A Systematic Mapping Study on Business Ecosystem Types

Completed Research

Anne Faber
Department of Informatics
Technical University of Munich, Germany
anne.faber@tum.de

Sven-Volker Rehm
EM Strasbourg Business School,
University of Strasbourg, France
sven.rehm@em-strasbourg.eu

Maximilian Riemhofer
Department of Informatics
Technical University of Munich, Germany
maximilian.riemhofer@tum.de

Gloria Bondel
Department of Informatics
Technical University of Munich, Germany
gloria.bondel@tum.de

Abstract

Researchers and practitioners increasingly recognize the relevance of the complex business environment in which companies develop, produce, and distribute their products and services. This environment is often referred to as business ecosystem. Various types of business ecosystems have been presented and discussed in literature, such as innovation or platform business ecosystems. We conduct a systematic mapping study analyzing 136 papers in order to characterize types of business ecosystems. We provide an overview of 12 business ecosystem types and visualize how they interrelate with each other.

Keywords

Business ecosystem, literature review, innovation business ecosystem, digital business ecosystem, platform ecosystem.

Introduction

Business ecosystems have gained interest from researchers and practitioners as companies as well as public organizations increasingly recognize the relevance of their complex business environment. This environment consists of all value creation activities related to development, production, and distribution of services and products and comprises suppliers, manufacturers, customers, and entrepreneurs. Coping with the challenges and opening up the opportunities that arise in these business ecosystems is a reality for most companies nowadays (Peltoniemi and Vuori 2004).

Business ecosystems extend the classic supply chain, consisting of suppliers and customers, by including other entities into the business environment of the enterprise. We define business ecosystems holistically as the environment of a company covering all current and potential future business partners, customers, suppliers, competitors, regulatory institutions, and innovative start-ups. This environment exhibits high dynamics as entities continuously enter and leave the ecosystem. Analogously to the metaphor of a biological ecosystem, which served as a basis for the initial definition of business ecosystems (Moore 1996), the economic success of an enterprise can depend on the ecosystem health and ability to grow its business ecosystem. The role of the enterprise within its ecosystem can range from a keystone to a niche player, with varying level of influence on the overall health of the ecosystem (Iansiti and Levien 2004).

Extensive literature already exists that discusses the concept of business ecosystems, contributing definitions of the phenomenon, describing related roles, underlying structures, evolutionary aspects, and specific types of business ecosystems. Types of business ecosystems might refer to, for instance, the innovation ecosystem – with the focus on developing ideas, products or services, or the platform business...
A Systematic Mapping Study on Business Ecosystem Types

ecosystem – consisting of a central digital platform and contributing peripheral organizations. However, extant literature does not provide an overview of the spectrum of types and their interrelations.

Our contribution in this paper involves the description of 12 business ecosystem types identified in previous literature and a characterization of their relationships with each other. We conducted a systematic mapping study on the basis of 136 analyzed papers.

The paper is structured as follows; we describe the business ecosystem concept as research background of this work; this is followed by a description of the systematic mapping study as our research design. We describe the 12 business ecosystem types we identified and provide an explanatory figure illustrating the relation of these types. Finally, we give a short discussion and an outlook.

Research Background on Business Ecosystems

James Moore introduced the term business ecosystem in the mid-1990s, defining it as a collection of interacting companies (Moore 1996). He used a 3-layer framework (as visualized in Figure 1) to explain the relation between the core business, the extended enterprise, and the business ecosystem. All entities located in the center have a high stake in the value creation, which decrease the further away an entity is from the core. Since its introduction, the concept has been widely studied and used in management science (Guittard et al. 2015). The initial definition was enriched describing the role of companies as “suppliers, distributors, outsourcing firms, makers of related products or services, technology providers, and a host of other organizations” (Iansiti and Levien 2004), all affecting business success and failure of companies active within the business ecosystem. Furthermore, business ecosystems constantly evolve, exhibiting a dynamic structure (Peltoniemi and Vuori 2004), with not only companies but also human actors, entering and leaving the ecosystem, which “are interconnected through a complex, global network of relationships” (Basole et al. 2015).

![Figure 1. Moore's (1996) framework putting the business ecosystem in relation to the core business and the extended enterprise](image-url)

Various types of business ecosystems have been presented and discussed in literature, such as innovation ecosystems (Adner and Kapoor 2010; de Vasconcelles Gomes et al. 2016), platform business ecosystems (Toivanen et al., 2015; Teece, 2017), or software ecosystems (van den Berk et al. 2010; Popp, 2010), describing the roles within (Moore 1996; Iansiti and Levien 2004) or the structure of (Tan et al. 2009; Visnjic et al. 2016) the business ecosystem in focus. Recently, Sako (2018) defined three meta-characteristics of business ecosystems, sustainability, self-governance, and evolution, to contribute to a better distinction of the ecosystem concept from clusters or networks. Thereby, he focuses on “value-creating process (...) rather than an industrial sector”.

Research Design

Research Method and Research Questions

This study aims at obtaining an overview of business ecosystem types in existing literature and their relation with each other. Therefore, we conducted a systematic mapping study as a specific form of a systematic literature review (Kitchenham et al. 2011, Petersen et al. 2008).

In a first step, we defined the research question as guideline to our study: What specific types of business ecosystems have been defined in literature, and how are they interrelated? Thereby, the rationale of the
research question is to gain an overview of how the business ecosystem concept has been adapted to various industries, organizations, products, services, and environmental circumstances. We also carry out a categorization of business ecosystem types.

**Search process**

The complete systematic mapping process is visualized in Figure 2. In the following, we will briefly describe the conducted steps of searching, selecting, and analyzing existing literature.

**Selection of data sources and search strategy**

For the selection of suitable databases, we identified research areas relevant to this mapping study. Thereby, we selected three research areas as business ecosystems are related to computer science, information systems, and management theory.

The conducted mapping study bases on electronic databases. An extensive selection of databases was the first step in fulfilling the research aim of a comprehensive overview of research in business ecosystems. We selected the databases Association for Computing Machinery (ACM), Electrical and Electronics Engineers (IEEE), ScienceDirect, Scopus, SpringerLink and Web of Science, as these databases cover publications of the previously identified research domains.

![Figure 2. Search process (following Petersen et al., 2008).](image)

The search string consisted only of the term *business ecosystem*, and within the initial search only the titles, abstracts, and keywords were analysed. If at least one of these three contained the term business ecosystem, the paper was included. This resulted in 1,842 papers after the initial search.

**Inclusion and exclusion criteria**

In the next process steps, relevant articles were entered in the “pool of papers” (Wendler 2012) and irrelevant papers were excluded. After reading the title, abstract, and keywords, 382 articles were labeled as relevant, whereby 124 duplicates were removed, leaving 258 relevant papers. Papers were included in case they were written in English and the scope was related to business ecosystems. We excluded papers with a lack of business focus, i.e., interaction of multiple actors crossing industries, but rather describing technical aspects or architectural descriptions of ecosystems, but also papers with a biological ecosystem in focus. To maintain high-quality standards, results with a "notice of violation" – or "notice of retraction" – note were excluded as well. For the remaining papers, a concept matrix (Salipante et al. 1982; Wendler 2012) was created, consisting of the business ecosystem concepts definition, roles, phases, types, visualizations, applications, and examples (with BE as abbreviation for business ecosystem)

- **BE definition**: either a new definition of business ecosystem is established, it adds to an existing definition, sums up different definitions or compares existing definitions.
- **BE roles**: the different roles ecosystem actors incorporate within an ecosystem are described, a new descriptive metaphor is established for these roles or different roles are compared.
• BE phases: the paper establishes a business ecosystem life cycle, describes at least one state of a business ecosystem, or it compares different life cycle models.
• BE types: the paper describes at least one type of business ecosystem or compares multiple types.
• BE visualization: the article contains at least one business ecosystem visualization, describes how a business ecosystem can be visualized, or develops or uses a visualization tool.
• BE application: applications of the business ecosystem concept in both research and practice.
• BE example: paper demonstrating a specific example of a business ecosystem in a real-world context, e.g., for companies such as Walmart or Alibaba.

Papers with at least one hit for these concepts were considered as relevant, leading to 118 relevant papers. Last, forward and backward citation search (Webster and Watson 2002) was applied to these records. This led to the inclusion of 18 additional paper. Thus, overall we analyzed 136 paper in our mapping study.

Related Work

As business ecosystems have recently gained relevance, this work is not the first literature review addressing business ecosystem related research. We identified four existing literature reviews targeting business ecosystems.

Mäkinen and Dedehayir (2012) published a literature review of 68 articles targeting business ecosystem evolution and strategic considerations. They discuss (i) business ecosystem members and their roles, (ii) factors that influence the evolution of business ecosystems, (iii) the dynamics of ecosystem change, and (iv) the strategic considerations of firms positioned in ecosystems. De Vasconceles Gomes et al. (2016) focused their literature review on innovation ecosystems and analyzed 193 articles. They highlight the most influential papers; discuss the innovation ecosystem concept and its variations. Finally, they identified six research streams in innovation ecosystem research: industry platform x innovation ecosystem; innovation ecosystem strategy, strategic management, value creation, and business model; innovation management; managing partners; the innovation ecosystem life cycle; innovation ecosystem and new venture creation. Järvi and Kortelainen (2017) describe the results of their literature review conducted in November 2014. They analyzed overall 72 articles applying three units of analysis: the individual actor (typically a firm), the relationship between the actors and the ecosystem. They describe business ecosystems, digital business ecosystems, innovation ecosystems, technology ecosystems, platform ecosystems, platform ecosystems, and supply ecosystems as ecosystem types. In a recent study, Scaringella and Radziwon (2018) analyzed 104 articles addressing ecosystems. They discuss the four main types of ecosystems - business, innovation, entrepreneurial, and knowledge ecosystem; provide an overview of related theories from the territorial approach and identify invariants between both research directions. In addition, they propose a research framework based on their comparison as a basis for future empirical research.

Even though the literature reviews partially discuss business ecosystem types, none of these targeted their literature review to identify business ecosystem types in general.

Business Ecosystem Types

Overall, we identified 12 business ecosystem types, which we briefly describe. Thereby, we used the name used in the paper, leading to types without “business” in its name. Nevertheless, we always describe the business-related description of the respective ecosystem type.

Platform Business Ecosystem

A platform business ecosystem incorporates a platform as the “keystone entity” (Fragidis et al. 2007a) of the business ecosystem, a central hub to which other entities connect. A platform is created by the keystone organization(s) and offers solutions that can be leveraged by other members of the ecosystem (Iansiti and Levien 2004). An example for such platform BE is Apple's App Store, through which Apple and third-party developers sell software applications (Apps) that users of Apple's mobile devices can download. Every App extends the functionality of Apple's devices, thus increasing its value (Basole and Karla 2011).
A Systematic Mapping Study on Business Ecosystem Types

A business ecosystem and a platform business ecosystem only differ in the core value: while a product or service by one or more keystones is the heart of a BE as defined by Moore and others, the platform is the center of the platform business ecosystem. As for Apple, the App Store is the core value rather than the iPhone, because the phone would lack value without third party Apps.

**Innovation Ecosystem**

Even though some scholars use the term innovation ecosystem synonymous to the term business ecosystem (Gawer and Cusumano 2014, Overholm 2015), we distinguish between these two concepts (following Scaringella and Radziwon (2018)).

Adner and Kapoor (2010) were among the first to describe an innovation ecosystem. Starting from a value chain, they included the core innovator as well as the upstream suppliers and the downstream buyers and complementors. This definition fits the keystone and niche-player model by Iansiti and Levien (2004); however, it does not include other entities relevant for business ecosystems, such as the government or research bodies. Both were added by Bodde and Taiber (2014), who further defined criteria for the building of innovation ecosystem: 1) there are many new, rapidly developing, and distinct technologies in the market; 2) these technologies create the most value when combined; and 3) organizations new to the field enter the ecosystem. Contrary to traditional business ecosystems, which are based on the exploitation of resources and cost-reduction to create values to its customers, an innovation ecosystem is neither distributed around an existing product or service, but rather an innovation (de Vasconceles Gomes et al. 2016, Valkokari 2015). Innovation actions occur when the market demands change or new technologies disrupt the markets (Annanperae et al. 2015). Even though innovation is an essential aspect of business ecosystems, it is not the base of it.

Examples for innovation ecosystems are the ecosystem that formed around the smartphone when it was invented, with Apple claiming a keystone spot at an early stage. A more current example is Tesla (Bodde and Taiber 2014).

**Software Ecosystem**

Jansen et al. (2009) defined a software ecosystem as "a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts". Therefore, the software ecosystem is another subtype of business ecosystems (van den Berk et al. 2010, Hyrynsalmi et al. 2015) and is an adaption of a business ecosystem to the software industry, where the center can be either one or more software vendors (Popp 2010), a software platform, or a programming language (Jansen et al. 2009).

**Knowledge Ecosystem**

A knowledge ecosystem differs from a business ecosystem in three ways: 1) the ecosystem’s focus activities, 2) the players’ connectivity, and 3) the keystone player (Clarysse et al., 2014). According to Scaringella and Radziwon (2018), this type of ecosystem is located around a university, focusing on knowledge generation and is usually geographically localized with close proximity. As key stakeholder, they identify large firms with established research and development (R&D) departments, small and medium enterprises (SMEs), and start-ups.

**Digital Business Ecosystem**

The European Union initiated the digital business ecosystem approach to strengthen the competitiveness of SMEs in the European Union. Initially, it was designed to supply SMEs with free software tools in order to help them grow and develop (Stanley and Briscoe 2010). The digital business ecosystem essentially is a platform ecosystem, which is described in detail by Corallo et al. (2007).
**Mobility Business Ecosystem**

As the concept of smart cities gains popularity, parts of it, the (smart) mobility, is described applying the business ecosystem concept. The mobility business ecosystem includes, e.g., ride sharing, connected cars, and driver-less transportation (Sako 2018). It includes actors such as automotive Original Equipment Manufacturers (OEMs) and their suppliers, public transportation, existing organizations without prior experience in the field, and research and regulatory bodies (Faber et al. 2018). Therefore, the mobility business ecosystem can be seen as a subtype of innovation ecosystems.

**IoT Business Ecosystem**

Another business ecosystem type was created with the emergence of the Internet of Things (IoT). Mazhelis et al. (2012) defined the respective IoT business ecosystem as “a special type of business ecosystem which is comprised of the community of interacting companies and individuals along with their socio-economic environment, where the companies are competing and cooperating by utilizing a common set of core assets related to the interconnection of the physical world of things with the virtual world of Internet. These assets may be in the form of hardware and software products, platforms or standards that focus on the connected devices, on the connectivity thereof, on the application services built on top of this connectivity, or on the supporting services needed for the provisioning, assurance, and billing of the application services”. They further specified the specific behavior-wise roles of such an ecosystem, including regulatory and legislative bodies such as governments, and adopted Iansiti and Levien’s (2004) keystone model.

In 2017, Papert and Pflaum (2017) developed guidelines for developing an IoT business ecosystem, comprising of the steps 1) define the IoT service, which will be the core of the BE; 2) determine own value contributions; 3) identify necessary complementors for the value creation; 4) initiate the business ecosystem, build and foster relations with other organizations necessary for the value creation and delivery; 5) negotiate compensation for value contributions; and 6) realize the desired IoT service.

**Entrepreneurial Ecosystem**

This ecosystem type is described in literature with the name entrepreneurial or start-up business ecosystem. Scaringella and Radziwon (2018) described it as 1) the government’s role is to nurture and sustain entrepreneurship; and 2) the ecosystem is purposely build around an entrepreneur or entrepreneurial teams. Other, already existing enterprises and organizations, such as universities, are involved in the ecosystem as well. Sako (2018) characterized it as an ecosystem consisting of start-up related organizations, such as entrepreneurs, investors, or end users, who collaborate to form a new start-up.

**Internet Business Ecosystem**

The Internet business ecosystem is the ecosystem around the Internet as the core value (Bai and Guo 2018). It is a specific type of platform business ecosystem.

**Mobile Internet Business Ecosystem**

The mobile Internet business ecosystem is a subtype of the Internet ecosystem (Bai and Guo 2018). It itself is a subtype as well, essentially describing platform ecosystems such as Google’s Android or Apple’s iOS (Gueguen and Isckia 2009). Sometimes being called mobile OS business ecosystem (Yang et al. 2018), a mobile business ecosystem sets the respective platform in its center and develops around it.

**Customer-centric Business Ecosystem**

We identified two papers that proposed a business ecosystem type tailored to customers. Fragidis et al. (2007a, 2007b) extended the platform ecosystem by adding customers in a keystone position connected to the platform in the center. The customers are involved in the idea generation and product/service development. In addition to its extension of a platform ecosystem concept, it is a type of knowledge and innovation ecosystem by including customers in the generation and sharing of ideas and their knowledge.
Family Spin-off Business Ecosystem

A family spin-off business ecosystem as described by Lozano (2017) is happening in case the spin-off splits up from the family company. The ecosystem consists of five major components, namely: 1) the family, providing and committing financial assets; 2) the family business, providing financial aid and knowledge; 3) the project committee, a decision body inside the family business assessing the spin-off and deciding on the level of support it will retrieve; 4) the environment, guiding and supporting the spin-off; and 5) the center of the family spin-off business ecosystem, the spin-off enterprise.

To sum up the description of ecosystem types, the most vividly discussed type of ecosystem is the ‘innovation ecosystem’. We have identified 13 papers that deal with this ecosystem type. This is analogous to the literature research result of Scaringella and Radziwon (2018). De Vasconceles Gomes et al. (2016) analyzed literature with the focus on innovation ecosystems and when this term established. Platform ecosystems are the focus of eight papers we identified. Software and mobile business ecosystem were both presented in six papers.

The Interrelation between Business Ecosystem Types

According to the description of each business ecosystem type, we mapped the types and their relations to each other in Figure 3. In a first step, we identified two perspectives from which a business ecosystem and its type can be looked at. One is an organizational perspective. It has the enterprise – or multiple enterprises such as the entrepreneurial group or the family spin-offs – in focus. The business ecosystem is the collection of all other entities in a relation to this enterprise.

The other perspective is the idea, product or service perspective. This perspective has a value creation – in the form of an idea, a product or service – in the center of the business ecosystem. Three in academic literature often discussed business ecosystem types are the platform business ecosystem, the knowledge ecosystem and the innovation ecosystem. Subtypes of the first mentioned ecosystem type are Internet business ecosystem with the mobile business ecosystem as a further subtype and the digital business ecosystem. As within an IoT business ecosystem both the platform used to connect multiple devices to share data generated can be in the focus but also the data and knowledge created with this data as such, this subtype is positioned in the intersection of knowledge and platform business ecosystem. As the mobility business ecosystem addresses innovation within the innovation connected to applying technologies for urban mobility, this is a subtype of the innovation ecosystem. Eventually, the customer-centric business ecosystem is located in the intersection of platform, knowledge, and innovation.
ecosystem, because it includes customers as the main contributor to a platform, while also fostering their contribution to both the knowledge generated and the associated innovation.

The type ‘software ecosystem’ is located between both perspectives. The center of the software ecosystem can either be one or more software vendors (Popp 2010) – categorizing it in the organizational perspective or a software platform or programming language (Jansen et al. 2009) – for which the product or service is in the center.

Discussion

In this paper, we present results of a systematic mapping study we conducted, analyzing 136 papers. We described these business ecosystem types and guide the interesting reader to literature targeting specific business ecosystem types. Using the insights we gained through the mapping study, we set the different business ecosystem types into relation to each other.

A noticeable limitation of the presented work is the applied search string and the selected databases within the systematic mapping study. Additional search strings, such as business network, business clusters or networked ecosystems could have contributed to the results presented here. In addition, search strings targeting specific business ecosystem types, such as innovation ecosystem or software ecosystems could have generated a broader picture of these ecosystem types. As additional database, the AIS e-Library should be searched for additional records. In addition, an evaluation of the relations set through business ecosystem practitioners active in different business ecosystem types is currently missing. We see great potential for future work in addressing these limitations.

In our view, the list of identified business ecosystem types is non-exhaustive and we make no claim to completeness. We see the result presented here as a baseline for further analysis on business ecosystem types, leading to refinement of the definitions and possible re-arrangements of the different types in Figure 3. Nevertheless, we believe interested researchers and practitioners can use the presented results as a starting point for further business ecosystem related work.

Acknowledgements

This work has been sponsored by the German Federal Ministry of Education and Research (BMBF) grant BEEx+ 01IS17049.

REFERENCES


