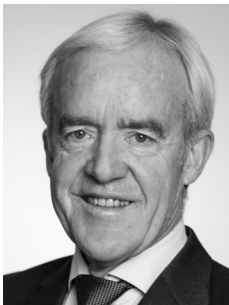

Navigating the Challenges of Ecosystem Emergence

A Multi-Level Review of Leader and Complementor Strategies



Joachim Stonig & Günter Müller-Stewens

Business ecosystems are currently transforming many established sectors. Understanding how ecosystems emerge and influence strategic outcomes is thus an important concern for academics and managers of incumbent firms alike. Ecosystems result from configuration processes where an ecosystem leader aligns multiple independent but complementary organizations to offer an integrated solution to meet a specific and often complex customer need. In this review, we analyze empirical research on the processes and outcomes of ecosystem emergence. We structure our findings along three analytical levels, highlighting the changes that ecosystems engender in competitive dynamics, the inter-organizational relationships, and the required internal organization of the participating firms. Ecosystem participants, leaders and complementors have to navigate the creation phase dynamically and then develop the strategic activities suited to their eventual role in the ecosystem.

Unternehmens-Ökosysteme transformieren derzeit viele etablierte Wirtschaftssektoren. Ein Verständnis für das Entstehen und die strategischen Auswirkungen von Unternehmens-Ökosystemen ist daher sowohl für Akademiker und Manager von grosser Bedeutung. Ökosysteme sind das Resultat eines Konfigurationsprozesses, bei dem ein Ökosystem-Leader unabhängige, aber komplementäre Organisationen zur Erbringung einer integrierten Lösung für ein spezifisches und komplexes Kundenbedürfnis ausrichtet. In diesem Review analysieren wir die empirische Forschung über die Prozesse und Auswirkungen von entstehenden Unternehmens-Ökosystemen. Wir strukturieren unsere Ergebnisse in drei analytische Ebenen und stellen dadurch die Veränderungen dar, die Ökosysteme in der Wettbewerbsdynamik, den Beziehungen zwischen Organisationen, und der adäquaten internen Organisation der Teilnehmer auslösen. Ökosystem-Teilnehmer, sowohl Leader als auch Komplementoren, müssen die Dynamiken der Entstehungsphase flexibel navigieren und dann strategische Aktivitäten, die auf ihre Rolle im Ökosystem spezialisiert sind, aufbauen.

ecosystem emergence, platform businesses, ecosystem orchestration, platform competition, disruption, literature review

Ökosystem-Entstehung, Plattform-Geschäftsmodelle, Ökosystem-Orchestrierung, Plattform-Wettbewerb, Disruption, Literatur-Review

1. Introduction

Would you rather buy DVDs or access to thousands of movies and series from any device? Would you rather buy a car or get from point A to B as fast and conveniently as possible, no matter the mode of transport? More and more customers choose the comprehensive and customized solutions of a platform ecosystem over the purchase of standalone products. As a result, many of the world's largest and most renowned companies now rely on such platform ecosystems for large parts of their business model. In fact, at the time of writing¹, seven of the world's ten largest companies in terms of stock market capitalization were ecosystem leaders, including famous names such as Apple, Amazon, and Facebook. What do these firms have in common? They all integrate and leverage the contributions of partners to offer a particularly comprehensive and complex value proposition towards their clients. This allows them to be very innovative, to grow extremely fast, all while maintaining a small asset base. However, not all of them are profitable, even after reaching a leading position in their sector. Hence, it is critical for managers to understand the creation and management of business ecosystems as part of their strategic toolbox. This knowledge is not only relevant in the software and high-tech sector, as one might presume given the introductory examples. Many traditional, asset-heavy sectors are on the verge of or amidst this transformation due to emerging business ecosystems. Therefore, understanding how ecosystems emerge and influence strategic outcomes is of great concern for managers of incumbent firms.

This review article aims to condense the insights of current empirical research on ecosystem emergence and distill its conclusions for both academics and managers. Research on ecosystem emergence to date has often drawn on conceptual arguments and anecdotal evidence. Alas, despite the relevance and popularity of the phenomenon, the empirically grounded academic knowledge about the emergence of business ecosystems remains relatively fragmented. Some conceptual work is beginning to consolidate the findings of extant research. *Jacobides et al.* (2018) have introduced complementarities as a mechanism for ecosystem emergence, and *McIntyre/Srinivasan* (2017) have surveyed the many research streams contributing to the phenomenon. We advance and complement their work with this review focused on the emergence phase, and on the challenges for ecosystem participants navigating this process. Looking at the early stages of an ecosystem's lifecycle, on the one hand, helps us to see more clearly what novel questions this phenomenon offers researchers. On the other hand, it will help strategy practitioners in the many industries not yet fully touched by ecosystems to think about implications and reaction strategies. Hence, the target audience for this article are academics who wish to gain an overview of the current state of research on ecosystem emergence, as well as managers looking for patterns and guidance to navigate this process.

We find that emerging ecosystems affect the competitive dynamics, inter-organizational relationships, and internal organization of the participating organizations. Managers and researchers have to address all these levels to gain a full understanding of ecosystems. Furthermore, the optimal strategic actions of participants vary with the lifecycle stage of the ecosystem. Initially, ecosystem participants have to navigate the dynamic ecosystem creation phase, and subsequently develop the strategic activities suited to fully profit from their eventual role in the growing ecosystem. Managers should be aware of the challenges

¹ July 31st, 2019.

and risks they face when tackling such a development process, and consider the levers and options available to them to shape this process.

2. Background

What exactly are business ecosystems? In a nutshell, business ecosystems help to integrate multiple complementary components (products or services), provided by independent organizations, to serve a specific and complex customer need. Such an integrated offer should have a superior value to the customer than the sum of its parts (Adner 2017, Jacobides et al. 2018, Kapoor/Agarwal 2017). The surplus value of an ecosystem can stem from integrating a large number of similar components in the offer, for instance, when more electrical charging stations increase the value of an electric car in a mobility ecosystem and vice versa. The value can also originate from combining a wide variety of different components with a high degree of customization, as in the example of Amazon Marketplace. In both cases, the ecosystem reduces the associated complexity for the customer to serve a specific need, *i.e.*, it makes consumption of the many components more convenient. Generally speaking, bringing together different organizations in an ecosystem exploits complementarities between their activities (Jacobides et al. 2018). Ecosystems do not always target the final customer, but also transform B2B sectors, for example in the domain of container logistics or automated production.

The participating organizations or members in an ecosystem fulfill different roles. First, there is usually a lead organization in an ecosystem. This *ecosystem leader* coordinates the interactions of the ecosystem members, in most cases aided by digital platform technologies (Adner 2017, Yoo et al. 2012). The role of ecosystem leadership can also originate from a consortium or an open standard, where examples such as Wikipedia or open-source operating systems come to mind. Second, a large number of organizations provide the individual components of the value proposition. These *complementors* not only bring the value of their components to the ecosystem, but also increase the overall value of the ecosystem with their aggregated presence and interactions. Third, *customers* of an ecosystem are not only passive absorbers of the offer, but fulfill a more nuanced role. Their presence increases the attractiveness of the ecosystem to complementors, and sometimes customers even act as complementors, for example by creating content or serving as interaction partners.

We provide a few prominent examples of ecosystems in table 1 to illustrate the different roles of the participants and the evolution of the ecosystem over time. We structure these examples along a classical lifecycle model (Levitt 1965, Van de Ven/Poole 1995), applied on the level of the ecosystem, from emergence (creation and initial growth) to maturity and decline (requiring radical transformation and/or extension of the ecosystem). In the focus of this review are the creation and growth phase.

Fulfilling client needs by using an ecosystem is an alternative to traditional modes of economic interaction, such as value chains or markets (Jacobides et al. 2018). However, unlike the value chain, which is a vertical integration mode, *ecosystems rely on horizontal interactions*. The complementors generally have a considerable degree of freedom in interacting with clients, and the ecosystem leader has little formal or legal authority like in a holding structure. This requires a partnership-focused approach to leadership, which is often a challenge for managers from traditionally hierarchical organizations. By drawing on the contributions from a multitude of independent organizations, a business ecosystem can provide customers with particularly complex, comprehensive, and customized value

propositions, whose scope and specificities are hard to reflect in one organization with a vertically integrated structure. We invite readers who are interested in more detail how ecosystems differs from other forms of organizing to consult the articles of *Adner* (2017) and *Kapoor* (2018).

The biological analogy of an “ecosystem” to designate such inter-organizational relationships has its origins in the interdependencies that exist between the organizations that participate in an ecosystem (*Iansiti/Levien* 2004, *Moore* 1993). The idea and aim is that every ecosystem participant profits, to a degree, from the success of the entire ecosystem, *i.e.*, the success of other participants. This is akin to biological species that both contribute to and benefit from the overall health of their surrounding ecosystem.

Example (original business)	Ecosystem participants	Creation of the ecosystem	Growth of the ecosystem	Transformation of the ecosystem
Apple (computer hardware)	Ecosystem leader: Apple with the iOS Complementors: app developers	Bring app developers and users on platform to address initial client need of com- munication	Add new devices (iPad, Apple Watch) and expand scope (e.g., with entertain- ment)	Possible transforma- tion with initiatives for Apple TV and Apple car
Amazon (online retail)	Ecosystem leader: Amazon platform Complementors: independent sellers	Expanding online book retail with inde- pendent vendors to- wards a convenient “everything store”	Grow breadth of of- fer rapidly by encour- aging sellers but also competing with them, increase customiza- tion with Amazon Prime offer	Entry into physical stores (bookstores, Whole Foods), spin- off ecosystems like Amazon Web Services
AirBnB (started as platform)	Ecosystem leader: AirBnB Complementors: apartment owners	Bring travelers and local hosts together on platform to pro- vide travel experi- ences	Expand geographic coverage, enter mar- ket for “experiences”	<i>none (yet)</i>
Netflix (VHS/ DVD rental)	Ecosystem leader: Netflix Complementors: movie studios	Serve client need for entertainment by bringing movies from multiple studios on a platform	Expand range of of- fers geographically and content	Entry into the produc- tion of movies and series
Spotify (started as platform)	Ecosystem leader: Spotify Complementors: artists and music labels	Bring artists and mu- sic fans together in a creative community	Expand music cata- logue, diversify con- tent and geographic scope	<i>none (yet)</i>
Daimler/ BMW (car manu- facturing)	Ecosystem leader: ReachNow (former Moovel) Complementors: mobility providers and services (like parking, charging)	Provide mobility for clients by bringing multiple transport options and auxiliary services on a conven- ient app	Close collaboration between Daimler and BMW in the domain of mobility ecosys- tems to share costs and expand rapidly	<i>none (yet)</i>

Table 1: Selected examples of business ecosystems and their development.

In the scientific discussion on business ecosystems, multiple disciplines have made contributions to understand the phenomenon (McIntyre/Srinivasan 2017). Strategic management (Adner 2017, Jacobides *et al.* 2018), innovation and technology management (Autio/Thomas 2015, Baldwin/Woodard 2009, Gawer 2014), as well as economics of multi-sided markets (Rochet/Tirole 2006). As already mentioned, this article focuses on empirical studies that address the topic of ecosystem emergence from a strategic angle.

3. Methodology of the review

To identify the core literature on the topic of ecosystem emergence, we have broadly followed the methodology proposed by Provan *et al.* (2007) and applied by Wassmer (2010). We first conducted a search for the terms “ecosystem*” or “platform*” in the ISI Web of Knowledge database. To reduce complexity, the search was initially limited to the highest ranked academic journals in the management and economics field.² In addition, the main practice-oriented journals were included.³ We studied the entire available timeframe for these journals, in general available since their establishment. This search yielded a rather large number of 450 results.

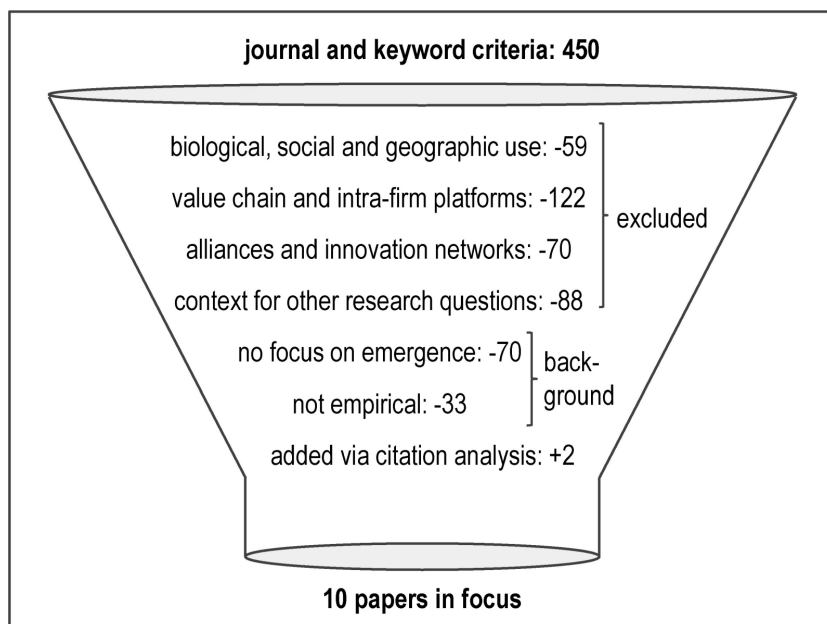


Figure 1: Methodological funnel to identify the relevant ecosystem emergence papers

2 I.e., Strategic Management Journal, Organization Science, Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Journal of Management, Organization Studies, Journal of Management Studies, Strategic Organization, Management Science Research Policy, Strategic Entrepreneurship Journal, Long Range Planning, American Economic Review, and RAND Journal of Economics.

3 I.e., Harvard Business Review, California Management Review, and MIT Sloan Management Review.

Authors (Year): Title	Journal	Setting	Type of emergence	Method	Ecosystem outcome	Level of ana- lysis	Research question	Main results
<i>Dattée, Alexy & Autio (2018):</i> Man- euvering in Poor Visibility: How Firms Play the Ecosystem Game when Uncertainty is High	Academy of Man- agement Journal	Technology- based mul- tination- al firms	De novo ecosystem	Multiple case study with 4 firms	Creation of ecosystems that are technologi- cal enablers	Inter-organ- izational relations	How does an ecosystem champi- on compel others to commit to a de novo ecosystem cre- ation effort in a sit- uation where uncer- tainty is high?	Ecosystem creation for gen- erative technologies is driv- en by coupled feedback loops that create a reso- nance dynamic between in- ternal and external re- source commitments, lead- ers have to exercise dynam- ic control over the process
<i>Gawer & Phillips (2013):</i> Institu- tional Work as Logics Shift: The Case of Intel's Transformation to Platform Leader	Organiza- tion Stud- ies	Computer mi- croprocessors	Industry transformation	Single case study	Transformation of in- cumbent to ecosystem leader	Internal or- ganization	What kinds of insti- tutional work do organizations per- form as they at- tempt to influence the institutional logic that character- izes their field?	Intel's ecosystem creation was driven by four forms of institutional work: exter- nal practice work and legit- imacy work, as well as in- ternal practice work and identity work, ultimately leading to a change in sec- tor logic from supply chain to ecosystem
<i>Sniebur, Thomas & Burgelman (2018):</i> An Ecosystem- Level Process Model of Business Model Disruption: The Disruptor's Gambit	Journal of Man- agement Studies	Enterprise software	Industry transformation	Single case study with two embed- ded cases	Disruption of incum- bent by ecosystem entrant	Sector and industry	How does a disrupt- ive business model innovator align framing and adap- tation of its busi- ness model over the disruption process?	Through effective framing early on, the entrant influ- enced ecosystem evolution from incumbent-centered to disruptor-centered, adapting to ecosystem dy- namics better than the in- cumbent

Authors (Year): Title	Journal	Setting	Type of emergence	Method	Ecosystem outcome	Level of ana- lysis	Research question	Main results
<i>Ansari, Garud & Kumaraswamy</i> (2016): The disruptor's dilemma: TiVo and the U.S. television ecosystem	Strategic Management Journal	U.S. television sector	Industry transformation	Single case study	Disrupted television ecosystem by entrant	Inter-organizational relations	What are the challenges that a start-up entrant confronts in introducing a disruptive innovation into an ecosystem, and how does it address them?	Three cooperative tensions arise during ecosystem change: intertemporal, dyadic, and multilateral. The disruptor continually adjusts its strategy to address these cooperative tensions, and accommodates incumbents in later stages
<i>Cozzolino, Verona & Rothaermel</i> (2018): Unpacking the Disruption Process: New Technology, Business Models, and Incumbent Adaptation	Journal of Management Studies	Italian media sector	Industry transformation	Single case study	Disrupted ecosystem by digital technologies	Internal organization	What are the triggers that stimulate incumbents' reactions after disruption? How does the process unfold, and how does business model adaptation evolve over time?	Distinguish the advent of a disruptive technology and the entry of disruptive business models as two temporal phases, incumbents seize opportunities with stand-alone adaptation first and then counter the competitive threat with alliances and acquisitions
<i>Garud, Jain & Kumaraswamy</i> (2002): Orchestrating institutional processes for technology sponsorship: The case of Sun Microsystems and Java	Academy of Management Journal	Software sector	New ecosystem stand-ard	Single case study	Initial success and subsequent struggles	Inter-organizational relations	What challenges does an individual firm face in sponsoring its own technology as a common standard within network technological fields?	An ecosystem sponsor faces coopetitional challenges to mobilize participants and maintain the standard, in particular regarding the legitimacy as a rule creator and enforcer, hence it has to deploy a combination of social and political skills

Authors (Year): Title	Journal	Setting	Type of emergence	Method	Ecosystem outcome	Level of ana- lysis	Research question	Main results
<i>Hannah & Eisenhardt</i> (2019): How firms navigate cooperation and competition in nascent ecosystems	Strategic Management Journal	Solar industry	Nascent ecosystem	Multiple case study with 5 firms	Competition between ecosystem firms	Sector and industry	How do firms successfully balance competition and cooperation over time in ecosystems?	Identify three ecosystem strategies (bottleneck, component, and system) with different degrees of cooperation and competition, highlight the role of technological bottlenecks and their evolution over time
<i>Ozcan & Santos</i> (2015): The market that never was: Turf wars and failed alliances in mobile payments	Strategic Management Journal	Mobile banking	New ecosystem stand-ard	Case study with multiple country foci	Failure of ecosystem emergence	Inter-organizational relations	How do prominent firms from distinct industries jointly attempt to define the architecture for a global nascent market?	Powerful players from different industries have difficulty in reaching agreement on the new market's architecture due to their history of dominance in their respective industries
<i>Ozcan & Eisenhardt</i> (2009): Origin of Portfolios: Entrepreneurs, Network Strategies, and Firm Performance	Academy of Management Journal	Wireless gaming industry	Nascent ecosystem	Multiple case study with 6 firms	Creation of ecosystem-like alliance portfolios	Inter-organizational relations	How do firms originate high performing portfolios?	Entrepreneurs need to visualize their portfolios in the context of the entire industry as opposed to a series of single ties and simultaneously form ties with multiple partners, highlight opportunity of strategic action to shape industry.
<i>Jacobides & Tae</i> (2015): Kingpins, Bottlenecks, and Value Dynamics Along a Sector	Organization Science	Computer sector	Emergence of ecosystem leaders	Hypothesis testing	Evolution of value in the computer ecosystem	Sector and industry	How is value distributed between different segments in a sector, and how does this value distribution change over time?	Ecosystem "kingpins" help a segment become a bottleneck in the sector and capture more value (also for rivaling players in the segment), but capture a high share of that value (more inequality in the segment)

Table 2: Overview of empirical studies on ecosystem emergence in renowned academic journals

We scanned this sample by reading the abstract of the papers, or the whole article if the abstract was inconclusive, in order to exclude articles that were irrelevant to the phenomenon of ecosystems (see figure 1). We removed, in particular, articles from the sample that focus on ecosystems in the sense of biological space, excluded papers that analyze intra-firm platforms or intra-firm ecosystems as well as traditional alliances or innovation networks, and eliminated papers where platform ecosystems were used as a context to study other questions (e.g., online branding). The remaining sample was further restricted to exclude papers focusing on mature platform ecosystems and conceptual and practitioner papers. This larger sample, however, serves as a background that informs the entire review. We extended the core sample of empirical papers on ecosystem emergence by looking at the reference sections to discover papers that were omitted by the keyword search focused on the top journals, but still are frequently and importantly cited as belonging to ecosystems research. If relevant, we also included books and book chapters by authors active in the ecosystem domain. Our final sample yielded a selection of ten empirical articles on ecosystem emergence in the highest-ranking journals, presented in table 2.

4. Processes and outcomes of ecosystem emergence

In order to describe the influence of emerging ecosystems, we distinguish between the following three levels of analysis: (1) The impact of ecosystems, at the level of the *sector and industry*, changes the *competitive dynamics* between firms. (2) In addition, ecosystems alter the structure and nature of *inter-organizational relationships* between the participating organizations, and (3) have implications on the optimal *internal organization* of most of the single participants to succeed, depending on their role in the emerging ecosystem. All three levels are interlinked. We will structure our analysis of extant ecosystem research along these three levels. Most studies focus on one of these levels, but often offer some insights that span multiple levels.

We further observed that emerging ecosystems differ between their *creation phase*, where an ecosystem leader works to align multiple participants around a value proposition, and a *growth phase*. In this later stage, the basic structure and rules of the ecosystem have been agreed upon, and competitive aspects become more relevant. Other stages of an ecosystem's lifecycle, like transformation or decline, were excluded in this review that focuses on ecosystem emergence.

4.1 Changing Industry Structure and Competitive Landscape

An ecosystem often spans traditional industry boundaries, as components from different industries converge to provide the value proposition (Yoo *et al.* 2012). For incumbent firms, this means new players enter the competitive space, and new rivals appear outside the original industry boundaries. As one example, many machine manufacturers now compete with software automation firms to capture the value of a production system. Hence, when an ecosystem emerges in an established sector, the distribution of the profits shifts, often away from traditionally privileged players. New entrants can take control of the profit pool in a sector and incumbents can be “degraded” to suppliers of components, dependent on the goodwill of the ecosystem leader.

One reason for the value shifts is the recombination of previously isolated products and services in an ecosystem. Of the many components that constitute an ecosystem, some are

more critical for the functioning of an ecosystem and constrain performance improvements. These components, called “*bottlenecks*”, appropriate a large share of the ecosystem’s value. In a nascent ecosystem, the bottleneck component can shift with the arising technological and commercial challenges of the value proposition. *Hannah/Eisenhardt* (2018) observed that in the solar power sector, the bottleneck shifted from finance, to selling, and eventually to installation. Firms positioned in these bottlenecks were particularly successful, while other component suppliers struggled and lost control of their business sector.

However, the shifts in value are not only due to changes in the bottleneck components that occur when certain technological or organizational activities become more valuable in the ecosystem. More importantly, the ecosystem leader often controls the interactions with the customer, and hence has an outsize influence on their behavior, the success of other ecosystem members, and the ability to capture value. The leader has an interest in keeping customers in his ecosystem as long as possible, which leads it to improve its offer continuously, as customer retention is extremely important in such a scale-driven business model. For example, TiVo created a TV entertainment system that mediated the interactions of viewers with different TV stations, and thus controlled the access to the customer and the associated ad revenue (*Ansari et al.* 2016).

Because of their control over ecosystem clients and their influence on how the ecosystem is structured, firms acting as ecosystem leaders capture a large share of the value of the ecosystem. At the same time, they raise the value creation for all ecosystem members, because of their coordinating role that makes the ecosystem attractive to clients (*Jacobides/Tae* 2015). For firms participating in an ecosystem as complementors, however, the presence of an ecosystem leader is a double-edged sword. Amazon, for instance, has been shown to attack complementors who become too successful by entering their product category in-house (*Zhu/Liu* 2016). Uber drivers, while benefitting from the possibility of gaining additional revenue as a driver, are dependent on the fare conditions of the platform. And in such an asset-light business model, the drivers bear the investment risk of their vehicles.

Proposition 1a: *Emerging ecosystems lead to shifts in the distribution of a sector’s profit pool and make the borders of the sector’s competitive landscape more permeable.*

As soon as a viable ecosystem has been created in a sector, an additional level of competition arises alongside competition between individual companies: the *competition between ecosystems*. Questions such as the following must be answered: Which ecosystem has the most attractive value proposition for customers? Which creates more net surplus value for participating organizations? These issues bring the topic of corporate strategy to mind, where not only individual business units, but also portfolios of businesses compete.

A classic example is the computer industry, where multiple members of a platform ecosystem, like Windows and Intel, compete against other technological systems (*Bresnahan/Greenstein* 1999). Network effects are an important driver of this type of competition (*Rochet/Tirole* 2006). Network effects are defined as feedback loops that lead to externalities between the participants (*Katz/Shapiro* 1994). Such feedback loops, for instance, occur when the presence of more users leads to the presence of more application developers, and vice versa. A consequence of these network effects is that, once established, ecosystems can dominate despite the presence of better, more innovative systems, because net-

work effects create consumer inertia (Farrell/Saloner 1986). It is not surprising that this tendency leads to “battles” between the lead firms who push their platform ecosystems to become dominant, like between Sun and Microsoft (Garud *et al.* 2002).

However, not every ecosystem will follow a winner-takes-all logic, for example when ecosystems are differentiated by offering significantly better quality or complement variety (Cennamo/Santalo 2013). Moreover, even if an ecosystem is a “winner” (*i.e.*, market leader), it does not mean that it is successful and profitable. For instance, the question regarding the sustainability of Uber's business model remains, because the company is still far from being profitable. The same question applies to the car sharing companies that the car manufacturers have built up as a response to Uber. Some of them are currently joining forces to become more profitable through the use of synergies.

Ecosystems can also run the risk of being subsumed in a more comprehensive ecosystem that starts to control the client. In such a case, a challenger with a leadership position in an adjacent platform market leverages the potentially overlapping user bases to integrate the functionalities of a competitor into its own platform (Eisenmann *et al.* 2011). Imagine, for instance, the impact of a potential merger between Booking.com and Airbnb on the competition in the tourism industry.

Proposition 1b: *The emergence of ecosystems gives rise to an additional level of competition where the ecosystem with the highest surplus value has a competitive advantage.*

4.2 Establishing and Managing Inter-Firm Relations of Multiple Partners

Ecosystems require multiple firms to cooperate and coordinate around a shared value proposition. Given that not all ecosystem members profit equally, why can ecosystems emerge in the first place? Ecosystems require active adaptations by participating firms to align their activities, which needs to build on a common understanding of how to interact. Such a common understanding can exist as an implicit shared cognitive frame, or can be expressed in a formal contract, technological interface, or terms of trade. Multiple ecosystem studies have used the concept of a *common cognitive frame* to explain how the inter-organizational relationships in an ecosystem are established and why participants adapt to the contractual and technological standards set by the ecosystem leader. To establish such a common frame, an aspiring ecosystem leader can face different challenges depending on whether the reason for ecosystem creation originates from a customer-centric vision or a technological development.

First, the aspiring leader can already have a clear vision of the value proposition of the future ecosystem, but needs clients and complementors (app developers, component suppliers, etc.) to adopt and share this vision. Ansari *et al.* (2016) studied a case where a start-up firm, TiVo, convinced incumbent firms, which initially did not want to participate, to join its ecosystem. TiVo maneuvered the co-opetitive tensions with incumbents by providing a vision of future benefits, building a critical mass of consumers, and playing off multiple incumbents against each other. In such a deductive approach that starts from an ecosystem value proposition, once a critical mass of users and complementors has adopted an ecosystem, the momentum is strong and hard to reverse. Snihur *et al.* (2018) observe this effect in the enterprise software industry, where the entrant Salesforce replaced a vertically integrated incumbent. By communicating the benefits for clients and the disruptive

nature of its ecosystem, and subsequently adjusting to their reactions, Salesforce created a virtuous cycle of adoption of its ecosystem.

Second, in other cases, the basis of the ecosystem is a new, generative technology from the leader that has many potential applications (Yoo *et al.* 2012), such as a mobile phone standard or server systems. The challenge for an ecosystem leader in such a more inductive approach is to convince firms to collaborate in the development of this ecosystem technology, while not yet knowing in detail the final value proposition and structure of the ecosystem. Dattée *et al.* (2018) analyzed how four firms created a positive dynamic despite the uncertainty associated with generative technologies. They found that aspiring ecosystem leaders have to manage feedback loops, first between technology and a slowly upcoming future vision, to narrow the range of options. Once the clarity increases, it is critical for leaders to remain in control of the ecosystem as more clients and complementors join.

As we have seen, the selection of partners as well as the constantly changing structure of the inter-organizational relationships between them is decisive for the success of ecosystem creation. Furthermore, Ozcan/Eisenhardt (2009) point to the potential for influencing the industry architecture through the strategic formation of ties between previously unconnected network members, in particular in the context of industry uncertainties.

Proposition 2a: *Ecosystem creation requires (re-)aligning inter-firm relationships around a shared value proposition.*

Once the basis of the inter-organizational ecosystem relations has been established, managers of an ecosystem leader have to cope with the permanent struggle about value appropriation between the participants. For example, despite their complementary nature and strong interdependent value creation, Microsoft and Intel have been shown to engage in a range of conflicts regarding strategic alignment and value capture (Casadesus-Masanell/Yoffie 2007). This phenomenon is commonly referred to as “*co-opetition*” – a combination of cooperation and competition. Cooperation is necessary for the ecosystem to provide innovations and attractive offers to clients, but at the same time, the ecosystem members fight over the value created for clients.

One of the key competitive levers for ecosystem participants is managing the competitive intensity in an ecosystem. On the one hand, the ecosystem leader tries to lower this intensity, to capture value from its central position. Complementors or rivaling ecosystems, on the other hand, work towards increasing the intensity to shift value their way. Complementor tactics to increase this competitive intensity include circumvention of the platform and multi-homing (Zhu/Iansiti 2019). In addition, powerful incumbents can sometimes prevent the emergence of an ecosystem by refusing to cooperate (Ozcan/Santos 2015).

To prevent a harmful degree of competition and conflict, the effective management of the relationships of multiple ecosystem members by a leading organization is required to coordinate activities in an ecosystem successfully. This process is called *ecosystem orchestration*, defined as the “set of deliberate, purposeful actions undertaken by the hub firm as it seeks to create value [...] and extract value [...] from the network” (Dhanaraj/Parkhe 2006: 659). The collaboration with multiple partners in an ecosystem is fundamentally different from managing a number of “one-on-one” relationships (Davis 2016). In each

phase of the emergence process, different challenges and tasks have to be managed in the changing network of partners.

For example, as soon as the number of participants rises, however, an ecosystem leader can reduce the challenges of collaborating with many partners at the same time by creating modular interfaces around digital platforms (Jacobides et al. 2018). Modularity achieved through shared interfaces, defined and controlled by the ecosystem leader, allows leverage of the contributions of a large pool of external capabilities and resources in the ecosystem (Gawer 2014). The leader of the platform ecosystem takes a core role, while many peripheral members follow the rules and standards set by the platform owner (Baldwin/Woodard 2009).

Orchestrating an ecosystem, however, is not only a technological challenge. Leading organizations play very different roles than peripheral members in an ecosystem and they have different options to play their orchestrating role. They can, for example, function as an integrator of the network members' contributions or as a platform leader that provides an infrastructure that can be leveraged by the members (Nambisan/Sawhney 2011).

For orchestrating firms, knowledge mobility, innovation appropriability, and network stability become central because these processes allow control of the innovative output of the ecosystem in the absence of formal hierarchy (Dhanaraj/Parkhe 2006). These orchestration practices were also confirmed by the case studies of Nambisan/Sawhney (2011), who identify modularity, network openness, and network embeddedness as options to shape the innovation ecosystem. Leading firms can thus significantly impact the evolution of their complementors in the ecosystem. Their strategic decisions to change fundamental network characteristics can lead to shakeouts among complementor organizations (Pierce 2009). However, there might be no "one" adequate governance for an ecosystem, instead a continually evolving set of practices that address simultaneous tensions with multiple partners is required (Wareham et al. 2014).

Proposition 2b: *An ecosystem leader has to take on the orchestrating role to balance the co-opetitive tensions between value creation and appropriation in the ecosystem.*

4.3 Organizing for Success in an Ecosystem Environment

Firms that successfully navigate the two levels of the changing competitive landscape and the inter-organizational relationships during ecosystem emergence display a number of common characteristics. First, *flexibility is key* to adjust to the changes in an emerging ecosystem. This flexibility concerns, first and foremost, the capacity to be responsive and open-minded on what is going on around the ecosystem. But it also includes the ability to quickly build the capabilities and resources of a bottleneck component (Hannah/Eisenhardt 2018) or the agility to adjust the ecosystem strategy to market feedback and changing customer preferences to facilitate the acceptance of the value proposition by customers (Ansari et al. 2016).

Second, *proactivity rather than adaptation* helps to control the dynamic feedback loops during ecosystem emergence. For example, through early and proactive framing of the ecosystem vision, an ecosystem leader can influence the sector structure in their favor (Snihur et al. 2018). Simply being reactive runs the risk of making myopic decisions that ultimately lead to a shift of value away from an incumbent (Jacobides et al. 2015).

Cozzolino *et al.* (2018) found that an incumbent media company modified its business model to cope with ecosystem challenges over two phases. First, it experimented internally with ecosystem technologies to seize market opportunities. With the entry of rivals with ecosystem business models, the incumbent shifted to respond to these threats and used acquisitions and alliances to foster its ecosystems.

But flexibility and proactiveness of ecosystem partners cannot be taken for granted because of *organizational inertia*. For example, Ozcan/Santos (2015) found that incumbents have a hard time overcoming their history of closed, internally-focused attention, to start collaborating with outside firms on a horizontal, eye-to-eye basis, as is required in an ecosystem.

Proposition 3a: *Successful firms have to be flexible and proactive throughout ecosystem creation, so as to shape the ecosystem and reach an attractive position.*

Once the ecosystem roles and structure start to stabilize, participant organizations have to develop competencies that are suited to and foster their role and position in the ecosystem. For example, an ecosystem leader has to balance its role as an orchestrator focused on the success of the entire ecosystem with the desire to optimize its own value appropriation. To this end, it has to adapt its own organization to the (new) role and position it strives for in the system. For example, to establish its position as an ecosystem leader, Intel had to transform both its internal identity and external legitimacy (Gawer/Phillips 2013). Internally, Intel's identity had to shift towards a new role in the sector as an ecosystem enabler rather than a product firm, creating a mindset of sharing and collaborating with partners. Externally, Intel had to build trust and legitimacy with these partners to credibly make the case that the new roles in the ecosystem are beneficial to everybody. The challenge of an ecosystem leader is always a tightrope walk between value appropriation and distributing benefits to partners. It is a continuous process of (re-)balancing. This requires great social and political skills to navigate, for example, the openness or closeness of the ecosystem (Garud *et al.* 2002).

Much less is known about how system complementors should approach their role in an ecosystem. The production of “hit” complements that are rare but highly relevant or interesting for clients is one approach to benefit from an ecosystem (Zhu/Iansiti 2019). These “hits” can be a particularly attractive video game, or a valued brand such as “Intel Inside”.

Proposition 3b: *Participant organizations in an ecosystem need to align their internal organization to fulfill and profit from their role in the ecosystem.*

Although the number of available studies on the emergence of ecosystems is still quite limited, they show that, on the one hand, ecosystems are a phenomenon of increasing relevance and, on the other hand, display effects that require new strategic thinking and tools of both managers and academics in order to make successful decisions and recommendations.

5. Implications for managers: Ecosystems are a new level of strategic action

The emergence of ecosystems highlights the strategic imperative for managers to assess whether their firm's strategy focuses on a customer need or on the improvement of an iso-

lated product. Ecosystem strategies are a particularly powerful tool to move closer to the customer with comprehensive solutions even for companies far upstream of the end customer in terms of the value chain. An incumbent that does not explore possibilities to develop or to contribute to complex, collaborative value propositions with the help of ecosystems risks the entry of ecosystem firms that start to control the clients' profit pool.

If one takes the perspective of an ecosystem leader, the propositions derived from this review call on managers to address all three levels of analysis strategically. Ecosystems lead to considerable disruptions of the competitive landscape in more and more industries, so that managers should take these propositions into account when developing ecosystem strategies or reviewing their current strategy.

An aspiring ecosystem leader needs to position the ecosystem in a changing landscape vis-à-vis competing ecosystems, align complementors around the shared value proposition,

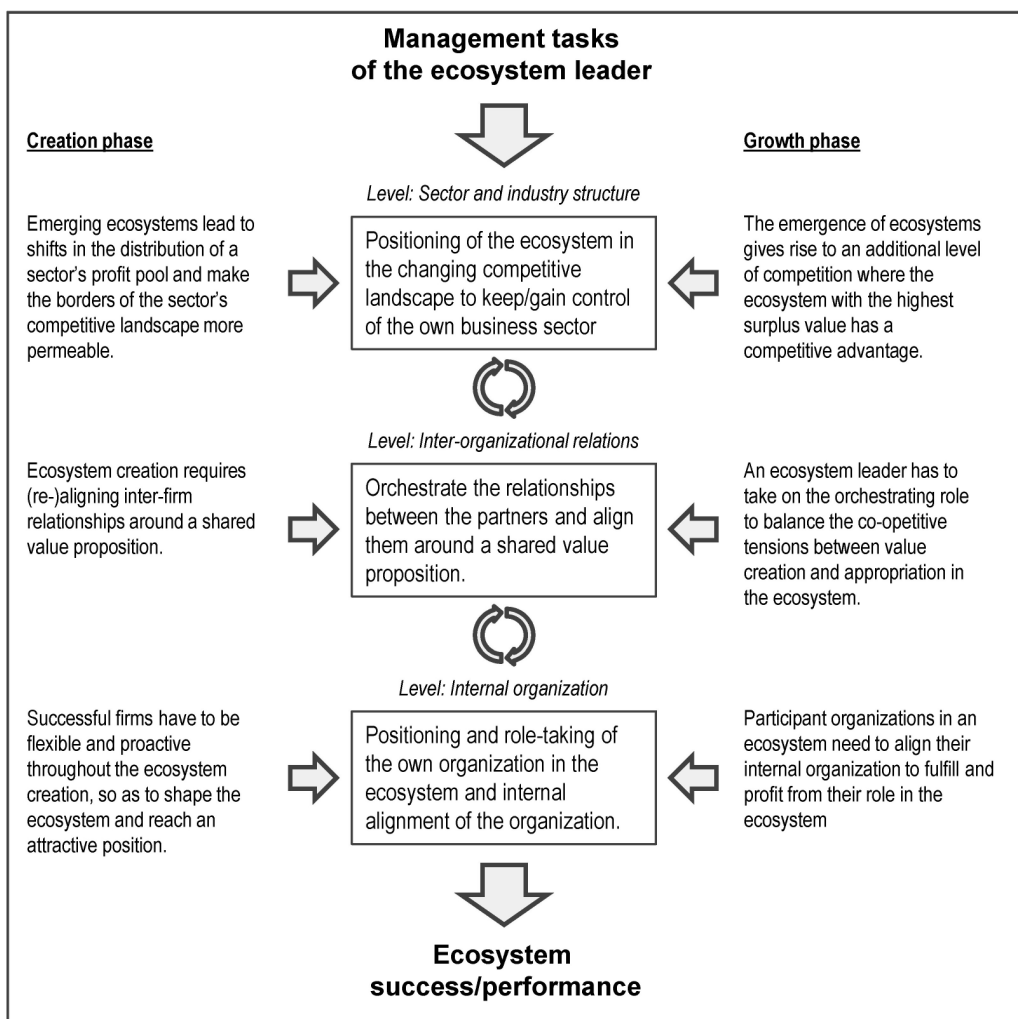


Figure 2: Observations on emerging ecosystems in their creation and growth phase and managerial implications.

and develop the required internal capabilities as an orchestrator. How to achieve these objectives depends on the phase of ecosystem development. In the early phase of ecosystem creation, our review highlights the critical task of shaping the discourse in the sector actively, in order to build consensus with clients and complementors around a new value proposition. For incumbents, moving reluctantly, underestimating the disruptive potential of ecosystems, or under-communicating externally, increases the risk of being outmaneuvered by entrants or competitors that convince clients and stakeholders of a new and potentially disruptive ecosystem vision.

For an ecosystem strategy to succeed after the initial creation phase, an aspiring leader has to build the required activities, capabilities and resources. Prime among these is the ability to collaborate with partners and open parts of the originally internal business activities. Furthermore, moving ahead under uncertainty and adjusting flexibly to market feedback are important skills to build. Often, firms separate these ecosystem activities from their historical core business in order to speed up this change process. However, incumbents should not neglect the possibility of transforming the product as part of an ecosystem and integrate the ecosystem with the product business (Müller-Stewens/Stonig 2019).

During the creation phase, complementors can try to block unfavorable ecosystem initiatives of rivals and entrants, and support selected ecosystems that reinforce their own product position. Myopic decision-making is a risk for complementors who affiliate to ecosystems without considering the long-term consequences for the sectoral structure and value distribution. When ecosystems have emerged and grow, complementors need to increase the competitive intensity inside in the ecosystem (e.g., through platform circumvention or multi-homing) to appropriate a higher share of the ecosystem value. They also need to develop resources and capabilities that are reinforced by the ecosystem (for example “hit” products or low-cost products).

Table 3 summarizes the major strategic options for leaders and complementors in the main phases of ecosystem emergence that we observed in this review.

	Creation phase	Growth phase
Ecosystem leader	- Shaping ecosystem structure proactively via internal and external communication - Reacting flexibly to emerging issues and adjusting ecosystem strategy - Recruiting critical partners and clients in sufficient quantity and quality	- Adapting ecosystem to changing client needs - Positioning ecosystem versus rival ecosystems, incl. managing its scope - Managing co-opetition with complementors via commercial and technological standards - Ensuring value capture through dynamic control of bottlenecks
Complementor	- Shifting strategy to ecosystem leadership - Blocking ecosystem initiatives of rivals and entrants - Supporting selected ecosystems that reinforce product position	- Increasing competitive intensity inside in the ecosystem (circumventing, multi-homing) - Developing resources/capabilities reinforced by the ecosystem (hits, low-cost position...)

Table 3: Strategic options for leader and complementor organizations during ecosystem emergence.

6. Implications for researchers

Many facets of ecosystem emergence require further research to solidify and nuance the observations in this review. An ecosystem is a new unit of analysis that can be scientifically studied in many disciplines and from a number of theoretical perspectives. We would like to highlight some selected facets of ecosystem emergence that offer particularly fruitful avenues for research.

We have seen a community of researchers emerge around ecosystems, with a number of theoretical concepts that begin to gain traction in the scientific discourse. These include a definition of roles of the players in an ecosystem, namely ecosystem leaders, complementors and clients. Furthermore, the necessity to orchestrate a modular system to exploit complementarities has become a central idea of ecosystem research. Building on these common concepts, ecosystem research can now begin to extend the body of theoretical concepts and explore the specificities of different ecosystem contexts.

One concept that requires further study is the idea of an ecosystem surplus, *i.e.*, how an ecosystem creates value in excess of the sum of its parts. In this area, research on ecosystems could benefit from analogies to research on corporate-level strategy, because in both cases it is a question of whether the whole is worth more than the sum of its parts. Somewhat similar to a corporate headquarter, an ecosystem leader has to create value for the participants with its orchestration activities. What influences surplus generation and appropriation by leaders, complementors or clients?

In relation to this, further research could analyze what is necessary from a social perspective in order to achieve fruitful collaboration of players in an ecosystem. It can be asked, for example, how “social capital” (*Bilhuber Galli/Müller-Stewens* 2012) is built up in an ecosystem.

A further concept with intriguing research possibilities are the interdependencies of ecosystem participants and their “shared fate”. The initial use of the ecosystem analogy (*Moore* 1993) set out to highlight the interdependence and mutual success of participants. Exploring how the ecosystem concept offers fitting analogies to such biological concepts might be a fruitful way to advance research, albeit with a great degree of mindfulness to account for the differences between economic and biological systems. Questions around ecosystem interdependence include how the practices of successful ecosystem leaders balance collaboration and competition with and between other participants?

Furthermore, the contextual differences between ecosystem lifecycle phases and analytical levels, as outlined in this review, require further exploration. It would be interesting to explore interactions across the three analytical levels highlighted in this article. For instance, what is the influence of intra-firm organization on the ability to create and manage ecosystem relations? Extant studies often focus on one level only, and for example, assume full internal flexibility when studying competitive strategies (*Hannah/Eisenhardt* 2018). What activities and competencies are required for organizations to succeed in the different ecosystem roles? How do intra-firm characteristics influence ecosystem outcomes?

The lifecycle phases, from creation, to growth, to eventual maturity and change are worthy of more detailed study. For example, under what circumstances do roles in an ecosystem fundamentally shift after its creation?

7. Conclusion

The objective of this article was to provide an empirically focused review of ecosystem emergence literature, integrating the findings in a framework that guides future ecosystem research and helps managers to expand and adjust their strategic toolbox. We contribute by advancing a multi-level understanding of ecosystem emergence, where the industry, inter-organizational relationships, and the internal organization constitute three distinct but interrelated levels of analysis of ecosystems. Furthermore, we highlight the temporal aspect of ecosystems, as the challenges for leaders and complementors change over the lifecycle of an ecosystem. Driven by digitalization, environmental dynamism and innovation complexity, the importance of ecosystems will only continue to increase in many sectors of the economy. Therefore, the importance of an empirically and theoretically grounded understanding of ecosystems has never been greater. We hope that this article, despite its limitations, will contribute to the advancement of research and managerial knowledge in this area.

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Joachim Stonig, Dr., is postdoc at the Institute of Management & Strategy at the University of St. Gallen.

Address: Institute of Management & Strategy, University of St. Gallen, Dufourstrasse 40a, CH-9000 St. Gallen, phone: +41 71 224 7619, email: Joachim.Stonig@unisg.ch

Günter Müller-Stewens, Prof. em. Dr., is director emeritus at the Institute of Management & Strategy at the University of St. Gallen.

Address: Institute of Management & Strategy, University of St. Gallen, Dufourstrasse 40a, CH-9000 St. Gallen, phone: +41 71 224 2355, email: Guenter.Mueller-Stewens@unisg.ch

Acknowledgement

We would like to thank the reviewers of our paper for their valuable advice.