The role of ecosystems in business and management – a systematic review of the literature

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Abstract

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Introduction
Over the last few years business and management scholars have shown an increasing interest into the phenomenon of ecosystems. Due to the relative novelty of the phenomenon, the term is used ambiguously and there is no clear definition of what constitutes an ecosystem (Teece, 2018). Besides, research addressed this phenomenon from a variety of different angles. The combination of the ambiguous usage of the term and the broad research interest lead to the emergence of several sub-terms and a variety of different research streams and outcomes. Recent work started to develop a coherent overview of the current research on ecosystems and the related open research avenues. However, this is often limited to the dominant ecosystem types (Jacobides et al., 2018) or a specific research domain (Tsujimoto et al., 2018). Therefore this paper seeks to contribute to existing work by conducting a broad systematic literature review (SLR) on ecosystem research in business and management. Thus, the researcher developed the following two research questions which this SLR seeks to answer:

RQ1: What are the main ecosystem terms used in the literature and how do they relate to each other?
RQ2: What are the main research streams and their findings and what research avenues remain open?

Methodology
The research methodology followed the three major steps proposed by Tranfield et al. (2003): planning, conducting and reporting. By adopting a content-analysis-based approach the researcher aimed to gain a coherent overview into existing literature on the topic. The search for papers was conducted in two databases: Web of Knowledge and Scopus. Both sources provide a large selection of peer-reviewed journals in business and management, which is important to ensure a comprehensive selection of papers. As ecosystems are discussed in several different contexts, the search string constituted of only "ecosystem*" to avoid any upfront selection bias. Papers were included if the respective journal was ranked within the Academic Journal Guide. Applying the inclusion and exclusion criteria reduced the original sample from 3,239 papers to 132 papers. The decisions were based on title...
and abstract, if necessary the author skimmed the full paper or asked for the opinion of another academic.

Results
Regarding the first research question the review shows that while research uses a large number of ecosystem terms, six terms are dominant in the literature. These differ along three dimensions: leadership, boundaries and purpose. Besides, specific terms seem to be dominantly used within specific research areas.
Regarding the second question, the author identified that research can be clustered into four categories (1) Terminology and relevance of ecosystems; (2) Ecosystem lifecycle; (3) Firm-level ecosystem strategy and (4) Ecosystem orchestration, with each one consisting of several sub-streams. Generally, it was found that ecosystems have been studied from different angles and in the context of different ecosystem types. Therefore it is difficult to decide, whether findings apply to ecosystems in general or just to a specific type. Further the absence of an agreed definition leads to scholars studying different phenomena under the ecosystem umbrella or to adopting different terminology for the same kind of ecosystem.

Discussion & Conclusion
Empirical research is dominated by case-studies and spread across all different ecosystem types, which hampers generalisation. Thus, ecosystem research would benefit greatly from a clearer conceptualisation or agreed definition of the phenomenon in general and the different sub-terms used in the literature. Nevertheless the SLR identified some research avenues that, regardless of the specific ecosystem context, promise helpful contributions to management research.
One of the key points across all ecosystem research is mutual interdependency and the assumption that competition shifts from firm-level to system-level focus. If that is the case, research should seek to explore how this influences firm-level strategy, for example regarding managing innovation and product development. Research could explore how to manage value creation if the locus of the activities shifts to a meta-level outside the control of a specific firm. Another promising avenue for further research is to explore what kind of resources and capabilities firms need to create or operate within an ecosystem and how these can be obtained or developed. While research started to do this from the perspective of platform ecosystems, the research is limited to a specific context and role (Helfat & Raubitschek, 2018; Teece, 2017) and should be broadened to include other ecosystem members or types of ecosystems.

References
Ecosystems in business and management: A systematic review of the literature

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Introduction

While research interest into business ecosystems has increased rapidly over the last few years, the concept as a facilitator to describe inter-organisational relations using an biological ecosystem analogy was first introduced in the 1990s (Moore 1993). The concept is studied by different research communities in the business and management field, but overall research is still at an early stage.

Due to the nascent state of research, the ecosystem term is often used ambiguously and there is no clear definition of the general concept or a differentiation between the different types (Teece 2018; Tsujimoto et al. 2018; Gupta et al. 2019). Therefore it has been applied widely and research diverged into various directions and industries such as software development, 3D manufacturing, power plants or solar panels (Dattee et al. 2018; Kwak et al. 2018; Kolloch and Dellermmann 2018; Hannah and Eisenhardt 2018).

Tsujimoto et al. (2018) published a systematic literature review (SLR) on ecosystems, but their purpose was to assess literature in the fields of innovation, technology and strategy research and not business and management research in general. Moreover their review was limited to Q1-journals and papers published until 2014 (Tsujimoto et al. 2018). The results of this work show though, that a lot of literature on ecosystems has been published after 2014 and outside of the Q1-tier journals. This paper seeks to expand existing work by conducting a broad SLR on ecosystem research in business and management. It aims to establish the key characteristics of different ecosystem typologies and to explore the main research streams. It will also point out future research directions.
Methodology

The review was conducted following the planning, conducting and reporting approach (Tranfield et al. 2003). The planning stage identified the relevant databases, the definition of the search terms and the selection of the set of papers to be considered for this review. Papers were then coded based on the research questions (conducting phase). The reporting part presents the outcomes and findings of the review.

Identifying search criteria

The SLR aims to answer two research questions:

**RQ1:** What are the main typologies used in research and how do these relate to each other?

**RQ2:** What are the main research streams within the ecosystem literature and how do they relate to the ecosystem types?

The search was conducted in the two databases: Web of Knowledge (SSCI) and Scopus. Both provide a large selection of peer-reviewed journals in business and management and combined ensure a comprehensive selection of relevant papers (Crossan and Apaydin 2010). As ecosystems are widely discussed in several contexts, the search string constituted of “ecosystem*” without any additional words or phrases. No substitutes or related terms such as ‘networks’ or ‘inter-organisational collaborations’ were used, as the paper aims to explore how the concept of ecosystems has been defined and in which areas the term ecosystem was used. Moreover, the search term ensured that results were not biased towards a certain context.

Journals were chosen as the source for relevant outputs and they were limited to fields related to business and management and journals published in English. After the elimination of duplicates, the initial output incorporated 3,239 papers, which were sorted manually by applying the exclusion and inclusion criteria.

Selecting relevant papers

Only studies that had been thoroughly peer-reviewed and were therefore assumed to have made a contribution to ecosystem research were included. This was ensured by checking if the paper was published in a journal that was ranked in the Academic Journal Guide with at least 2 or above. If not, papers were excluded unless high citations signalled influence of a
specific paper. Citations were taken from Google Scholar, Web of Science and Scopus and papers were included if citations were above 50. This lead to the exclusion of 375 papers.

As this SLR focuses on ecosystems in business and management, papers that used the term from another perspective, for instance discussing sustainability, tourism or environmental ecosystems were excluded, which applied to 1,754 papers.

The remaining 1,110 papers’ abstracts and titles were screened on whether ecosystem was actually the focus of the research. Based on abstract and title screening, papers which mentioned ecosystems but focused on something different were excluded. This also applied, if the paper used ecosystems as a theoretical lens rather than as the object of analysis. Where necessary, the full paper was screened to make a decision. Finally, only those papers were considered which discussed ecosystems as an inter-organisational phenomenon of several actors working together to achieve a common goal. This assumption is widely in line with early work on ecosystems (Moore 1993; Iansiti and Levien 2004) as well as more recent but widely acknowledged and cited research (Adner 2016; Jacobides et al. 2018). Papers that were included had to be either conceptual or empirical, any reviews or interviews were excluded.

Whenever there was a doubt about a paper fulfilling the criteria, it was shared with another researcher to get a second opinion to eliminate a potential bias in the final selection. 136 papers remained after the application of all criteria. As 4 papers could not be accessed the final sample includes 132 papers. Figure 1 gives a detailed overview of selection process.

Figure 1: Selection process
Analysis of the literature

The remaining papers were carefully read and clustered based on their ecosystem typology and research purpose. The first aspect identified the key criteria and differentiators between the ecosystem typologies adopted by the literature. The second aspect enabled the researcher to get a thorough overview of the main research topics studied around ecosystems. The identified research topics were grouped into four major research streams to provide a holistic overview of the emergence of ecosystem research.

The remainder of the paper is structured as follows: At first, the paper provides the analysis of the identified ecosystem typologies and their characteristics. The second part provides an overview of the research topics clustered into the four research streams. The section summarises the main research findings in the context of the ecosystem typologies. For each of the research streams the author provides ideas for further research.

Ecosystem Typologies

Due to the absence of a widely agreed definition and the broad research interest on ecosystems, different sub-types of ecosystems emerged. While not fundamentally different, they take different approaches to a foundationally similar concept which leads to an ambiguous application of the term ‘ecosystem’ (Ritala and Almpanopoulou 2017).

In an attempt to the strengthen the foundations of the ecosystem typologies, Jacobides, Cennamo and Gaver (2018) distinguished between three different types of ecosystems most commonly used in business and management research: business ecosystems, innovation ecosystems and platform ecosystems. Additionally Gupta, Mejia and Kajikawa (2019) applied text mining technologies to identify the most commonly used ecosystem types and their overlaps and characteristics. Similarly to Jacobides, Cennamo and Gaver (2018) they found the most relevant types to be business ecosystems, innovation ecosystems and digital ecosystems. This paper has identified additional terminologies such as service ecosystems or entrepreneurial ecosystems that are frequently used in the literature.

In the following section, I provide an overview of the ecosystem types most commonly used in this SLR, identifying the key characteristics alongside the dimensions of leadership, purpose and boundaries.

Business Ecosystems

This term was used first to describe the analogy between biological ecosystems and inter-organisational relations between business actors. The purpose was to underline the
growing interdependence between actors in a business environment, especially regarding value creation (Moore 1993). Nowadays the term seems to serve two purposes. On the one hand, scholars use business ecosystem as an umbrella term for the various other ecosystem terminologies, and on the other hand, it is used to describe an established ecosystem, that does not fall into the criteria for any of the more specific ecosystem typologies illustrated below.

In early work a business ecosystem was recognised as companies which “co-evolve capabilities around a new innovation” and which have their origins in different industries (Moore 1993, p.76). Later the boundaries of business ecosystems were extended to incorporate actors that shaped their development. From this perspective, business ecosystems did not only include firms, but also financiers, regulatory agencies and, to a certain degree, customers or competitors (Iansiti and Levien 2004).

Some researchers draw business ecosystem boundaries around those firms that directly contribute to the value creation. For them, they describe set of firms which interact across industry boundaries and are mutually dependent on each other to create and capture value. The full customer value of the product or service can only be reached if all the components provided by the members of the business ecosystem are available and integrated seamlessly (Jacobides et al. 2018; Hannah and Eisenhardt 2018). In this conceptualisation, business ecosystems develop across regional boundaries (Clarysse et al. 2014). Other work draws the boundaries of business ecosystems wider by including regional organisations that influence the ecosystem such as regulatory agencies, city councils, chambers of commerce, universities and research institutions. This work often studies business ecosystems in a local context (Rong, Wu, et al. 2015; Moss Kanter 2012).

The two different boundaries can be combined by dividing the business ecosystem into two layers: 1) a core layer which consists of location- and industry-independent actors directly contributing to the value creation; and 2) a surrounding layer including financiers, regional regulators and other public organisations, which influence the business ecosystem in a specific location.

**Platform ecosystem**

Platform ecosystems reflect a special type of ecosystem based on a hub-and-spoke set-up between firms. The hub firm, often referred to as the platform leader or platform owner, is the central provider of the platform and orchestrator of the complementary ecosystem. The spoke firms come from a variety of different backgrounds and build their products on services
based on the platform and are described as complementors. Together they build the platform ecosystem. By developing complements for the platform support the platform’s growth and value creation for the customer (Inoue and Tsujimoto 2018a; Teece 2018; Gawer and Cusumano 2014; Gawer 2014).

Figure 2: Platform ecosystem structure

Within the platform ecosystem literature the term is divided into “interaction or market platforms” and “technological or innovation platforms”. The key characteristic of the market-based platform is the development of a multi-sided market in which the platform owners acts as a facilitator connecting actors on the demand- and supply-site of the platform which may not have been connected outside of the platform (Cennamo and Santalo 2013; Ozalp et al. 2018; Helfat and Raubitschek 2018). In contrast, a technology platform provides a basis on which other firms can build innovative products or services (Gawer 2014; Teece 2018). Technology platforms are characterised by a modular set-up. This allows third-party complementors to connect their innovations to the platform via standardized interfaces and independent of other complementors (Tiwana 2015; Nambisan et al. 2018; Jacobides et al. 2018). Customers benefit from the modularity as they can choose which complements to use (Gawer 2014).

In terms of interdependency platform ecosystems differ from other ecosystems as platform owners are often able to offer their own complements (Inoue and Tsujimoto 2018a; Ozalp et al. 2018). Therefore, the complements offered by other firms in the ecosystem are supporting the platform growth and value, but the platform is not dependent on any specific complement (Cennamo and Santalo 2013; Ozalp et al. 2018).

Digital ecosystems

Digital ecosystems incorporate firms which operate in a digital environment and use digital technologies to create their value. Research on digital ecosystems has often applied
terminology also used in the context of platform ecosystems, for example by deeming the focal firm a platform owner. This overlap in use of terminology and examples indicates a close relationship between the two concepts (Selander et al. 2013). Helfat and Raubitschek (2018) used the term ‘digital multi-sided platform ecosystem’ stating that “Digital platforms are often multi-sided, providing interfaces with and among two or more groups of economic actors on different ‘sides’ of the platform” (Helfat and Raubitschek 2018).

While in general platform ecosystems can be hardware-based like those based on a videogame console (Ozalp et al. 2018; Inoue and Tsujimoto 2018b), research using the digital ecosystem terminology refers to software or internet-based platforms such as SAP, iOS or Facebook (Weill and Woerner 2015). It can therefore be argued that the digital ecosystem has not yet emerged as an independent type and usually describes a sub-set of platform ecosystems.

**Innovation ecosystem**

The systematic review showed that there are two different understandings of the purpose and set-up of innovation ecosystems.

The first identifies innovation ecosystems as set of actors connected by a technological innovation of a single firm. In these cases, the innovation is part of an ecosystem and value from the innovation can only be realised, if the innovation is seamlessly integrated into the ecosystem (Jacobides et al. 2018; Adner and Kapoor 2010), which requires adjustments of the upstream and downstream complements. Thus the incumbent product (or service) is only replaced gradually. An example often used in the literature to illustrate these types of innovation ecosystems is high-definition TV which not only requires new TVs but at the same time recording and broadcasting technology need to be able to produce and transfer HD data to the consumers. Further studies have been conducted with lithographers in the semiconductor industry or hard disk TV recording (Ansari et al. 2016; Adner and Kapoor 2016b; Toh and Miller 2017; Adner and Kapoor 2010).

As this understanding of innovation ecosystems only considers actors directly connected to the focal innovation, their number is usually limited. Leadership or orchestration of activities lies with the focal innovator, who has to integrate the innovation into the existing ecosystem (Adner and Kapoor 2016b).

The second approach conceives innovation ecosystems as firms that combine their resources to develop an innovation. In this approach, innovation ecosystems are often initiated
by incumbent firms or research institutions and have more regional focus. The aim is to develop a new value proposition by utilising or developing a new technology. The interdependency in these cases relies on the specialised resources and capabilities such as knowledge or market experience, which each of the actors can contribute to the ecosystem (Walrave et al. 2018; Ritala et al. 2013; Leten et al. 2013; Xu et al. 2018; Reynolds and Uygun 2018). In both types the integration of the elements mainly falls into the responsibility of the ecosystem to achieve the full value potential. This aspect differentiates innovation ecosystems from platform ecosystems, where customers can choose their complements (Adner and Kapoor 2010; Gawer 2014).

![Innovation Ecosystem (Type 1)](image1)

![Innovation Ecosystem (Type 2)](image2)

**Figure 3: Innovation ecosystem structures**

**Service ecosystem**

The service ecosystem is pre-dominantly used in service-dominant logic and marketing research. Similar to other ecosystems the purpose of service ecosystems is to co-create value or develop an innovation through the resource combination and interaction of several actors. It is not lead by a specific actor but instead by a set of rules, norms, value upon which members agree (Vargo and Lusch 2016; Chandler et al. 2019). As opposed to other ecosystems the service ecosystem does not distinguish between sellers and buyers but instead considers all other actors, including customers, as resources integrators and being actively involved in value creation.
The service ecosystem is often clustered into three layers - a macro- (institution or society), meso- (industry or brands) and micro-level (individual actors) (Vargo and Lusch 2016; Meynhardt et al. 2016).

**Entrepreneurial ecosystem**

Entrepreneurial ecosystems consist of new ventures that interact to realize a new value proposition and create an environment which supports new ventures growth. They are decentral and self-organised by the entrepreneurs within the ecosystem (Clarysse et al. 2014; Liguori et al. 2019; Roundy et al. 2018). Entrepreneurial ecosystems differ from other ecosystems as they describe a set of firms that interact on a regular basis, but the emphasis is not on jointly realising a value proposition. Instead the purpose of an entrepreneurial ecosystem is to foster activities such as knowledge exchange or resource allocation which lead to the growth of entrepreneurial activity in a region (Spigel and Harrison 2018; Roundy et al. 2018; Liguori et al. 2019).

Entrepreneurial ecosystems are closely related but not identical to the concepts of clusters and regional innovation systems. All three concepts stress the importance of local density for the growth and development of entrepreneurial ventures. However, clusters and regional innovation systems focus on questions regarding how central actors such as incumbents or state agents can increase the total number of entrepreneurial ventures in a region. The entrepreneurial ecosystem framework identifies the entrepreneur as the key actor and seek to understand how a region can increase the quality of entrepreneurial activity which will lead to the development of high-growth ventures in a region (Spigel and Harrison 2018). An entrepreneurial ecosystems is locally embedded and includes local organisations such as financiers, regulators or incumbent firms (Brown and Mason 2017).
A brief summary of the different typologies is provided in Table 1. As business ecosystem was identified as the umbrella term, it is not separately listed in the table.
<table>
<thead>
<tr>
<th>Type</th>
<th>Leadership</th>
<th>Purpose</th>
<th>Boundaries</th>
<th>Examples from the literature</th>
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</table>
| Platform ecosystem (incl. digital ecosystem) | Platform owner                                 | 1) Create multi-sided markets to enable transaction between either side of the platform  
2) Provide a technological platform on which other actors can develop innovative products or services | Location and industry independent | 1) Market platforms: Amazon, Alibaba  
2) Technology platforms: Android, Apple iOS |
| Innovation ecosystem                  | 1) Firm introducing the innovation  
2) Incumbent or research institution | 1) Commercialise an innovation by integrating it to other elements  
2) Develop an innovative technology or business model together | Depending on industry and type of innovation  
Usually a mix of regional and global actors | 1) Semi-conductor industry, high definition television  
2) Research-based ecosystems to utilise 3D technology |
| Entrepreneurial ecosystem              | Orchestrated by the entrepreneurs themselves | Enable sustainable growth of new ventures by building strong linkages and knowledge exchange between incubators, financiers, research institutions and the new ventures themselves | Regional                       | Silicon Valley                                                 |
| Service ecosystem                     | Operated based on the commonly agreed rules, norms and values | Co-create value through the integration of resources from all actors within the service ecosystem | Location independent            | Tesco Supermarket, LEGO                                         |

Table 1: Ecosystem characterisation
Ecosystem-related research streams

The next section will address the four research streams identified in the SLR. I will link them to the typologies previously identified and point out open research avenues. Figure 1 provides an overview of the research streams and topics.

![Figure 6: Overview of research streams](image)

**Ecosystem Concept**

As this stream was already discussed detailed in the previous section, only a short discussion will be provided here, focusing on the reasons why the ecosystem concept recently gained increasing relevance.

**Ecosystem relevance**

An increasing complexity in products and services as well as changing customer demand lead Moore to the assumption that future firms would need to cooperate across industries to develop the required capabilities, create innovation and satisfy customer demand. This would cause firm’s development depending on that of other firms just as a species’ development depends on its ecosystem. Thus he introduced the idea of business ecosystems as a unit for value creation (Moore 1993). The concept gained further relevance through developments such as open innovation which increasingly shifted the locus of innovation from within a firm to being embedded within a group of firms. Ecosystems provided a useful lens to study these groups (Altman and Tushman 2017). Besides open innovation, digitalisation is another driving factor for the growing importance of ecosystems. It opens new avenues for firms to connect their product or services with those of other firms, thus creating new or better value for the customer. As firms cannot develop all complementarities
themselves they seek partners with whom to create this value thus building an ecosystem (Subramaniam et al. 2019). Further the ecosystem concept provides a framework to understand how firms can cooperate and coordinate their activities without establishing a vertical integration or hierarchical relationships (Jacobides et al. 2018).

**Ecosystem definition**

Adner (2016) defines ecosystems as “the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize” (Adner 2016, p.42). A further definition proposed by Jacobides, Cennamo and Gawer (2018) on ecosystems in general is closely related, stating that ecosystems represent “a set of actors with varying degrees of multilateral, non-generic complementarities that are not fully hierarchically controlled” (Jacobides et al. 2018, p.2264). Nevertheless scholars have yet to agree on a definition, which would also support to strengthen the foundation of future research and a first attempt at identifying the key differences has been made in the previous section.

Further research should address these ambiguities and develop a clear conceptualisation and definition of business ecosystems in general and the different types in particular, as the absence of clear definitions leads to a fuzzy utilisation of the term (Ritala and Almpanopoulou 2017; Teece 2018).

**Ecosystem Lifecycle**

A further stream of inquiry explores how ecosystems are created and develop over time. They study the development process as well as capabilities required to achieve ecosystem sustainability.

**Creation**

In the business ecosystem context, a strong emphasis has been placed on integrating firms into the ecosystem and on establishing the ties between the different ecosystem actors to achieve the value proposition. Those ties are dependent on the position of the actor and their contribution to the ecosystem (Williamson and De Meyer 2012; Moss Kanter 2012; Rong, Wu, et al. 2015; Nishino et al. 2018). Studying the case of Cisco and their ecosystem, Li (2009) has suggested a different approach to building an ecosystem, one that includes the acquisition of relevant firms. However, this conflicts with the approach to the ecosystem.
concepts which understands them as a set of firms that are not vertically or hierarchically integrated. While Li stresses that Cisco usually grants a high degree of independence to the acquired firms, the approach of building relations with independent firms seems more common in building a business ecosystem.

The innovation ecosystem creation process and its outcome are non-linear and cannot be defined ex ante. It requires continuous consideration of feedbacks from actors joining the ecosystems as well as external stakeholders (Dattee et al. 2018; Walrave et al. 2018; Furr and Shipilov 2018). Further studies have depicted innovation ecosystems for new technologies as the combination of multiple platforms or ecosystems that emerge around a new technology such as 3D printing platforms. These classification have been made along the dimension of activities (hardware development, funding generation, marketing etc.) or along the process development cycle. The latter used the idea of an innovation ecosystem consisting of a science ecosystem which consists of actors required for basic research, a technology ecosystem which develops the applied usage of the technology and a business ecosystem commercialises the technology (Kwak et al. 2018; Su et al. 2018; Xu et al. 2018). However, it must yet be understood how these different sub-ecosystems are linked and interact.

Research on the implementation of platform ecosystems has been twofold. On the one hand, it was studied how firms can create a platform and become a platform leader and on the other hand, research explored how successful platforms can be transferred into a different market context. The first stream has looked at the key parameters that enable firms to become platform leaders. It identified those as the development of a core on which other firms want to build on, the tipping of the competition in their favour and the influence, which usually benefits firms of a certain size (Gawer and Cusumano 2015). Besides those firm-specific parameters which relate to the aspiring platform leader, the platform leader must also develop the platform itself. To do so, firms must define the platform’s value proposition, the governance mechanisms by which the platform is operated and the market forces and competition the platform will face. As competition and customer demands change over time, this is a continuous process (Tura et al. 2018; Kabakova et al. 2016).

Firms that established a platform ecosystem within a market may want to expand it to a new business context. By studying how a successful technology platform operator struggled to achieve the same success in a different market, it was found that industry architecture has a strong influence on platform implementation strategy. Therefore platform leaders must ensure that their implementation strategy aligns with the specific industry architecture in the market.
they want to access (Tee and Gawer 2009). This shows that platform expansion into a new market context is an iterative process and platform leaders cannot use a one size fits all approach to roll out their platform.

Further research studied the effects of a platform aiming to establish a new market. It compared the development of the Nintendo Wii, which addressed a new market segment within the videogames industry, with the development of the PlayStation 3 operating in the traditional market segment. The expansion into a new market leads to insecurity on both the complementor and customer site of a platform. Therefore the actions of the platform owner have a strong impact as both sites seek guidance by considering the activities of the platform leader, i.e. developing complements similar to those provided by the platform leader and buying the complements provided by the platform leader or complementors with a strong reputation (Inoue and Tsujimoto 2018b).

While the studies drew attention to the risks and barriers to accessing a new market niche with a platform, research has yet to explore the success factors that enable platform leaders to successfully position their ecosystem in a new market segment.

As opposed to the creation of innovation or platform ecosystems, the formation of a service ecosystem seems to be much less deliberate and research has not yet defined specific steps or success factors. It is suggested that a service ecosystem emerges based on the development of shared intentions between resource integration actors, which co-create value. Over time the actors built stronger ties and further actors enter spurring the need for orchestration. A stable order forms between different actors and around a common value proposition which builds the foundation for a service ecosystem. Over time external or internal influence may disrupt the established order and require the service ecosystem to adapt (Taillard et al. 2016; Meynhardt et al. 2016; Xiao et al. 2019; Frow et al. 2014). Service ecosystems do not develop around a specific value proposition or innovation, instead they develop around the relationships and interactions between resource integrating actors which leads to value creation (Taillard et al. 2016). These blurry boundaries may be the reason why the precise creation is less well studied than with different ecosystem typologies.

**Development**

This topic explores how ecosystems develop after their creation. Research studied how and why ecosystems change over time, how long-term success and growth are achieved and
what role resources and capabilities play when it comes to ensuring sustainable ecosystem development.

Two aspects where studied in the business ecosystem context. The first addresses their adaptability and co-evolvability along the lifecycle phases. It has taken a process perspective to explore how behaviour and interactions are changing throughout the lifecycle. The early phases are characterised by a higher degree of openness to new entrants, while the later stages, once the business ecosystem reaches a more mature stage, are less open and focused on optimising the existing ecosystem (Rong, Hu, et al. 2015; Liu and Rong 2015). Besides these internally triggered changes, business ecosystems also evolve to address external changes. Gómez-Uranga, Miguel and Zabala-Iturriagagoitia (2014) studied these changes using an epigenetics perspective thus building on the biological analogy of business ecosystems. They concluded that even though business ecosystems remain connected with their original roots (DNA) they can adapt and adjust over time (epigenetic change). The authors identified patents as a main reason for the prevention of disruptive change arguing that they tie the business ecosystem to its history.

All studies explored the development of a business ecosystem from the perspective of the keystone firm and did rarely consider the perspective of other actors. It also remains unclear how business ecosystems transition from one phase to the other and whether the process is linear. The study by Rong et al. (2015b) explored different ecosystems in different maturity stages at the time of the study; however, their approach does not allow to observe any longitudinal development of a specific ecosystems.

It can be interesting to explore if and how other actors in the ecosystem adjust their behaviour throughout the different lifecycle phases and their effect on the overall ecosystem health. Based study by Gómez-Uranga, Miguel and Zabala-Iturriagagoitia (2014), it could be interesting to explore whether the limiting constraints can be lifted by a changing the keystone firm within the business ecosystem.

Research also analysed the role of resources and capabilities in the development of business ecosystems. Taking a firm-perspective it was found that resource redeployment within a business ecosystem can be of strategic use. It enables a firm to deploy resources in bottleneck components to resolve those or to train ecosystem partners thus enabling them to resolve the bottlenecks. Furthermore, a broad resource base allows a firm to exploit the most beneficial ecosystem component by re-allocating resources between the components (Hannah et al. 2016). A further study focused on how ecosystem members can enhance their
resources base by identifying resources and capabilities of other ecosystem members they perceive valuable. By interacting with those firms they can access or combine these resources and capabilities with their own (Selander et al. 2013). Both studies take a firm-level view and analyse how business ecosystems provide resource- and capability-based opportunities for the individual firm. Neither has studied how resource combination by different actors on the ecosystem-level can lead to a better performance and value creation.

Amit and Han (2017) suggested to study resource configuration from an ecosystem-level perspective, illustrating how business ecosystems and digitalisation enable resource combinations across firm- and industry-boundaries. Their study emphasises the importance to shift from a firm-centric and value-capture based perspective to a system-centric, value-creation based view to fully explore the opportunities in business ecosystems.

However all studies assume an existing set of firms that willingly contribute to the ecosystem. What remains open is the question how firms can achieve this state and convince actors to contribute their resources and capabilities to the ecosystem. Further, ownership of and access to resources created on the ecosystem-level (e.g. data) is not considered. As other studies have stressed the importance of generated data to improve the ecosystem (Subramaniam et al. 2019), studying how firms manage the access to data generated on the ecosystem-level might provide promising insights.

Scholars studying platform ecosystems have addressed similar questions by studying how platform ecosystems can achieve its status and long-term viability and how dynamic capabilities enable continuous platform development. Two major contributions have been made with regards to long-term platform success. First, platform ecosystems do not always have to enter in winner-takes-all competition against other platforms. Instead long-term survival may also be achieved by strategically positioning the platform ecosystem in a niche and providing exclusive complements that tie actors to the platform ecosystem (Cennamo and Santalo 2013). Second, besides positioning the platform itself, it is important, that platform leaders find a way to tie existing complementors to the platform while simultaneously attracting new ones. Continuously developing and acting on opportunities that enable value creation and value capture for the platform leader but also for the complementors is a key driver for long-term success within a platform ecosystem (Laczko et al. 2019). However, the results are based on a single case study on a sharing economy platform ecosystem and it remains unclear on whether the identified value-driving mechanisms are applicable to other types of platform ecosystems.
Further research has been conducted to explore the capabilities required by a platform leader to successfully manage a platform ecosystem. Teece (2017) argued that along the platform lifecycle different ordinary and dynamic capabilities are required by the platform owner in each of the phases (birth, expansion, leadership and renewal) (Teece 2017). Helfat and Raubitschek (2018) more specifically identify innovating, sensing and integrating capabilities as the main capabilities a platform owner must develop to ensure continuous platform development.

Even though research recognised the importance of those capabilities as they “are fundamental to the business models and competitive success of firms at the centre of business ecosystems because they enable firms to better orchestrate alignment of activities and products with and among their partners” (Helfat and Raubitschek 2018), it remains unclear what specifically is required when scholars discuss “integrative capabilities”. Further, neither work explained how firms obtain or build those capabilities if they do not possess them already.

Scholars studying entrepreneurial ecosystems have been interested in exploring the requirements to develop continuously successful entrepreneurial ecosystems (Roundy et al. 2018). The success of entrepreneurial ecosystems strongly depends on external factors such as policies, the availability of resources (knowledge, work force, capital) and the support and culture in the environment. Further internal relationships that enable the access and flow of the available resources among the actors are crucial. All these factors must be considered to determine whether an entrepreneurial ecosystem will fail or succeed (Spigel and Harrison 2018; Liguori et al. 2019). It was found that even though researchers and practitioners identified these success factors, it is still difficult to establish a copy of a local entrepreneurial ecosystem in another region. Thus success and growth are not achieved by the pure availability of the success factor and instead need to be rightly applied and structured (Theodoraki et al. 2018).

Future research should explore what triggers the emergence of an entrepreneurial ecosystem in a specific spatial context and whether this can be actively facilitated. As the study by Theodoraki, Messeghem and Rice (2018) focused on university/incubated entrepreneurial ecosystems, future research should try to understand how these dynamics can be achieved in other contexts. Moreover, research may explore whether, and if so by whom and how the external factors can be changed to achieve better development.
Ecosystem firm strategy

A third research stream emerged around exploring the relations between ecosystems and the strategy of individual firms. It can be divided into three topics: 1) the role and influence of the firm’s position, 2) the effect of the ecosystem on the firm’s business model and 3) the influence of co-opetition.

Positioning

Business ecosystems research studied how the position of a firm within an ecosystem influences their behaviour. Actors broadly fall into three categories, that is: keystone firm, dominant firm, niche actor (Iansiti and Levien 2004) and each of these roles provide different challenges for the firms. Therefore firms need to gain awareness of their role and understand how their actions influence the overall ecosystem. Besides, they need to overcome limitations in their individual position and rethink their entrepreneurial activities and strategic behaviour to generate benefit from the ecosystem. A firms individual firm identity and their role in the ecosystem can be different and cause identity tensions. To overcome these they need to align their actions with their role and contribution in the ecosystem rather than their self-perception or individual identity (Zahra and Nambisan 2012; Lindgren et al. 2015; Iansiti and Levien 2004; Basole 2009). After firms have identified their own role and position, understanding their relations to other ecosystem members can help them to develop their ecosystem strategy. Firms need to decide how they want to manage their inter-firm relations and what firm-specific goals they want to achieve through their membership (Basole 2009; Weill and Woerner 2015; Kapoor and Lee 2013).

Researchers should explore in more detail, how firms can overcome or balance their identity tensions, especially as firms may run their further business activities besides those in the ecosystem. Further research could explore how firms can actively change their position in the ecosystem.

Research in innovation ecosystem explored similar aspects, in particular how the position of firms influences their contributions and benefits. Dominant firms will benefit from making their innovations accessible to other firms, as the increased integration leads to better value creation and capture. In contrast, smaller firms that invest heavily in making their innovations accessible hoping to achieve the leading position may not reap the same benefits, as other actors will attempt the same. Thus fierce competition will actually result in less value capture (Mantovani and Ruiz-Aliseda 2016). A high influence density, that is dominance by one or few firms, hinders evolvability of an ecosystem, while diversity, that is a high number
of firms, which benefit from a technology, facilitates evolvability. Therefore firm’s awareness of their ties and the overall architecture of the innovation ecosystem can provide guidance in deciding whether to join and contribute to an innovation ecosystem (Luo 2018).

As ecosystems are dynamic it would be interesting to identify if and how positions within the innovation ecosystems change over time. Further research may study how firms achieve a dominant position and whether the negative effects from the study by Mantovani and Ruiz-Aliseda can be prevented through any precautionous measures.

Platform ecosystems studies explored the parameters that influence the position of the platform leader and complementors. Early in the platform lifecycle firms which develop an enabling technology should consider the dynamics of platforms and ecosystems to identify how they can achieve value capture and bargaining power from their innovation (Teece 2018). The complementor’s position depends on two aspects: the complexity of the platform and the consumer mix. Firstly, complementors are more likely to retain a superior position in a platform ecosystem if the platform ecosystem’s complexity is conceived as high. Secondly, the consumer mix and demand across new platforms changes over time. In the beginning early adopters dominate a platform and its demand while more risk-averse users join the platform in a later phase. Complementors should consider this when they decide they plan their entry (Kapoor and Agarwal 2017; Rietveld and Eggers 2018).

The behaviour of complementors is further influenced by the role of the platform leader. If platform leaders decide to get involved in complementary development from the beginning it impacts complementors’ entry decisions and complement development. While the provision of complements by the platform leader supports the initial growth of a large customer base, it also causes bandwagon effects by encouraging complementors to provide similar complements. This will increase complementary competition and reduces ecosystem diversity, which will in the long-term result in a limited customer base and complementors’ exit (Inoue and Tsujimoto 2018a).

In contrast, platform leaders entering a complementor’s domain at a later stage create positive spill-over effects for large complementors, as customers’ interest in these types of complements increases. However, the strong integration of a complementary product or service into the platform will push smaller complements out of the market (Foerderer et al. 2018; Li and Agarwal 2017).

It must be recognised, that the studies that found these effects both conducted their research in an app-based platform ecosystem in which switching cost between apps are
usually low and customers may multi-home. It would be interesting to study, whether the same mechanisms apply in other platform ecosystems in which multi-homing may not be possible or convenient for platform users.

**Business models**

Participation in business ecosystems can influence a firm’s the business model. When firms want to adopt a new technology into their business model, they should consider the technology’s business ecosystem and the business models of other firms that use this technology. By using these insights, firms can develop a business model that aligns well with the overall ecosystem. Besides, the development of a new business model is supported by the broader consideration of the overall business ecosystem. By providing a broad perspective it also enables established firms to develop or adjust their business model and incorporate more factors into their decision-making (Rong et al. 2018; Shaw and Allen 2018).

Research in this domain is still at an early stage and has not yet been applied to specific ecosystems and or looked beyond the firm-level business model. It would be interesting to study if all or specific types of ecosystems develop a business model on the ecosystem-level. It would be interesting to explore, how the business model is shaped by ecosystem members over time and if business model innovation unfolds on the ecosystem-level. Moreover, research could address if and how incumbent firms that create or join an ecosystem balance tensions between their incumbent business model and their ecosystem’s business model.

**Coopetition**

Within business ecosystems coopetitive tensions usually occur if firms disagree on the individual value capture of value created by the business ecosystems. To strengthen their position firms can either aim to dominate the overall business ecosystem by occupying more than one niche or they may occupy the niche that fits best with their capabilities. Another option, which promises strong bargaining power within the business ecosystem, is to occupy the bottleneck niche which limits the growth of the business ecosystem (Hannah and Eisenhardt 2018).

In innovation ecosystems coopetition is usually triggered by the introduction of an innovation that threatens the position or value proposition of other ecosystem actors. As the innovator depends on the support of the overall ecosystem, they should resolve these tensions
by outlining the benefits for the ecosystem and be willing to adjust their own position and interests to allow other actors their space (Ansari et al. 2016).

**Ecosystem orchestration**

The fourth major research stream in ecosystem research studies how ecosystem actors and activities can be orchestrated. Research can be divided into two major topics, governance in platform ecosystem and orchestration of innovation in ecosystems.

**Governance**

Platform leaders must consider several different aspects upon developing the governance mechanisms for their platform. These include deciding how value is captured and shared, who open the platform is with regards to complementors how the relations between the actors are managed and how the firm handles technology development and intellectual property (IP) generated on the platform (Huber et al. 2017; Gawer and Cusumano 2014; Tiwana 2015; Ceccagnoli et al. 2012). While complementors’ individual interest is to secure and exploit their IP for as long as possible, it may be in the interest of overarching platform ecosystem development to share the IP to facilitate further innovation based on the IP. Thus platform leaders must identify a balance that encourages complementors to develop and exploit IP while it the IP is later shared across the ecosystem for further innovative activities (Parker and Van Alstyne 2018). The development of complements can be facilitated further by modularization, is this enables complementors to individually contribute and add to the platform and interdependencies between different complements are reduced. Platform leaders should further be open to re-consider their platform rules, if this would support increased value creation (Tiwana 2015; Ceccagnoli et al. 2012).

**Innovation orchestration**

Orchestration of innovation has been studied in various ecosystem types. An ecosystem can only benefit from an innovation if and when all actors and elements are integrated. Research introduced the notion of “ecosystem clockspeed” to measure the time span between the introduction of an innovation in one element and the moment, in which the last element caught up by utilising the innovation (Mäkinen and Dedehayir 2013; Dedehayir and Mäkinen 2011). It was also found that the performance benefits a firm can achieve by introducing an innovation are strongly dependent on the position of integration challenges along the value chain. Further the transition from an existing to an innovative technology will
be prolonged, if the challenges to integrate the innovation are high and in contrast, the existing technology provides opportunities extend its performance. Therefore firms introducing an innovation should be aware of the challenges within the innovation ecosystem as this enables them to better time the release of their innovation or to support ecosystem members in resolving the challenges (Adner 2006; Adner and Kapoor 2010; Adner and Kapoor 2016a; Adner and Kapoor 2016b). However, findings have almost exclusively been generated through the studies in the semi-conductor industry. Therefore, further research across different innovation ecosystems may be required to explore, whether these assumptions are widely generalisable.

If innovation is not introduced by an individual actor but instead by a whole new innovation ecosystem, the incumbent innovation ecosystem may react by re-configuring the roles and activities of the actors within the innovation ecosystem (Dedehayir et al. 2017). Lastly a regional innovation ecosystem will be most successful if strong ties exist across all types of actors (large incumbents, key suppliers, new ventures, research facilities) and if all of them are equally represented in knowledge exchange, R&D activities, and decision making. The requirements and expectations regarding R&D can only be aligned if stakeholders are equally represented (Reynolds and Uygun 2018).

Platform leaders need to orchestrate two different kinds of innovative activities. First, if they introduce innovation to the platform itself, they need to support their complementors in transitioning from the existing to the new platform and guide them to learn how to fully utilise the opportunities provided by the new innovation. Further, they need to encourage complementors to continuously develop innovations for the platform, which can be achieved through guidance on the platform’s functionalities and opportunities (Ozalp et al. 2018; Eckhardt et al. 2018).

The focus on innovation in service ecosystems has been on understanding how innovation is achieved. It was found that it is important to challenge existing innovation process rules to achieve disruptive results. Despite the importance of breaking rules however, it was also found that the maintenance and creation of new rules is equally important as they lay the foundation of mutual trust between actors. It is also important to conduct a reconciliation phase before implementing the solution. The reconciliation phase aims to resolve tensions between actors and to converge and align expectations. If no agreement is achieved, actors need to return to the idea phase and implementation can only be started once
all interests and expectations are reconciled. Thus innovation emerges non-linear (Koskela-Huotari et al. 2016; Chandler et al. 2019).

Conclusion

It can be seen that broad research has been conducted on the ecosystem phenomenon. However, research has been widely spread across the different types of ecosystems and thus it is difficult to decide, which findings apply to ecosystems in general and which are only applicable to their specific ecosystem context. In the absence of an agreed definition, it remains unclear, if different scholars actually studied the same phenomenon even though they use the same term. Future research would therefore greatly benefit from a clearer definition and better differentiation between the different ecosystem types. Empirical research is dominated by case-studies and spread across all different ecosystem types, further limiting generalisation.

Besides, the SLR showed that research should further engage with studying the behaviour and activities of different actors in ecosystems. At this stage, a large amount of research has put their emphasis on the central actor’s (platform leader, keystone firm) role. However, the majority of firms in an ecosystem takes the role of a partner (niche member or complementor), and thus understanding their perspective promises interesting insights into understanding ecosystem development. It would also allow practitioners to better manage their ecosystem activities. Additionally, one of the key points across all ecosystem research is mutual interdependency and the assumption that competition shifts from firm-level to system-level focus. If that is the case, research should seek to explore how this influences firm-level strategy, which might be related to research in fields like open innovation.

References


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