking after each other.” (CR-I.8)

CR-IC.1 explained that this understanding is based on the *ecosystem culture* that reflects the extrinsic values of the DPE. CR described this culture as a support structure that they nurture within their company and DPE. It extends from their employees to their customers, partners, developers, and ecosystem members. They all work together to take care of one another and stress the importance of having fun. CR-PO.2 illustrated how this culture influences complementors: “We proactively work ... to protect IP our partners create. And ... give [them] as much freedom as possible. ... And then the partners do share their IP to other partners ... all the trust comes in, [as we] operate in this culture of trust, meaning that we won’t steal IP from our partners.”

The interviews indicate that this culture creates a favorable environment for autonomous coalitions to form, as it “engages other people” and creates an “exciting environment” to partner (CR-I.8). CR-I.9 stated that their coalition formed because “our culture is very, very similar,” and that this overlap influenced the culture within the coalition.

The culture influences the formation of autonomous coalitions and those they involve. CR-I.9 described their coalition organizing global workshops and summits that “bring in industry leaders ... from huge corporations.” They brought new coalition members to “introduce them to big companies.” Asked why they are doing this, they said: “You know, that’s the kind of thing that we do if we have a partnership.” In that sense, autonomous coalitions control who can participate in these events and who cannot. CR-I.9 referred to this as: “As long as they played the game and they do the right thing, they will be invited again.” In addition, even if they do not need to, they “always involve [CR]” in their events (CR-I.9).

Comparing Ecosystem Cultures

In contrast to CR, we found no instances of proactive mention or reference to an ecosystem culture in the EM DPE. In addition, we found fewer instances of autonomous complementor coalition formation and found that these instances were more likely to harm the EM DPE than the CR DPE. Although we only observed a correlation between ecosystem culture and the formation and impact of autonomous coalitions on the DPE, we illustrate these differences based on perceptions of ecosystem competition and limited resources in the ecosystem.

First, autonomous coalition members in the CR ecosystem had a different understanding of competition than those in the EM ecosystem. Even though coalition members in the EM ecosystem “collaborate, even in competition” (EM-IC.5), they do it mostly based on their more selfish intrinsic

values. EM-IC.8 said they “do not engage and partner with a major competitor.” Instead: “[They] crowd them out. ... [They] displace them with industry knowledge, with resources.” If they add partners to their coalition, they do it “with smaller companies” (EM-IC.8). Other participants perceived competition as “all partners compete” (EM-C.1) or, upon being asked about competition, just answered: “brutal” (EM-C.3).

In contrast, the autonomous coalitions in the CR ecosystem have a vastly different understanding of competition. When asked about competition, CR acknowledged that “there is certainly healthy competition. Everyone tries to position their solutions as well as possible and to make sure that they find the best target group” (CR-PO.5). However, in the spirit of autonomous coalitions, even in competition, “the [CR] community still shares,” because they know that in the end it will benefit the customer and help the coalition “to position [themselves] better strategically” (CR-C.4). CR-C.6 summarized the perspective on competition as follows:

I’ve never had the feeling that there is a partner who wants to poach my clients. I would never do that myself. I do not look around, see who has what, and then knock there. I would never do that because I don’t think I would ever do that to [CR]; that doesn’t fit in with [CR’s] corporate culture. So, you rather try to make win-wins. That it really fits together.

Similarly, when faced with limited resources in both DPEs due to market growth, we noted different perceptions between EM and CR. As illustrated in the trigger for the formation of autonomous self-organized coalitions, coalitions in the EM ecosystem tend to perceive the limited resources as a “war of talents” (EM-IC.9). We also observed tendencies that autonomous coalitions in the EM DPE perceive partners as resources that they could onboard and offboard depending on the project: “For a project, [we might need] like 50 people because I cannot hire 50 people all at once. Then we fall back on these smaller partners” (EM-IC.8).

Again, in the CR DPE, we observed more tendencies that partners are “looking after each other” (CR-I.8) and that they acknowledge the culture in dealing with limited resources:

Because that is a very crowded environment. ... There are thousands of ISV partner companies. So, money talks, but then having said that, the culture is very important for [CR]. And we have to be, you know, really exhibiting the same kind of cultural alignment. The customer center, of everything we do, we donate a lot of money each year to charities, we’ve got a very sort of similar holistic approach, and that’s respected. (CR-I.9)

Outcomes of Autonomous Self-Organization

Like supported self-organized coalitions, autonomous coalitions can increase the DPE's generativity, interoperability, and scalability. However, autonomous self-organization is more effective because the cost of managing these coalitions is zero. They autonomously self-organize to increase market reach, create novel solutions, and increase platform interoperability. Depending on the culture of the DPE, we also observed more pronounced negative effects such as direct bargaining, circumvention of DPE solutions, and increased intra-DPE competition.

In contrast to the *generativity* created by supported self-organized coalitions, where the platform owner can indirectly steer the coalition's behavior, autonomous coalitions identify and work on problems beyond the design of the platform scaffolding and are unknown to the platform owner. By acting outside the control of the platform owner, the coalition has strategic flexibility, allowing it to focus on its core products and services while addressing unmet demands (CR-IC.2). These solutions benefit the DPE and the coalition: "The software solution that a partner has developed can save time for the customer, save time for us." (EM-C.1).

In addition, these solutions can improve the *interoperability* between solutions in the DPE. CR-C.4 explained that they developed standardized interfaces between their solutions in collaboration with their partners. However, instead of using this interface alone, they decided to "make it available to others as well ... in the interest of the community." Again, through these interfaces, autonomous coalitions extend the platform scaffolding and improve not only their partners but also DPE's market position: "[Our partners] make it possible for us to deliver a whole solution to compete with SAP, Oracle or others." (CR-I.10).

In addition, autonomous coalitions promote the *scalability* and reach of the DPE. CR-I.11 explained that they do "co-implementation" with ISVs in the DPE to ensure "complementary functionality" that allows them to "reach new customers [they] could not before." CR-C.7 confirmed that coalitions increase customer satisfaction, create business opportunities, and expand cooperation in the DPE.

Autonomous coalitions further increase *scalability* by building their own scaffolding within the DPE. CR-I.9 explained that the coalition organizes and hosts its global workshops, inviting potential customers and partners from the coalition's network to identify new opportunities and meet potential partners. These meetings can then lead to

expansion strategies that the coalitions pursue autonomously. One example is expansion into international markets, as reported by the U.S.-based CR-I.10, when CR entered the European, Japanese, and Australian markets. CR's activities included identifying and connecting new partners with customer contacts in these markets, training partners, and jointly developing go-to-market strategies.

Through their activities, coalitions create new customers in different regional markets, increasing the total number of customers and the overall international presence of the DPE—to the benefit of all actors: The platform owner sells additional licenses and increases its market share, complementors are able to reach new customers with their products and services, and customers gain access to solutions for their complex problems. A consequence of this self-organization is that the platform owner needs to spend fewer resources, as "one developer helping another developer means that [CR] needs fewer resources to answer questions and essentially, the more self-help partners can achieve the less handholding we need" (CR-PO.2)

Nevertheless, autonomous self-organized coalitions can also lead to *direct bargaining and circumvention of the platform*, compromising the DPE's integrity. EM-C.2, for example, stated that customers are sometimes "not willing to invest [amount blinded] [into EM]" and that they then, as a coalition, might develop solutions for cheaper platforms outside the EM DPE. Based on this position, autonomous self-organized coalitions can lead to a fragmentation of the DPE by creating lock-in effects that harm all actors in the DPE. EM-PO.2 is aware of this effect and confesses: "[coalitions are] significantly responsible for lock-in [effects]."

Last, autonomous coalitions can increase *intraplatform competition* by crowding out other complementors. Again, EM-IC.8 stated that their coalition "do[es] not engage and partner with a major competitor" and that they actively "crowd them out ... and ... displace them with industry knowledge, with resources." This behavior then creates unfavorable conditions, because these coalitions can "ruin projects," which leads to an "unsatisfied customer, and an unsatisfied customer means ... bad reports about [EM]," which, in turn, affect all other complementors in the DPE (EM-IC.2)

Discussion

This study explored the bottom-up self-organization of complementors into coalitions in top-down controlled DPEs. These self-organizing coalitions represent novel parts within

the hierarchical fabric of DPEs that increase generativity by identifying and addressing existing demands in the DPE that individual complementors cannot (Hausman, 1981; Jacobides et al., 2024). However, if not managed, these coalitions can also erode the integrity of the DPE (Karhu et al., 2018). Both positive and potentially adverse effects illustrate a novel governance challenge for platform owners in managing the tension between the integrity and generativity of the DPE (Cennamo & Santaló, 2019; Wareham et al., 2014).

Our research extends the prevailing owner-centric top-down theory of platform governance (Chen et al., 2022a; Jacobides et al., 2024) by providing evidence of soft power to govern the self-organization of coalitions bottom-up. Based on IE theory (Koestler, 1968; Wang, 2021), this extension accounts for the integrity-generativity tension of platform governance and complementors' compliance and autonomy. These tensions lead to hierarchical trade-offs that arise from the interaction between top-down control and bottom-up self-organization. We begin our discussion by adding the bottom-up perspective of self-organization to the top-down perspective on owner-centric governance based on three integrated governance modes. Each mode presents different trade-offs and offers insights into how platform owners can effectively navigate the balance between maintaining the integrity of the DPE and fostering its generativity in the context of self-organization.

Adding the Bottom-Up Perspective to Top-Down Platform Governance

The results reveal mandated, supported, and autonomous self-organized interactions between the platform owner and complementors. Each interaction explains the dynamics between the integrity-generativity tension of platform owners and the compliance and autonomy of complementors (Wareham et al., 2014). Platform owners can manage this tension through governance modes that range from exercising hard power to designing platform scaffolding to using soft power. Analyzing this with IE theory (Wang, 2021), coalitions can be seen as holons where each mode prioritizes either the coalition's integrative tendency toward the DPE or its self-assertive tendency toward complementors.

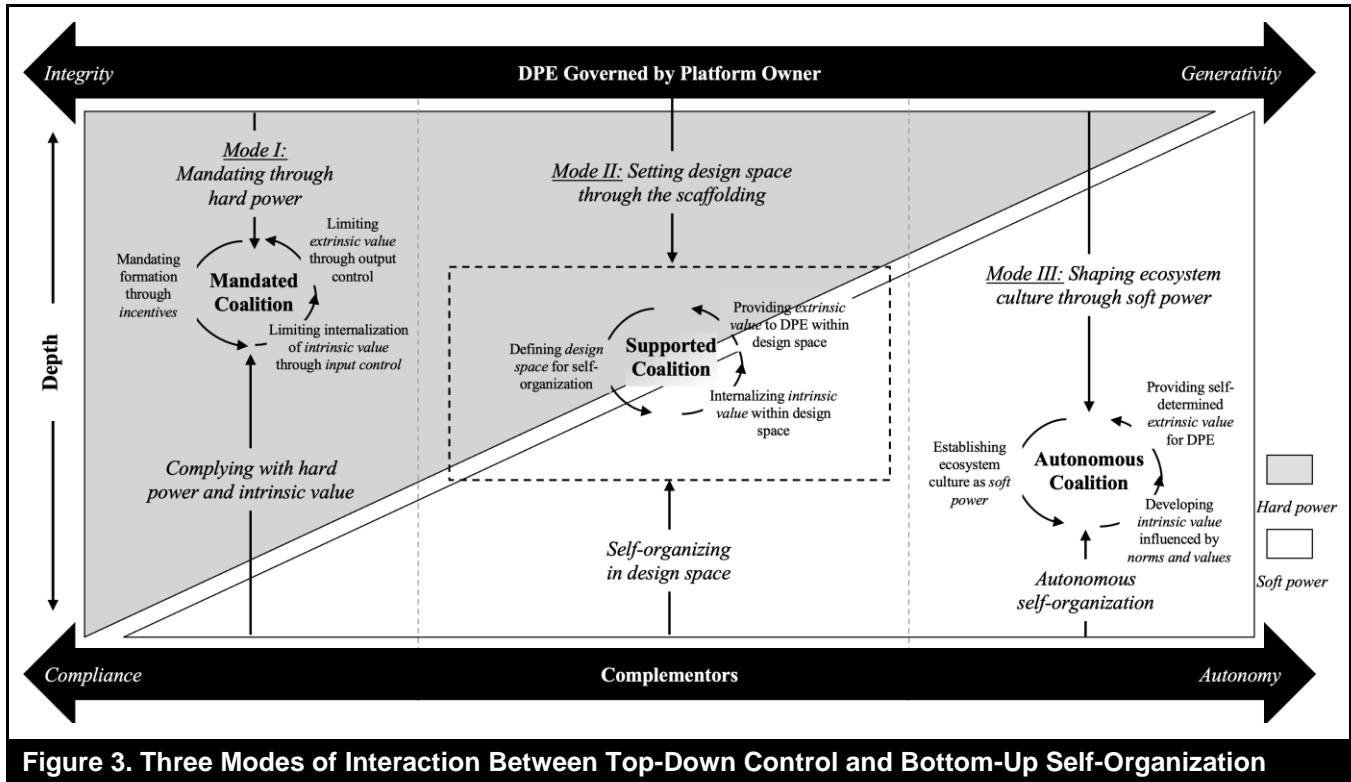
Based on these governance modes, coalitions can take different forms, from mandated coalitions with no self-organization to autonomously self-organizing coalitions. On the one side of the spectrum, platform owners can prioritize the integrative tendency of coalitions by mandating their formation and controlling the extrinsic value provided to the DPE through hard power. Conversely, platform owners can

prioritize the self-assertive tendency of coalitions by establishing norms and values in the DPE to influence the coalition's internalization of intrinsic value through soft power. Although both coalitions increase the depth of the holarchy (Koestler, 1979; Wilber, 2017) in the DPE, they differ in their integrative or self-assertive tendencies, bringing them closer to the DPE while ensuring integrity but stifling self-organization or bringing them closer to the complementors while ensuring generativity and self-organization but risking a fragmentation of the DPE. Analyzing this interplay with IE theory provides insights into how each mode affects the internalization of intrinsic values, representing a coalition's self-assertiveness and the provision of extrinsic value to the DPE and, in turn, a coalition's integrativeness (see Figure 3).

Mandated Coalitions: Hard Power and No Self-Organization

From a top-down perspective, mandated interactions illustrate the platform owner's use of hard power to ensure the DPE's integrity by forming mandated coalitions with a strong integrative tendency. Platform owners start this process by incentivizing complementors through lucrative projects to form a coalition that can solve predefined customer problems (Sarker et al., 2012). As platform owners use input control to restrict the complementors that can collaborate, they also limit how mandated coalitions form, internalize intrinsic value, and build emergent capacities. Even after the coalition is formed, platform owners control the extrinsic value these mandated coalitions provide for the DPE through output control, such as periodic reviews (Chen et al., 2022a; Wareham et al., 2014).

From a bottom-up perspective, mandated interactions stifle self-organization as platform owners limit the internalization of intrinsic value through input control and the provision of extrinsic value to the DPE through output control. However, despite this control, complementors still have the autonomy to decide whether they want to join the mandated coalition. This is why platform owners must provide compelling incentives to "offset the platform's lower level of direct authority over participants' behavior." (Kretschmer et al., 2022, p. 409) or establish DPE-wide norms and values so that complementors volunteer to join these coalitions. However, in both scenarios, the input and output control lead to a strong integrative tendency of mandated coalitions, limiting their own intrinsic value. This limited intrinsic value could explain why these coalitions tend to be more short-lived, exemplified by CR-C.9, who stated that a missing shared identity does not sustain a mandated coalition.



Both perspectives illustrate that platform owners can mandate the formation of coalitions to address customer demands that require a high degree of control. Mandated coalitions extend the depth of the DPE through a dominant integrative tendency that links them more closely to the whole than to the parts. This control stifles the mandated coalitions' intrinsic value development, requiring constant engagement of platform owners to sustain them. The costs involved could help explain why CR uses mandated coalitions only selectively for high-prestige projects requiring high integrity. On the contrary, due to the lack of other coalitions, EM uses mandated coalitions more frequently to address known demands in the DPE.

Supported Self-Organization and Indirect Control Through Platform Design

From a top-down perspective, supported interactions illustrate platform owners balancing the integrity-generativity tension by setting the design space for complementors to self-organize into supported coalitions. Platform owners define this space by designing and providing the means (e.g., APIs) and context (e.g., industry-specific events) (Ghazawneh & Henfridsson, 2013; Hukal et al., 2020) for self-organization. By defining this space, platform owners seek to provide complementors with the

autonomy to increase the DPE's generativity while constraining interactions to maintain control (Boudreau, 2010; Eaton et al., 2015; Wareham et al., 2014). This top-down perspective illustrates that platform owners can control the design of the platform scaffolding but cannot dictate if and how complementors will self-organize within it.

From a bottom-up perspective, complementors use the design space to meet, collaborate, and form supported self-organized coalitions. Within this space, complementors use social and technical boundary resources (Foerderer et al., 2019; Ghazawneh & Henfridsson, 2013) to identify and address demands in the DPE. Examples are APIs to increase platform interoperability and industry-specific events to access new markets (Hukal et al., 2020). With the help of these resources, complementors formalize a common identity that represents its intrinsic value and emergent capacities to address these demands. Although the design space provides the means and context for self-organization, platform owners neither control the internalization of intrinsic value nor the extrinsic value supplied to the DPE, making the DPE susceptible to adverse effects (Karhu et al., 2018).

Combining both perspectives, we see that platform owners can combine the design space (Eaton et al., 2015; Ghazawneh & Henfridsson, 2013) with soft power to

influence supported coalitions' intrinsic and extrinsic value. This can be illustrated in the cross-case analysis where CR has more coalitions that positively contribute to the DPE. For example, the influence of CR's ecosystem culture was evident in the coalitions' intrinsic values throughout the interviews, representing "collaboration," "taking care of," and having "fun."⁶ Intrinsic values like *collaboration* could help explain why complementors used the scaffolding more often for self-organization and values like *taking care of* explain why supported coalitions tended to provide more positive extrinsic value to the DPE. On the contrary, factors like competition in the EM DPE can lead to friction within the ecosystem and could help explain lower levels of self-organization. This synthesis of top-down and bottom-up dynamics highlights how the design space provides a framework for self-organization and how the prevailing norms and values guide complementors in forming supported coalitions that are both self-assertive and integrated into the broader DPE.

Autonomous Self-Organization and Soft Power

Finally, autonomous self-organization expresses the autonomy of complementors to form coalitions bottom-up and outside traditional top-down control. Unlike other modes of interaction, autonomous self-organized coalitions form bottom-up, without direct or indirect top-down interference from the platform owner. Hence, platform owners often "do not even notice [their formation]" (EM-PO.4). The guiding principle of complementors to engage in autonomous coalition formation is to identify and address demands in the DPE that complementors cannot address individually.

In contrast to mandated and supported self-organization, autonomous self-organization can only be controlled from the bottom-up through soft power. The cross-case analysis revealed differences in the number of instances and sentiments of autonomous coalitions between CR and EM. These differences can be attributed to the norms and values of complementors that trigger the formation of coalitions and whether they feel part of a larger whole. For example, CR uses soft power through its ecosystem culture, which influences whether complementors form coalitions (i.e., by acting upon the value of "working together") and the intrinsic value of these coalitions (i.e., by acting upon the value of "taking care of each other").

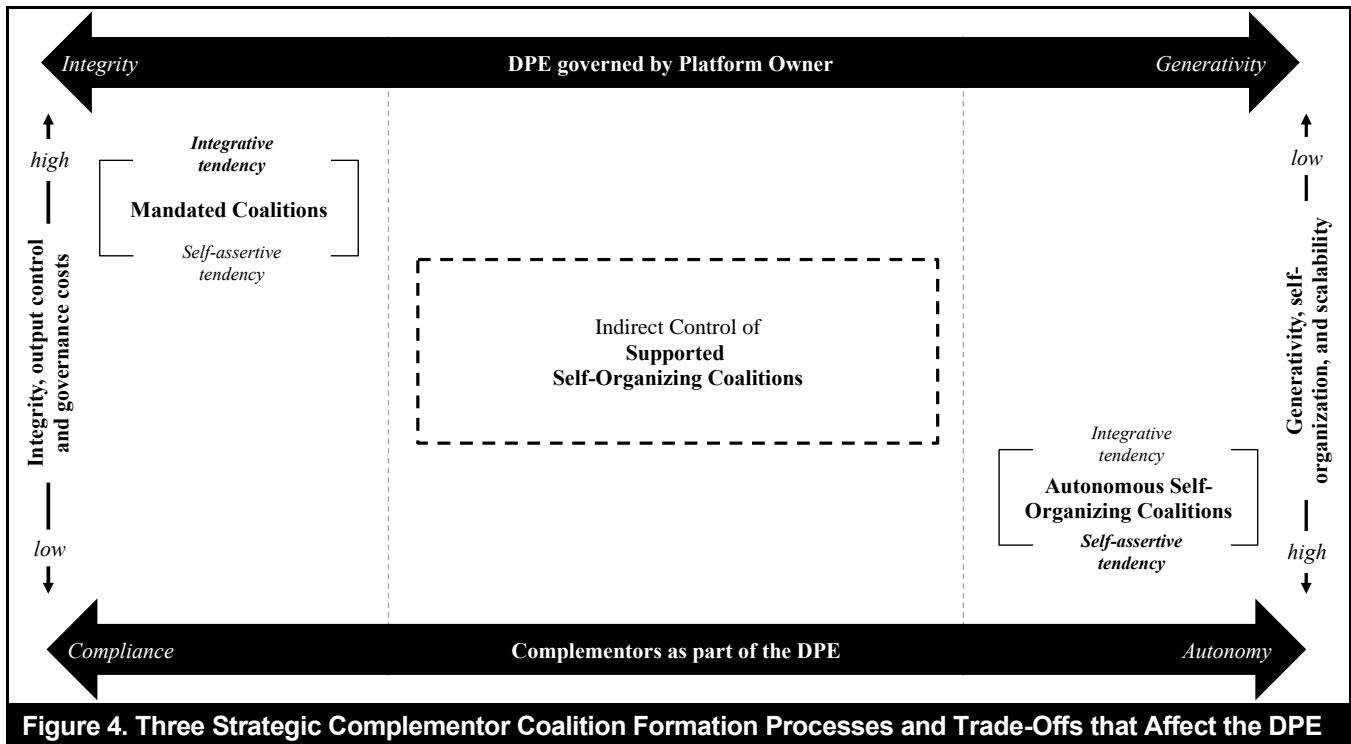
⁶ The results show two hits within CR for "fun," compared to zero for EM; four hits for "taking care" in the context of coalitions for CR, compared to zero for EM; and 131 hits for CR, compared to 52 hits within EM for "collaboration."

A common corporate responsibility promise illustrates how CR employs soft power to cultivate the intrinsic values of the DPE. In this promise, CR dedicates a fixed amount of the firm's equity, product, and employees' time to the community and encourages complementors to do the same. CR-C.3 informed us about this concept and mentioned that they are working on "non-profit projects with [a social organization]" because this "is part of the ecosystem." This example illustrates how soft power can shape the intrinsic values of a DPE. These values can "pull" complementors into autonomous coalitions who adopt them as their own when forming coalitions, thereby guiding the extrinsic value that these coalitions provide to the DPE.

The three governance modes show that the self-organization of coalitions in DPEs is a complex interplay of top-down and bottom-up mechanisms, characterized by the dual nature of coalitions as holons. Hard power restricts the extrinsic value of mandated and supported coalitions, reinforcing their integrative tendencies and alignment with the DPE's objectives at the cost of suppressing innovation and intrinsic motivation. In contrast, soft power subtly guides coalitions' intrinsic values, reinforcing their self-assertive tendency at the cost of lessened control and integration with the DPE objectives. Managing these tensions presents hierarchical trade-offs between top-down control and bottom-up self-organization that help platform owners steer DPEs more effectively.

Trade-Offs Between Top-Down Control and Bottom-Up Self-Organization

Integrating bottom-up self-organization of complementors into coalitions with top-down platform governance theory reveals hierarchical trade-offs that help explain why and how DPEs succeed. Based on IE theory, these coalitions increase the depth of the DPE and develop emergent capacities (Wilber, 2017), leading to unaccounted effects on the integrity-generativity tension. Driven by their self-assertive tendency, coalitions can prioritize intrinsic values, which could compromise the DPE's integrity as a whole (Karhu et al., 2018). However, when driven by their integrative tendency, holons can use their emergent capacities to increase the generativity of the DPE (Zhang et al., 2022). Our results show that platform owners can use the three governance modes as a strategic tool to influence both tendencies, creating coalitions with different trade-offs to manage the integrity-generativity tension (see Figure 4).



First, platform owners can exercise hard power to form mandated coalitions. These coalitions are characterized by a strong integrative tendency, where the platform owner exercises hard power over the coalitions’ intrinsic and extrinsic values through input and output control. This strict control—for example, in regular reviews—results in high governance costs (Huber et al., 2017). Hence, platform owners use mandated coalitions strategically for high-stakes prestige projects with a high potential for adverse spillover effects. CR-IC.2 illustrated that mandated coalitions help win high-profile customers who would have otherwise joined a competing platform. Hence, mandated coalitions help address customer demands of high importance that require predefined and controlled outcomes. However, the trade-off is evident in a lack of self-organization, constrained scalability, and lower generativity within the DPE. Strategically, mandated coalitions are best employed for achieving specific, high-impact goals where failure could jeopardize the integrity of the entire DPE.

Second, platform owners can employ soft power to shape the emergence of autonomous self-organizing coalitions. These coalitions have a strong self-assertive tendency and are driven by the norms and values of complementors. CR’s ecosystem culture illustrates how a platform owner can permeate a DPE-wide culture that influences these norms and values, shaping the development of autonomous coalitions’ intrinsic values and sentiments. Their formation requires no involvement of the platform owner, leading to low governance costs and high

scalability. Based on their intrinsic value and sentiment, these coalitions can increase the DPE’s generativity by expanding the platform into new markets (CR-I.10) or creating novel solutions (CR-C.7). However, they can also threaten the integrity of the DPE by increasing intraplatform competition and crowding out complementors (EM-IC.8). Strategically, these coalitions can be used to identify and address demands that are less critical for the DPE’s integrity, such as innovating, scaling and expansion.

Third, the middle ground in this spectrum illustrates platform owners designing the platform scaffolding to support self-organizing complementor coalitions. This approach differs from mandated and autonomous interactions as it neither fully controls nor provides full autonomy for complementors during the formation process. Instead, it provides the means and context for interactions, giving complementors the autonomy to address demands in the DPE within set boundaries (Wareham et al., 2014). Hence, platform owners can indirectly use supported coalitions to steer and control what (i.e., APIs) and where (i.e., industry) coalitions will identify and address demand in the DPE. The strategic use of supported coalitions lies in the platform owner’s ability to indirectly steer these coalitions to enhance the platform’s interoperability or penetrate new industries. This governance mode leverages the strengths of both top-down and bottom-up approaches, offering a versatile tool for platform owners to evolve the DPE while maintaining a degree of control over its trajectory.

Implications, Limitations, and Future Research

The integrated theory of top-down control and bottom-up self-organization has theoretical implications for the literature on platform governance and IE and practical implications for platform owners to strategically encourage self-organization to evolve their DPEs. In addition, our study has limitations and provides avenues for future research.

Theoretical Implications for Research on Platform Governance

Our work goes beyond predominant theorizing about centralized platform governance employed by platform owners (Chen et al., 2022a; Jacobides et al., 2024). According to this stream, platform owners employ direct control, platform design, and relational control to govern complementors and manage the integrity-generativity tension (Huber et al., 2017; Hukal et al., 2020; Wareham et al., 2014). Although scholars have acknowledged that control in DPEs is bidirectional (Engert et al., 2023; Tiwana et al., 2010) and that complementors can influence platform governance (Eaton et al., 2015), we lack a thorough understanding of the bottom-up perspective, i.e., how complementors react to this top-down control. This is evident in calls for research, such as how to govern collective actions (Constantinides et al., 2018) or collaboration among complementors (Kretschmer et al., 2022).

The integrated theory complements the prevailing top-down perspective on platform governance (Chen et al., 2022b; Zhang et al., 2022) by revealing soft power (Nye, 1990) as a normative mechanism that influences the norms and values of complementors. Although early research showed the potential value of normative approaches (Goldbach et al., 2018; Yoffie & Kwak, 2006), knowledge about the combination with top-down mechanisms and their influence on collective action—for example, in the form of self-organization—was lacking. The integration of soft power closes this research gap by adding a “pull” perspective (Nye, 1990) to traditional “push”-oriented governance mechanisms. This pull perspective helps explain how a DPE culture and subsequent norms and values propagate through the DPE and influence the bottom-up self-organization process of complementors.

The integrated theory also helps explain how platform owners can use self-organization as a strategic tool for the DPE to evolve and succeed. In particular, the integrated theory sheds light on how platform owners can use coalitions to identify and address demands in the DPE that individual complementors cannot (Jacobides et al., 2018). Based on three governance modes that combine top-down control and bottom-up complementor self-organization, our theory reveals different

hierarchical trade-offs between platform owner control and complementor self-organization. The integrated theory contributes to extant research on governance tensions by adding the perspective of self-organization and its influence on governance costs (Huber et al., 2017), output control (Chen et al., 2022a), and scalability of the coalition formation and their effect on the generativity and integrity of the DPE (Cennamo & Santaló, 2019; Wareham et al., 2014).

Autonomous self-organized coalitions are particularly novel in that they can scale the ecosystem beyond traditional network effects from within the DPE (McIntyre & Srinivasan, 2017). As parts within the DPE, these coalitions themselves have the autonomy to identify and address unmet demands by developing unanticipated capacities without platform owners needing to invest resources. Overall, complementor coalitions create DPE value through increased generativity and scalability beyond platform owners’ actions, complementing recent work on intercomplementor interactions (Li et al., 2022). This points to a largely overlooked way of scaling DPEs through self-organization.

The implications of an integrated theory on platform governance go beyond software enterprise DPEs. Taking the example of social media platforms, soft power could help explain why and how echo chambers might form a supported self-organized coalition of users (Kitchens et al., 2020). These echo chambers embody the reciprocity between top-down control by the platform scaffolding (i.e., recommender systems) and bottom-up self-organization of users into coalitions that form their own intrinsic values. Without appropriate soft power, these coalitions, initially formed through the scaffolding, can grow autonomously and lead to the fragmentation of the DPE in the form of echo chambers.

Theoretical Implications for Information Ecology Theory

The integrated theory has implications for IE theory (Wang, 2021) by illustrating how different governance modes can shape the overall structure of a holararchy (Koestler, 1968). In this regard, we extend IE theory by showing not only that holons add an additional layer of depth to the holararchy but that this depth can be shaped through different governance modes that influence the self-assertive and integrative tendency of holons. Mandated interactions reflect the holons’ integrative tendency, where the higher-order level entity uses hard power to control the extrinsic value provided for the whole. Conversely, autonomous self-organized interactions reflect holons’ self-assertive tendency, where intrinsic value development is influenced through soft power. Supported self-organization supports the formation of holons through design, enabling

actors to pursue their individual goals (intrinsic value) and self-assertive tendency while contributing to the whole's collective objectives (extrinsic value).

This nuanced understanding of holons, influenced by the three governance modes, adds additional depth to IE theory (Wang, 2021). As DPEs grow, the complexity and interdependencies within these DPEs also increase. This growth can lead to a more intricate holarchy, where the depth in the form of self-assertive and integrative tendencies and the span in the form of different types of holons as coalitions become critical factors in understanding the governance and evolution of these DPEs (Koestler, 1968; Wilber, 2017). For instance, as complementors become more autonomous and the DPE expands, the platform owner's direct control through hard power may diminish. This diminishing control can be conceptualized as an evolution in the holarchy's depth, where holons with more dominant self-assertive tendencies necessitate different governance approaches. These insights underscore the importance of understanding how governance modes impact holons' tendencies towards self-assertion and integration, shaping the DPE's overall structure and functionality.

Practical Implications

The results help platform owners to strategically evolve their DPE by encouraging self-organization and complementor coalition formation. Depending on the sensitivity of the task, platform owners can mandate interactions to ensure the integrity of the DPE or support self-organization by designing the context and means of interaction, thereby setting boundaries for the formation of coalitions. The case of CR illustrates the importance of soft power by not only "lead[ing] others to want what you want" (Yoffie & Kwak, 2006) but also by influencing how complementors self-organize into coalitions to identify and address demands that would otherwise be left unmet (Jacobides et al., 2024). Through soft power, such as developing a DPE-wide culture of norms and values, platform owners can influence the bottom-up response of complementors, influencing the number and sentiment of these coalitions.

Furthermore, complementors can use their insights into the platform's governance mechanisms to predict and adapt to the platform's strategy shifts. For instance, an increased emphasis on soft power by the platform might signal a shift towards more autonomous complementor coalitions, presenting new opportunities for innovative partnerships and ventures. By staying attuned to these dynamics, complementors can proactively adjust their strategies to remain competitive within the evolving landscape of the DPE. This proactive approach ensures that complementors can contribute to and benefit from the generativity and scalability of the DPE, aligning their individual goals with the DPE's objectives.

Limitations

The study has several limitations. First, based on our focus on self-organization, we cannot explain all facets of soft power in DPEs. For example, although we show that using soft power as a DPE-wide culture correlates with more autonomous coalitions with a positive sentiment, it could also influence knowledge sharing within and across coalitions (Foerderer et al., 2019). Second, as our dataset is predominantly cross-sectional, we can only derive insights on correlation based on a cross-case analysis. Although we tried to mitigate this issue by comparing instances of coalition formation within and between cases, statements about causation are impossible. Third, although we chose soft power due to its bottom-up focus, other mechanisms on an interorganizational level, such as identity regulation (Alvesson & Willmott, 2002) or cultural control (Kunda, 1995) could have been contextualized.

Future Research

The integrated theory of top-down control and bottom-up self-organization in DPEs offers novel opportunities for future research on platform governance and DPE success. Our findings raise questions about how platform owners can combine different governance mechanisms to allow complementors to self-organize and evolve the DPE while preventing them from threatening the DPE's integrity. In this regard, the three interaction modes between top-down control and bottom-up self-organization might inspire future research on how platform owners can effectively configure top-down and bottom-up governance mechanisms. Related to this question is how complementor coalitions that are themselves self-assertive wholes consisting of autonomous parts interact, evolve, and govern their members.

Finally, different complementor coalitions are essential for the evolution of DPEs. Consequently, DPEs with more supported and self-organized coalitions (*ceteris paribus*) are expected to better succeed in scale and generativity. For example, the success of CR in the enterprise software business is likely related to a high number of autonomous complementor coalitions. However, these coalitions also have negative effects. For example, complementors could build integrations of their applications outside the DPE, thus benefiting from the platform but not contributing to the whole. Although we provide initial evidence for using soft power in DPEs to control bottom-up self-organization, more research is needed to explain how platform owners can use soft power and how it affects each of the three modes of interaction.

Conclusion

Complementor coalitions are an emergent phenomenon in DPEs, and they surface tensions between generativity and integrity such that platform owners must confront trade-offs when emphasizing one versus the other. These coalitions embody a pivotal force that boosts ecosystem competitiveness and adaptability if properly harnessed yet poses substantial risk to the DPE's integrity when unaccounted for. In recognition of this underexplored challenge, this research augments existing governance perspectives in three significant ways. First, it identifies three key pathways for complementor coalition formation (mandated, supported, and autonomous). Second, it articulates the primary tradeoffs that platform owners face when pursuing each of these pathways (compliance at the expense of generativity, on the one hand, versus autonomy at the expense of integrity, on the other). Third, it uncovers the utility of hard power (Chen et al., 2022a) and soft power (Nye, 1990) as a means to navigate these tensions and their associated trade-offs given the objectives of the platform owner. The result is an integrated theory that provides a foundation for researchers seeking to understand how platform owners and complementor coalitions are implicated in the enterprise of value creation for customers in DPEs. It offers clear guidance for practitioners on the circumstances in which mandated, supported, or autonomous complementor coalitions may be desirable and on how to intentionally foster their formation. The theory offers a new lens to conceive pathways for managing value creation and sustainability of DPEs in ways that benefit platform owners, complementors, and customers. As DPEs confront increasingly complex customer demands, platform owners will need to harness the collective capacities of complementors to sustain the health of the DPE, ensuring that they serve as a source of strength rather than a vulnerability and ultimately defining and safeguarding the DPE's competitiveness and resilience.

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Appendix A

List of Interview Partners

Table A1. List of Interview Partners				
#	Alias	Interviewee position	Act #	Length (min)
1	CR-PO.1	SVP Country Region	1	50
2	CR-PO.4	Manager Regional Partner Strategy	1	49
3	CR-PO.3	Senior Technical Partner Support	1	68
4	CR-PO.2	Manager Partner Enablement	1	60
5	CR-PO.5	Senior Partner Manager	3	38
6	CR-I.16	Director Business Development Region	1	41
7	CR-I.15	Managing Director & VP Region	1	38
8	CR-I.14	Vice President Commercialization	1 & 3	30
9	CR-I.13	Head of Alliances & Partners Region	1	29
10	CR-IC.3	Business Development Region	1	48
11	CR-I.12	Head of Global Partnerships	1	37
12	CR-I.11	Vice President Sales	1	25
13	CR-I.10	General Manager, International	1 & 3	31
14	CR-I.9	Alliances Manager Region	1	44
15	CR-I.8	Vice President, Region	1	35
16	CR-I.7	Chief Executive Officer	1	26
17	CR-I.6	Head of Platform A Solutions	1	28
18	CR-I.5	Head of Sales Region	1	41
19	CR-IC.2	President	1	58
20	CR-C.7	Chief Executive Officer, Owner	2	77
21	CR-C.9	Regional Market Lead	2	55
22	CR-C.10	Founder & Managing Director	3	56
23	CR-IC.4	Consultant Platform A	2	50
24	CR-C.8	Chief Executive Officer, Owner	2	34
25	CR-IC.5	Consultant Platform A	2	44
26	CR-C.2	Director Business Development	2	30
27	CR-IC.1	Chief Executive Officer	2	32
28	CR-C.5	Chief Executive Officer	2	45
29	CR-C3	Chief Technology Officer	2	50
30	CR-C.4	Global Alliance Manager	2	45
31	CR-C.1	Chief Executive Officer	2	47
32	CR-I.1	Chief Executive Officer	2	30
33	CR-I.2	Developer	2	35
34	CR-I.4	Chief Executive Officer	2	35
35	CR-I.3	Chief Executive Officer	2	80
36	CR-C.6	Chief Executive Officer	2	75
37	CR-IC.7	CR Practice Lead	2	56

38	CR-IC.6	Business Development Manager	2	53
39	EM-PO.1	Director Regional Partner Management	2	52
40	EM-PO.2	Account Executive Enterprise	2	34
41	EM-PO.3	Director Strategic Alliances	2	46
42	EM-PO.4	Account Executive Enterprise	2	55
43	EM-PO.5	Senior Partner Manager	2	51
44	EM-I.1	VP Sales	1	72
45	EM-IC.1	Chief Executive Officer, Owner	1 & 3	75
46	EM-IC.2	Managing Director	1	49
47	EM-I.2	Manager Strategic Partners	1	50
48	EM-IC.3	Director Sales	1 & 3	50
49	EM-C.3	Principal Consultant	1	45
50	EM-IC.4	Chief Executive Officer, Owner	2	55
51	EM-C.1	Head of Professional Services	2	47
52	EM-C.2	VP Business Unit Platform B	2	48
53	EM-IC.5	Chief Executive Officer Country	2	47
54	EM-IC.6	Chief Operating Officer	2	53
55	EM-IC.7	Chief Executive Officer	2	55
56	EM-IC.8	Practice Lead EM	3	52
57	EM-IC.9	Alliance Manager	3	42

Note: CR = CRMCo; EM = ESMCo; PO = Platform owner; I = Independent software vendor (ISV) partner; C = Consulting partner; IC = ISV and consulting partner

Appendix B

Interview Guidelines

Table B1. Interview Guidelines

Summary of interview guidelines in Act 1

Complementor Interviews

Complementor organization and role of interviewee

- Information about the company: membership; overview of products and services
- Interviewee position and role: Role concerning platform owner and ecosystem
- Adoption decision: Reasons for joining the DPE; alternative DPEs; decision

Complementor details

- Products and services: Offered products and services; customer groups
- Activities: Customer acquisition process
- Partnership status: Partner-level status; requirements for attaining the status

Relationship with the platform owner

- Criteria for offering applications on the marketplace
- Collaboration/help provided by platform owner...
 - ...in the app development process
 - ...in the marketing process (e.g., product placement in the marketplace)
 - ...with customer relationships/analysis
 - ...through exchange options (online communities, events)
- Guidelines for the promotion of apps for the marketplace on their own website
- Competition with the platform owner

Relationship with other complementors

- Value creation/collaboration through other ways than developing products

Platform Owner Interviews

Platform owner organization and role of interviewee

- Interviewee position and role

Partner management strategy

- Important contributions of the partners to the platform ecosystems
- Balancing interests, and resources between partners and platform owner
- Investments as support for partners to improve R&D and increase competition
- Tools and methods to assess the contribution, innovation, and partner values
- Relationship with partners
- Methods for supportive, cooperative partner management
- Customer success stories
- Tension due to competition with complementors
- Actions causing competitive environment
- Mitigating tensions
- Control mechanisms
- Frequent updates on the platform as a way to ensure the quality of complementary applications
- Exclusive agreements with specific partners

Growth strategy

- Growth targets
- Role of partners for platform's growth
- Implications for partner management
- Increase variety and diversity of partners

Summary of interview guidelines in Act 2 (changes only)
<p>Complementor Interviews</p> <p><i>Adoption decision and strategic aspects of partnership</i></p> <ul style="list-style-type: none"> ▪ Reasons for choosing the technology type of partnership ▪ Applications in the app marketplace and further services offered ▪ Partner level status <p><i>Ongoing engagement</i></p> <ul style="list-style-type: none"> ▪ Positive and negative influences on participation in platform ecosystems ▪ Success factors for current partnership ▪ Necessary resources provided by the platform ▪ Aspects that would enhance and deepen the partnership with a platform ▪ Possible reasons to end partnership with platform ▪ Relationship and collaboration with other complementors <p>Platform Owner Interviews</p> <p><i>Partner management strategy</i></p> <ul style="list-style-type: none"> ▪ Structure of partner system ▪ Impact of partners on the relationship between platform owner and customer <p><i>Collaboration among partners</i></p> <ul style="list-style-type: none"> ▪ Reasons for collaboration ▪ Partner ecosystem ▪ Role of personal relationships
Summary of interview guidelines in Act 3 (changes only)
<p>Complementor Interviews</p> <p><i>Relationship with the platform owner</i></p> <ul style="list-style-type: none"> ▪ Implications of partnership on the operative business ▪ Necessary resources provided by the platform ▪ Customer acquisition ▪ Customer relationship with the platform owner ▪ Role of complementor in customer care ▪ Aspects that would improve and deepen the partnership with a platform <p><i>Relationship with other complementors</i></p> <ul style="list-style-type: none"> ▪ Reasons for collaboration with other complementors ▪ Preferred partnerships ▪ Personal connection/relationship with other partners <p>Platform Owner Interviews</p> <p><i>Role of partners in the platform ecosystem</i></p> <ul style="list-style-type: none"> ▪ Importance <p><i>Collaboration among partners in the ecosystem</i></p> <ul style="list-style-type: none"> ▪ Events, partner networking, involvement of platform owner ▪ Implications of collaboration for platform owner, other complementors ▪ Preferred partnership constellations

Appendix C

Coding Scheme Following Gioia et al. (2023)

Table C1. Coding Structure			
Illustrative quotes with open codes underlined	Concepts (axial)	Final model (selective)	
CR and EM cross-case similarities: formation based on compliance and control			
<p>“We ... have <u>regular reviews</u> [with our mandated coalitions] where we discuss ... the strategy ... and <u>the alignment</u>” CR-PO.3</p> <p>“We do run <u>compliance</u> on our [mandated coalitions]” CR-PO.2</p> <p>“I need [partners] who <u>understand the [industry]</u> and have <u>access to the board members</u>.” EM-PO.3</p> <p>“... there is also a <u>responsibility for us</u> to make sure the promised <u>business values ... are delivered</u>.” EM-PO.3</p> <p>“And then bring [mandated coalitions] together and <u>create an in-depth understanding of where we want to go together</u>.” EM-PO.4</p>	<p>Formation trigger: Direct top-down control (DPE)</p>	Mandated interactions (absence of self-organization)	
CR and EM cross-case similarities: formation through compliance to control			
<p>“We show up together; we present together; we really <u>are a team to work on a pre-defined solution ...</u>” CR-I.5</p> <p>“So, they came to us ... because [we] are <u>so good at what [we] do</u>, [and asked] could we use you for more [projects]?” CR-I.8</p> <p>“We join [mandated coalitions] because otherwise, we can't do it alone, of course.” CR-IC.2</p> <p>“[EM] <u>regularly checks about the partnership</u>: ‘Is everything ok?’ ... If not, they <u>intervene</u> to protect their reputation” EM-IC.5</p>	<p>Formation response: Bottom-up compliance response</p>		
CR and EM cross-case similarities: high integrity and outcome control			
<p>“We are <u>making money</u> for both of our organizations and are ... <u>working very closely with [EM]</u>” CR-I.12</p> <p>CR cross-case differences: mainly used for strategically relevant projects</p> <p>“And ... the more <u>[strategically] relevant</u> the solution becomes, the more we invest into the [mandated coalition].” CR-PO.4</p> <p>EM cross-case differences: also used to address functional failures as a substitute for low self-organization</p> <p>“We [mandate interactions] to trigger partnerships that solve <u>[customer problems]</u> and increase <u>platform stickiness ...</u> [which is] important for cloud retention, where you have to keep the customers in the rental model.” EM-PO.5</p> <p>“ERMCo has very <u>limited capacities</u> to work on projects and <u>relies on [mandated coalitions]</u>” EM-C.2</p>	<p>Formation outcome: Bottom-up compliance</p>		
CR and EM cross-case similarities: formation based on the platform scaffolding designed by the platform owner			
<p>“We give them access to all our <u>events</u> like [CR event] and others where they can use the <u>exhibition space</u> to collaborate and meet customers” CR-PO.1</p> <p>“We identify partners by checking the <u>partner status ...</u>” EM-IC.5</p> <p>“We [also meet partners] at <u>beta programs or early adopters [program]</u>” EM-IC.6</p> <p>“We start searching partners through <u>[the app store]</u> and then engage in further <u>demos, lunch and learn sessions</u>” CR-I.5</p>	<p>Formation trigger: Top-down platform design</p>	Supported self-organization	
CR and EM cross-case similarities: formation through compliance to platform scaffolding			
<p>“<u>[Industry-specific events]</u> are] one of the most important, ... event because [they not only] <u>offer training</u> [but make you see] <u>all the experts on-site</u>.” EM-IC.7</p> <p>“[The coalition is] <u>API-triggered</u>, whereby CR offers <u>preconfigured connectors [that we use]</u>” CR-IC.1</p> <p>“... we had a very intensive opportunity to <u>discuss the combination of these partner offerings with customers or potential customers</u>. ... We did this in the construction sector [and] <u>got in touch</u> with [coalition member]” CR-I.16</p>	<p>Formation response: Bottom-up compliance response</p>		
CR and EM cross-case similarities: formation through autonomous use of the platform scaffolding			
<p>“One of the great things is that <u>there are so many events</u>. ... we look for customers; <u>we look for partners</u>. ... we <u>sell licenses</u>, we work with partners on implementation, and give <u>credit to CR</u> for the revenue that we generate CR-I.8</p> <p>“As far as <u>conferences</u> go, ESMCo just provides a <u>platform</u>, and we need to leverage it ourselves” EM-I.1</p> <p>“We [use] the [CR] platform [forums and app store] to <u>partner and generate new business opportunities</u>” CR-I.5</p>	<p>Formation response: Bottom-up autonomous response</p>		

<p>CR and EM cross-case similarities: impact on generativity, scalability, outcome control and governance costs</p> <p>"[Complementor coalitions] <u>increase the amount of innovation</u> ... to our customer significantly. And, of course, they are creating a much, much <u>better experience for our customers</u> by substantially <u>extending specific functionality</u> to our product. And that's great, you know, we are <u>much closer to our customers</u>, you can much better <u>fulfill the individual requirements</u> either from an industry or from a functional point of view." CR-PO.1</p> <p>"[coalitions help to] <u>pitch the platform on the platform</u>, and that they <u>help to close deals</u>." EM-PO.5</p>	<p>Formation outcome: Bottom-up balancing</p>	
<p>EM cross-case differences: *to avoid redundancy, we illustrate those in autonomous self-organized coalitions.</p> <p>CR and EM cross-case similarities: formation through internal and external ties</p> <p>"Often, we are <u>approached by smaller solution providers</u> that want to [form a coalition] to solve a specific problem" CR-IC.7</p> <p>"One person you <u>meet at an event</u>, another you are asked to <u>meet because there is a customer and they can't help him or don't have enough resources</u>. ... And at some point, this leads to - I would say - <u>preferred partnerships</u>." CR-IC.7</p> <p>CR cross-case differences: collaboration because it is best for the ecosystem</p> <p>"We [form autonomous coalitions] because [they] <u>work best for the customer</u>." CR-IC.7</p> <p>"[We form autonomous coalitions in an] <u>environment where everybody is kind of looking after each other</u>." CR-I.8</p> <p>EM cross-case differences: collaboration out of necessity</p> <p>"For some of those projects I need <u>additional resources</u> ... Because I cannot hire 50 people." EM-IC.8</p> <p>"Sometimes it is <u>necessary</u> to get involved in a project with a competitor because you <u>do not have the skills</u>." EM-IC.5</p>	<p>Formation trigger: Bottom-up self-organization</p>	
<p>CR and CN cross-case similarities: autonomous coalitions emerge outside traditional top-down control</p> <p>"Often, we <u>do not even notice</u> that those [coalitions form] and work with customers" EM-PO.4</p> <p>CR cross-case differences: impact of ecosystem-wide culture on the formation process</p> <p>"The relationship between many partners is very benevolent. ... There are quite some <u>people with whom we get along well</u>. We also <u>coordinate strategy, get information, exchange ideas</u>." CR-C.3</p> <p>"We have also done pro bono projects from the CR universe for a good cause. CR calls it [culture] that you <u>get involved, and our people think it is great</u>" CR-IC.1</p> <p>"It is part of the <u>culture to share knowledge, even with competitors, to work together on solving problems</u>" CR-C.4</p> <p>"Customer success is one of our five values. And when partners work together, they say: I know this! You know about that! And we work together ... because ... the customer trusts me and we want to <u>give them a positive experience</u>." CR-PO.5</p> <p>"At CR, everything is organized by ... a <u>system of values and metrics</u>. [The method defines] the vision, methods, obstacles, and measurements. We have introduced the method <u>throughout our company</u>." CR-C.3</p>	<p>Influence of formation trigger through soft power</p>	<p>Autonomous self-organization</p>
<p>CR and EM cross-case similarities: impact on generativity, scalability, outcome control, and governance costs</p> <p>"Those [coalitions] are often <u>faster</u> and we do not have the <u>resources</u> to do all those projects on our own." EM-PO.1</p> <p>"One developer <u>helping another developer</u> means that CR needs <u>fewer resources to answer questions</u>, and essentially, the more <u>self-help</u> partners can achieve, the <u>less handholding</u> we need." CR-PO.2</p> <p>"[Our partners] make it possible for us to <u>deliver a whole solution to compete</u> with SAP, Oracle or others." CR-I.10.</p> <p>CR cross-case differences: moderated by ecosystem-wide culture</p> <p>"It creates <u>excitement</u> and a <u>sense of belonging</u>. ... It is really helping people to <u>stay motivated</u>" CR-PO.2</p> <p>"We <u>collaborate, take care</u> of one another, <u>have fun</u> together, and work to leave the world a better place!" Archival Data#23</p> <p>We proactively work ... to <u>protect IP</u> our partners create. And ... <u>give</u> [them] as much <u>freedom</u> as possible. ... And then the partners do <u>share their IP</u> to other partners ... all the <u>trust</u> comes in, [as we] operate in this <u>culture of trust</u>" CR-PO.2</p> <p>"[We] always involve CR [in our events, even if they do not need to be there]" CR-I.9</p>	<p>Formation outcome: Positive effect on ecosystem evolution</p>	
<p>CR and EM cross-case similarities: impact on fragmentation of the ecosystem</p> <p>"Individual complementors lose importance compared to [complementor coalitions]" EM-IC.1</p> <p>"We also simply have the delivery power in our global network ..., we <u>can replace</u> that. ... we're more interested in <u>displacement</u>." EM-IC.9</p> <p>EM cross-case differences: moderated by ecosystem-wide culture</p> <p>"[The client is] not willing to invest [anonymized amount] for the platform," then [we, as a coalition <u>propose other</u>] <u>solutions outside EM</u>" EM-C.2</p> <p>"We do <u>not engage and partner</u> with a major competitor ... [we] <u>crowd them out</u>." EM-IC.8</p>	<p>Formation outcome: Negative effect on ecosystem evolution</p>	

Note: A detailed coding structure can be found in the transparency document: <https://osf.io/fvj7c>