



# DESIGNING DIGITAL PLATFORM ECOSYSTEMS

## A SYNTHETIZATION OF RELEVANT DESIGN TOPICS FOR ECOSYSTEMS FROM A LITERATURE REVIEW

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### ABSTRACT

#### **Purpose**

The purpose of this paper is to contribute to the existing research on digital platforms by adopting an ecosystem perspective, considering an established framework. Our work synthesizes previous findings on digital platforms and offers insights into their ecosystem design.

#### **Design/methodology/approach**

A literature review was conducted to identify and synthesize the relevant findings. Considering the framework, and by conducting a qualitative content analysis, design recommendations and related aggregated design topics were derived from the publications.

#### **Findings**

The findings of our study show a detailed framework including various design topics for different stakeholders within the ecosystem of a platform.

#### **Research limitations/implications**

Our review depends on the quality of the databases selected, as well as the search string, to identify clear design topics for platform ecosystems and not the ecosystem logic itself.

#### **Practical implications**

Our results provide guidance for practitioners as they help to focus development and resource decisions in complex transformation projects. The topics synthesize activities for developing the ecosystem of a platform that can be regarded as a design framework. This framework might constitute a playbook for supporting practitioners in the examination of a digital transformation toward a platform.

#### **Originality**

Given the importance of designing platforms in both academia and practice, the purpose of this study is to synthesize the current research findings on platforms and to provide a framework with possible design topics under consideration from a business ecosystem perspective.

*Keywords: Digitalization, Digital Platform, Ecosystem Design, Supply Chain, Literature Review.*

# 1 INTRODUCTION

Digitalization of the economy has engendered a proliferation of digital platforms (DPs) and intricate business ecosystems (BEs). In the current digital era, companies must leverage these DPs and BEs effectively to remain competitive and adeptly navigate the rapidly changing market conditions. The relevance of these concepts is rooted in their ability to support firms in generating and capturing value through amplified collaboration and co-creation with other organizations and stakeholders (Adner, 2017; Jacobides *et al.*, 2018; Lusch and Nambisan, 2015; Wagner, 2021). The shift toward value-creating networks (Jacobides *et al.*, 2018; Prockl *et al.*, 2017; Stevens and Johnson, 2016), has persisted, resulting in co-creation processes – facilitated by advanced social technologies – that supplant traditional value chains with open knowledge- or skill-based networks. Multiple actors, including individuals, customers, partners, competitors, suppliers, and stakeholders partake in these networks to create value (Jacobides *et al.*, 2018; Jonsson *et al.*, 2021; Prockl *et al.*, 2017; Stevens and Johnson, 2016). This trend has been noted by several authors (Gawer and Cusumano, 2002; Jacobides *et al.*, 2018; De Reuver *et al.*, 2018; Felch and Sucky, 2022).

Consequently, value creation has evolved into a more collaborative and open process (Adner and Kapoor, 2010). A novel perspective on value, value creation, and value extraction, taking into account multiple levels and actors, differentiates ecosystems from conventional value chains and transactional networks (Vargo and Lusch, 2008; Ben Letaifa, 2014). The shift toward BEs relocates value creation from a linear economic process in a specific supply and production chain to a more interconnected, open, and emergent process that involves multiple actors, including customers and competitors (Ben Letaifa, 2014; Adner, 2017). This process provides opportunities for cross-border and cross-industry collaboration (Porter and Heppelmann, 2014) and facilitates access to open resources for companies of all sizes (Nambisan *et al.*, 2017; Felch and Sucky, 2022). The integration of resources between actors creates value for themselves and the ecosystem (Wieland *et al.*, 2012). In the context of networked and interconnected communities, traditional silos within and outside organizations are no longer feasible (Ben Letaifa, 2014). Digitalization, DPs and data-driven services are paving the way for a paradigm shift in supply chain management (SCM), leading to more self-organizing and self-optimizing ecosystems (Alexander *et al.*, 2022; Frederico *et al.*, 2019; Jonsson *et al.*, 2021; Pflaum *et al.*, 2022; Prockl *et al.*, 2017). To facilitate the development and delivery of value in today's complex ecosystems, future studies may explore design issues (Felch and Sucky, 2022; Fink *et al.*, 2022; Helfat and Raubitschek, 2018; Porter and Heppelmann, 2014; Goertler *et al.*, 2023). The effective utilization of these concepts is crucial for companies that seek to remain competitive in today's volatile, uncertain, and complex digital economy, and they must embrace innovative technologies and DPs and establish strategic partnerships and collaborations in order to succeed. Therefore, the purpose of this study is to devise a framework that can aid both organizations and scholars in accurately characterizing the BE centered on a digital platform (DP). This framework functions as a tool for identifying the configuration of the ecosystem and its corresponding manifestations, while simultaneously reducing the intricacy of the design process. The review question is as follows: *What topics should be considered when designing the business ecosystem of a digital platform?*

In an effort to address the research inquiry, a systematic literature review (SLR) was performed (Cooper, 2017). The review was focused on 22 publications containing insights into DPs. These insights were then utilized to amalgamate related research findings and to create a framework that facilitates the design of a DP ecosystem. We structure the remainder of our paper as follows: Section 2 summarizes the conceptual background of our study. In the subsequent

sections we present the methodology and summarize the results of our review. We conclude our paper with a discussion of the findings and ideas for further research.

## 2 CONCEPTUAL BACKGROUND

### 2.1 On Supply Chains and Business Ecosystems

Supply chains are understood in the classic definition of Mentzer *et al.* (2001, p. 4) as “*a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, financial resources, and/or information from a source to a customer*”. In this context, supply chains were initially depicted as a series of process steps to transform raw materials into final products, with these steps increasingly being carried out by multiple suppliers over time (Legenvre *et al.*, 2022). Thus, supply chain governance has gained strategic importance, whereby competition has been understood as rivalry between entire supply chains and not just between companies (Ketchen Jr. and Hult, 2007). More recently, network theory has added a mix of performance factors, such as reliability and flexibility, to the view of supply chains as networks (Ketchen Jr. and Hult, 2007; Stevens and Johnson, 2016).

While SCM was originally described as the management of relationships with suppliers and customers, with the goal of achieving superior customer value at lower cost for the entire supply chain (Christopher, 1998, 2016), current views are moving away from a static view toward a concept that takes into account the volatility and complexity surrounding companies in today's business environment (Christopher and Holweg, 2017; Richey *et al.*, 2022). The importance of information and communication technologies (ICTs) also has a strong impact on SCM (Choi *et al.*, 2022; Ivanov *et al.*, 2021; Pflaum *et al.*, 2018). Digitization of supply chains through ICTs enables information sharing, collaboration, and communication via DPs, which in turn leads to increased reliability, agility, flexibility, and effectiveness (Attaran, 2020; Khan *et al.*, 2021). DPs play a critical role in this context (Pan *et al.*, 2021), as they bring together all of the operational processes (e.g., procurement, production, logistics, or distribution), supply chain flows (e.g., physical, information, and financial), and supply chain actors (e.g., suppliers, producers, or customers) on the platform (Attaran, 2020; Ivanov *et al.*, 2022). A BE approach is shown to be suitable for such a dynamic environment. Such an approach implies a community consisting of different levels of interconnected participants that are interdependent for their mutual effectiveness and survival and which thus share their fate (Iansiti and Levien 2004). The goal of BEs is to collectively create value in ways that a single actor would not be able to (Adner, 2006). Therefore, a BE focuses on customer value created by combining complementary products and services (Felch and Sucky, 2022). Companies bundle their individual offerings into a coherent, customer-centric solution (Adner, 2006). The interaction of the different providers results in the total benefit (Burgin and Meissner, 2017; Ennen and Richter, 2010); in other words, the value of combining the products is higher than if the products were purchased individually (Nalebuff and Brandenburger, 1997). The increasing relevance of ecosystems may also be due to the ongoing digitization, the expansion of DPs, and the rapid development of advanced ICTs (Gawer and Cusumano, 2002; Jacobides *et al.*, 2018; Felch and Sucky, 2022; Goertler *et al.*, 2023). Consistent with Pflaum *et al.* (2022), we believe that DPs, in combination with data-driven services, pave the way for a paradigm shift in SCM, leading to more self-organizing and self-optimizing ecosystems, which is why the exact description of the ecosystem structure is necessary.

The ecosystem-as-structure approach developed by Adner (2017) serves as a perspective that explains the structure of interdependent value-creation activities (Adner, 2017) within dynamic

environments. Using this conceptual framework, the alignment of activities, actors, positions, and connections within an ecosystem can be characterized (Adner, 2017). Thus, the focus of this perspective is on the value-creating activities, which fits our research objective. Therefore, we use the following definition of a BE: “*The alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize*” (Adner, 2017, S. 42). According to Adner's (2017) ecosystem-as-structure approach, four key elements of structure are vital to capturing the value proposition of a BE. The first element pertains to *activities* that outline the individual actions necessary for value creation (Adner, 2017). *Actors*, the second element, are the entities that perform activities, with a single actor being capable of performing multiple activities, and vice versa (Adner, 2017). *Positions*, the third element, denote where actors are situated in the activity flow and indicate who transfers to whom (Adner, 2017). Finally, *links* refer to transfers between actors, which are independent of the focal actor, meaning the actor from which the analysis is conducted, as specified by Adner (2017). The aforementioned four elements delineate the design for creating value in the interdependent collaboration of the BE that underlies a value proposition. This ecosystem-as-structure approach follows a specific order and starts with the value proposition, then considers the activities required to achieve it, and ends with the actors that need to be aligned (Adner, 2017). The approach explicitly extends the strategic perspective to activities and actors over which the focused organization may have no control and with which it has no direct contact, and it depicts the actors and activities that are essential in realizing the value proposition (Adner, 2017). Since this is inherently the case within SCM, Adner's (2017) framework was selected for this study.

## 2.2 Digital Platforms

The flourishing of digitalization has rendered the availability of a significant volume of information and knowledge crucial to the success of businesses (Porter and Heppelmann, 2014; Van Alstyne *et al.*, 2016). In order to thrive in the context of increasing volatility, uncertainty, and complexity, companies must be capable of exhibiting a high degree of adaptability. The ability to make informed, high-quality decisions in response to rapidly changing business units or technologies can be facilitated through the configuration of an appropriate BE (Adner, 2006, 2017; Ben Letaifa, 2014; Adner and Kapoor, 2010; Jacobides *et al.*, 2018). This BE also mandates that companies adopt innovative technologies and DPs for data collection, integration, and utilization, as well as pursuing opportunities for growth, in order to remain competitive (Subramanian *et al.*, 2011). Platforms are not a new concept and have been around for years (Van Alstyne *et al.*, 2016; Zhu and Furr, 2016; Rietveld and Schilling, 2021). However, recent decades have witnessed a huge transformation, with the rise of ICTs reducing the need for physical infrastructure and assets (Van Alstyne *et al.*, 2016; Vaska *et al.*, 2021). These technologies make it easier and more cost-effective to build and expand platforms, enhance network effects through simplified participation, and enable the capture, analysis, and evaluation of vast amounts of data, increasing the platform's value for all participants (Van Alstyne *et al.*, 2016). Unlike traditional businesses that create content, DPs provide an infrastructure for market participants, facilitating the exchange of products or data-driven services between these participants (Gawer, 2021; Van Alstyne *et al.*, 2016; Liu *et al.*, 2021; Zhu and Furr, 2016). The central role of these DPs is to enable and mediate interactions between market participants, creating value for all involved parties (Rochet and Tirole, 2006; Parker *et al.*, 2016; Liu *et al.*, 2021; Goertler *et al.*, 2023). In this regard, a platform business can be defined as a business that facilitates value-creating interactions between external producers and consumers through the provision of an open and participatory infrastructure and governance conditions (Parker *et al.*, 2016). The overarching goal of such a DP is to match users and facilitate the exchange of goods, services, or social currency, thereby enabling value creation for all participants (Parker *et al.*, 2016). The contemporary marketplace is being shaped by the

proliferation of DPs and the corresponding ecosystem. Recent years have witnessed a trend toward the increasing prevalence of DP markets as venues for economic activity, as evidenced by a growing body of literature (Liu *et al.*, 2021; Rietveld and Schilling, 2021; Kretschmer *et al.*, 2022). Competition in this new arena is no longer solely about mastering the value chain: it is about attracting generative activities related to a DP (De Reuver *et al.*, 2018) and fostering interaction between disparate participants within the BE (Van Alstyne *et al.*, 2016). Given the importance of DPs and BEs in shaping the business environment and value creation (Alexander *et al.*, 2022; Anderson *et al.*, 2022; Frederico *et al.*, 2019), it is imperative that a thorough examination of their evolution be undertaken. As the field continues to evolve at a rapid pace, the study of BEs has become a critical area of inquiry (Fink *et al.*, 2022; Wagner, 2021).

### 3 RESEARCH DESIGN AND METHODOLOGY

To support our research focus, we performed a systematic literature review in line with Cooper (2017) to identify relevant literature from the scientific community. The methodical steps are illustrated in Figure 3.1 and outlined as follows.

Problem Formulation					
RQ: What topics should be considered when designing the BE of a DP?					
Locating Publications					
Search string	(smart* OR digital* OR iot* OR *sided* OR cloud*) AND (platform* OR market*) AND (taxonom* OR typolog* OR classif*)				
Academic databases		Ebsco	AISeL	Web of Science	Science Direct
	Title	18	5	231	596
	Keywords	15	9		
	Abstract	1,434	193		
	Σ Database	1,467	207	231	596
	Σ Total	2,501			
Screening of Search Results and Article Selection					
Exclusion criteria	Duplicate removal	2,152			
	Limitation to English language	2,024			
	Journal ranking (ranked in VHB or ABS)	478			
Inclusion criteria	DP BE design relevance in title, abstract, full text, as well as sufficient research method	13			
Sample after forward and backward search		10			
Final sample		23			

Figure 3.1: Systematic literature review following Cooper (2017)

#### 3.1 Problem Formulation

In line with Cooper's (2017) suggestion, we began our literature review by formulating a review question: *What topics should be considered when designing the BE of a DP?*

#### 3.2 Locating Publications

In accordance with Cooper (2017), we defined four academic databases for our literature search: EBSCO host, Web of Science, ScienceDirect, and AISeL. These databases are widely used for literature reviews (Fan and Stevenson, 2017; Cooper, 2017) and were selected to uncover DP design-related publications from both business and information systems domains. To focus on design topics for DPs, we used a search string combining three keyword clusters and applying the Boolean operators AND and OR, along with truncations (Cooper, 2017): (*smart\**, *digital\**, *iot\**, *sided*, *cloud\**) AND (*platform\**, *market\**) AND (*taxonom\**, *typolog\**, *classif\**).

The search string reflects commonly used DP synonyms, such as multi-sided or two-sided markets (Asadullah *et al.*, 2018). As our focus lies on the identification of design topics for platform BEs, we tried to capture relevant design topics through a focused search with a specific search string. This means we did not focus on a general search for platform BEs (general research level), as the literature already provides a huge amount of publications on this topic. Instead, we tried to focus our search on the identification of specific design topics from the beginning of our study. In other words, the level of analysis was below the generic level of a platform BE. Our search using the string in the title, abstract, and keywords of the four databases produced 2,501 hits.

### **3.3 Screening of Results and Article Selection**

We took three steps to filter the initial list of studies to find those that provide valuable information for solving the problem (Cooper, 2017). First, we eliminated duplicates, reducing the list to 2,152 unique hits. Next, we established criteria to assess the quality of the remaining hits and decided which ones to include in our synthesis (Cooper, 2017). Exclusions included studies not written in English, non-academic sources such as non-scientific conference papers, and journals with poor academic quality (as determined by ABS or JOURQUAL guidelines). This resulted in a list of 479 high-quality publications. Finally, we thoroughly examined each publication's title, abstract, and full text for relevance and quality, and we conducted a forward and backward search in line with Webster and Watson (2002), resulting in a final sample of 23 relevant and high-quality publications. These articles are indicated in the references (see \*).

### **3.4 Analysis and Synthesis of Publications**

We analyzed the selected publications for relevant design aspects and used the BE framework according to Adner (2017) to structure our synthesis of the findings. By conducting a qualitative content analysis, following Mayring (2019), we identified design recommendations and related topics from the publications. The authors synthesized these topics with reference to the key elements of ecosystem structure (*activities, actors, positions, links*), and we collaborated to ensure the reliability and validity of the synthesis. In the following sections we present the results of our descriptive and content-related analysis.

## **4 RESULTS**

### **4.1 Descriptive Analysis**

The identified final sample consists of eleven conference papers, nine journal publications, two reports, and one book chapter. Conferences considered include the European Conference on Information Systems, the International Conference on Advanced Information Systems Engineering, the Hawaii International Conference on System Sciences, the International Conference on Engineering, Technology and Innovation, and Wirtschaftsinformatik. The *European Management Journal*, the *Journal of Management Information Systems*, *Information Systems and e-Business Management*, the *International Journal of Conceptual Modeling*, *Research Policy*, *Computers & Industrial Engineering*, *Enterprise Information Systems*, *Sinergie Italian Management Journal*, and the *Vietnam Journal of Computer Science* constitute the source for the nine journal papers.

Examination of the publication frequency over the course of several years has led to the conclusion that, with the exception of two papers, all publications concerning DP BE configuration options were disseminated between 2016 and 2021. This finding indicates a

modest but discernible escalation of scholarly interest in the aforementioned subject matter within the past seven years, as illustrated by Figure 4.1 in the online appendix. In addition, examining the nature of publications reveals a predominance of conceptual approaches, with nine papers developing a taxonomy, three a typology, three a classification (framework), and two an architecture.

## 4.2 Content-related Analysis

Figure 4.2 synthesizes our results and offers a comprehensive overview of the design topics identified for each key element. The subsequent section delineates these findings in detail.

1 Activities	<div data-bbox="461 600 722 663">1.1 Integration of complementors</div> <div data-bbox="461 674 722 736">1.2 Offer preparation by complementors</div> <div data-bbox="461 748 722 808">1.3 Incentives for participation</div>	<div data-bbox="751 600 1015 663">1.4 Establishment of trust</div> <div data-bbox="751 674 1015 736">1.5 Asset structure and ecosystem design</div> <div data-bbox="751 748 1015 808">1.6 Governance decisions</div>	<div data-bbox="1043 600 1305 663">1.7 Centrality decisions</div>
2 Actors	<div data-bbox="461 819 722 882">2.1 Platform participants</div> <div data-bbox="461 893 722 956">2.2 Platform operator</div>	<div data-bbox="751 819 1015 882">2.3 Key partners</div> <div data-bbox="751 893 1015 956">2.4 Resource owner</div>	
3 Positions	<div data-bbox="461 976 722 1039">3.1 Access to resources</div> <div data-bbox="461 1050 722 1113">3.2 Strategic positioning</div>	<div data-bbox="751 976 1015 1039">3.3 Geographical coverage</div>	
4 Links	<div data-bbox="461 1133 722 1196">4.1 Relation among platform participants</div> <div data-bbox="461 1207 722 1270">4.2 Interaction behavior of platform participants</div>	<div data-bbox="751 1133 1015 1196">4.3 Marketplace</div>	

Figure 4.2: Overview of design topics identified for each key element of structure

### 4.2.1 Activities

According to Adner (2017), the initial key element of structure is referred to as *activities*. Adner (2017) positioned the value proposition as the cornerstone of the ecosystem, establishing it as the proposed value proposition that sets the endogenous boundary for the pertinent ecosystem. In our literature analysis we were able to identify the following topics as activities: integration of complementors (1.1), offer preparation by complementors (1.2), incentives for participation (1.3), establishment of trust (1.4), asset structure and ecosystem design (1.5), governance decisions (1.6), and centrality decisions (1.7).

The integration of complementors (1.1) describes the extent to which complementors are integrated into the ecosystem and how the access restrictions of the DP are constructed. Complementors can be completely excluded, manually selected, or admitted based on specific access conditions (Kazan *et al.*, 2018; Geske *et al.*, 2021; Abendroth *et al.*, 2021; Blaschke *et al.*, 2019; Zutshi and Grilo, 2019; Hodapp *et al.*, 2019). In addition, it is also possible for a DP to be open to complementors in general (Abendroth *et al.*, 2021). Integrated complementors thus have the opportunity to contribute certain offers to the DP to achieve the common purpose (Geske *et al.*, 2021). Examples of offer preparation by complementors (1.2) include resources, interactions, technologies, services, and combinations thereof (Kazan *et al.*, 2018; Geske *et al.*,

2021; Abendroth *et al.*, 2021; Iasevoli *et al.*, 2018; Perscheid *et al.*, 2020; Rix *et al.*, 2020). Other design topics for the key element *activities* are incentives for participation (1.3) and the establishment of trust (1.4). The incentives created by the DP are intended to motivate actors to participate in platform activities and – according to the literature – can be monetary or non-monetary in nature (Abendroth *et al.*, 2021; Rix *et al.*, 2020). However, a certain foundation of trust is necessary to achieve stakeholder participation, and this trust needs to be established for the technologies used, for the DP itself, as well as for the encompassing community (Zutshi and Grilo, 2019; Perscheid *et al.*, 2020). Asset structure and ecosystem design (1.5) describes the general structure of the DP and, according to the literature, is based on two different aspects. Thus, the platform is composed of its own asset structure and the ecosystem surrounding the DP (Evans and Gawer, 2016). In terms of asset structure, it shows how much access a company has to the necessary resources to create the value proposition and, in contrast, how much dependence it has on other companies that can provide access to the necessary resources. Gawer (2014) also addressed governance decisions (1.6). In today's business environment, which is characterized by growing uncertainty, increased complexity, and high dynamics, it is even more important for companies to achieve efficient regulation and flexible governance. Governance provides the legal and factual framework for DPs to manage and monitor an organization. This is followed by decisions relating to centrality (1.7). This deals, for example, with decisions regarding platform strategies, which can be either centralized or hierarchical, or decentralized or market-driven (Perscheid *et al.*, 2020; Derave *et al.*, 2020; Derave *et al.*, 2021). Numerous intermediate forms also exist in this context, with parts of the DP organized centrally and others de-centrally (Abendroth *et al.*, 2021; Stahl *et al.*, 2016; Wang and Archer, 2007; Staub *et al.*, 2021; Perscheid *et al.*, 2020).

#### 4.2.2 Actors

As posited by Adner (2017), *actors* are the entities that carry out the activities. Given that diverse actors may hold distinct viewpoints and intentions regarding the composition of the set of partners, a collaborative value-creation endeavor serves as a common objective for all actors involved in the ecosystem (Adner, 2017). By means of our review, the following topics could be identified for actors: platform participants (2.1), platform operator (2.2), key partners (2.3), and resource owner (2.4).

Platform participants (2.1) basically comprise producers and consumers (Iansiti and Levien 2004; Van Alstyne *et al.*, 2016). In this context, platform participants refer, on the one hand, to basic types of business relationship between actors – B2B, B2C, C2C, P2P – or other participants (Derave, 2019; Derave *et al.*, 2020; Täuscher and Laudien, 2017, 2018; Hodapp *et al.*, 2019; Derave *et al.*, 2021; Perscheid *et al.*, 2020; Rix *et al.*, 2020). On the other hand, market participants (Fruhirth *et al.*, 2020), platform participants (Täuscher and Laudien, 2018; Staub *et al.*, 2021), customer types (Hodapp *et al.*, 2019; Rix *et al.*, 2020), or user segments (Täuscher, 2016) describe the potential participant base of a platform ecosystem. In addition to the platform participants (2.1), the forms of expression of the design topic of the platform operator (2.2) are also determined for the key element *actors*. In this respect, the literature distinguishes between small and mid-sized, large enterprises, joint ventures, open-source operators, or mixed forms regarding the platform operator, and their background can be in different industries (Abendroth *et al.*, 2021).

In the design topic key partners (2.3), the most elementary partners of the platform operator are presented. In this context, a differentiation is made between competitors and non-competitors, the method of piggybacking (Osterwalder and Pigneur, 2011; Rix *et al.*, 2020), and significant customers (Rix *et al.*, 2020). Following Rix *et al.* (2020), partnerships have the potential to confer benefits and enhance the appeal of a DP, but they can also result in dependencies that

curtail flexibility. Collaborating with competitors may aid in expediting the attainment of critical mass for existing offerings (Rix *et al.*, 2020), while forging strategic partnerships with non-competitors can facilitate the outsourcing of non-core activities (Rix *et al.*, 2020). Furthermore, smaller firms can leverage piggybacking, namely, partnering with larger companies to leverage their experience or network (Parker and Van Alstyne, 2014). Another potential avenue for advantageous partnerships is with major customers, wherein a firm can secure enduring relationships, improve customer consultation and efficient fulfillment of requests, generate predictable sales, and tailor the DP's offerings to specific requirements (Rix *et al.*, 2020). The resource owner (2.4) takes into consideration ownership of the platform content, where ownership can be held by a private individual, on the one hand, or by a company, on the other (Chasin *et al.*, 2018).

### **4.2.3 Positions**

*Positions* pertain to the arrangement of system actors within the flow of activities, serving to determine the transfer of accountability from one actor to another (Adner, 2017). Following Adner (2017), it is critical for a company, operating within the ambit of its ecosystem strategy, to ensure that its partners occupy the designated positions and fulfill the assigned roles envisioned in the ecosystem strategy. Based on the review, a number of topics could be identified for this key element: access to resources (3.1), strategic positioning (3.2), and geographical coverage (3.3).

The first design topic, access to resources (3.1), can differ at the ecosystem level; in other words, access can, for example, only be granted internally within the company, within the supply chain, or within the entire ecosystem (Gawer, 2014). If companies do not have access to relevant resources because they are otherwise only accessible internally, these companies are increasingly dependent on strategic partnerships and thus also on other actors. Resources are accessible to the supply chain if a company has decided to open up its DP and integrate other actors in the ecosystem. The strategic positioning (3.2) of the DP refers to the initial intended use of the DP. Some DPs have been developed for internal purposes, for example, and are used exclusively for this purpose. Others were originally developed for internal use but are currently also accessible to external participants. In contrast, some DPs have been designed for external use from the beginning (Abendroth *et al.*, 2021). In addition, the design topic of geographical coverage (3.3) provides information about the application and scope of the platform. In this context, the literature distinguishes between regional, national, and international (Abendroth *et al.*, 2021; Täuscher, 2016; Chasin *et al.*, 2018; Evans and Gawer, 2016; Rix *et al.*, 2020). This is particularly relevant with regard to individual market needs or the location of the headquarters of globally operating companies (Evans and Gawer, 2016).

### **4.2.4 Links**

*Links* refer to the transfers of various elements, such as material, information, influence, and funds, across actors in the ecosystem, without necessarily having any direct connection to the focal actor (Adner, 2017). Within the ecosystem-as-structure approach, links are established based on the alignment requirements that generate positions in the overarching value blueprint (Adner, 2017). From our review, three topics were identified as links: the relationship among platform participants (4.1), the interaction behavior of platform participants (4.2), and the marketplace (4.3).

The number of participating users within the types mentioned above in 4.1.2 (B2B, B2C, C2C, P2P) is examined in more detail in the relationship among platform participants (4.1), as the ecosystem design must consider the relationship between producers and consumers for value creation and exchange in specific marketplaces (B2B, B2C, C2C, P2P). Thus, for example, in

a one-to-one or one-sided relationship, only one participant per side can be facing the other (Wang and Archer, 2007). In a many-to-many or multi-sided relationship, on the other hand, a large number of participants sit opposite one another on both sides, with intermediate levels of the two characteristics being, for example, one-to-few, one-to-many, or few-to-few relationships (Derave *et al.*, 2020; Wang and Archer, 2007; Derave *et al.*, 2021; Perscheid *et al.*, 2020). Furthermore, the interaction behavior of the participants also differs, which is described by design topic 4.2. The literature refers to the two possible forms of expression as either collaborative (Rix *et al.*, 2020) or competitive (Staub *et al.*, 2021). The last design topic of the key element, *links*, is the marketplace (4.3), which describes whether a marketplace is offered in connection with the DP (Arnold *et al.*, 2021) or whether the option to application sales channels exists (Hodapp *et al.*, 2019). If this is offered, the forms of the design topic differ between an internal – platform-owned – marketplace and an external – non-platform or outsourced – marketplace (Arnold *et al.*, 2021; Hodapp *et al.*, 2019). For example, firms in a B2B context, such as an automotive OEM, try to establish a platform-owned and company-restricted marketplace to manage global inbound logistics in their ecosystem. Meanwhile, firms that operate at the intersection of B2B and B2C, for example, a technology retailer who also sells related product insurance, follows a non-platform or outsourced marketplace design.

## 5 DISCUSSION AND CONCLUSIONS

The purpose of this study was to contribute to and advance existing research on designing DP-ecosystems in a SCM context by adopting Adner's (2017) ecosystem-as-structure conceptualization. Based on a literature review (Cooper, 2017; Webster and Watson, 2002), the authors synthesized previous work regarding ecosystems and provided further insights into their design. In other words, the literature review revealed design issues that the authors assigned to the ecosystem-as-structure conceptualization of an ecosystem (see Figure 4.2). A content analysis (Mayring, 2019) supported this assignment. Scholars and practitioners can find behind the structural elements *activities*, *actors*, *positions*, and *links* design options resulting from the scientific literature. Further information on this literature can be found in the online appendix.

Regarding Figure 4.2 and our findings, the authors assigned most of the design topics to the structural element *activities* (7 out of 17). This could demonstrate that issues concerning ecosystem activities are frequently addressed by academia. A closer look at the structural element *activities* shows that most activities focus on governing or managing the participation and value co-creation in an ecosystem, such as design topic integration of complementors (1.1), incentives for participation (1.3), establishment of trust (1.4), or governance decisions (1.6). This finding corresponds to other studies, such as Adner and Kapoor (2010), Hannah and Eisenhardt (2018), and Prockl *et al.* (2022), and should therefore be considered by scholars and practitioners in realizing an ecosystem. In comparison with the structural elements of *activities* and *actors*, the authors identified fewer design topics that could be assigned to the structural elements of *positions* and *links* (see Figure 4.2). With the exception of existing studies on platform leaders (for example, Gawer and Cusumano, 2014; Gawer, 2021), this finding could mean that the structural elements *positions* and *links* are less frequently investigated in detail. From the author's point of view, this finding corresponds to the understanding that ecosystems, especially *positions* and *links*, represent a comprehensive and complex unit of analysis (Adner, 2017; Jacobides *et al.*, 2018) and that detailed design topics and related recommendations depend, for example, on the research perspective (focal actor for ecosystem design), value proposition, and industry context. The findings of our study provide some contributions to academia. By applying the ecosystem-as-structure conceptualization of an ecosystem (Adner, 2017), the presented results and Figure 4.2 attempt to provide interesting design topics and thus

help to devise an ecosystem. The authors believe this study contributes to and advances important research on ecosystems in a SCM context (see, for example, Fink *et al.*, 2022; Felch and Sucky, 2022; Jacobides *et al.*, 2018; Prockl *et al.*, 2017; Wagner, 2021). This study structurally synthesizes existing work relating to the design of an ecosystem and has the potential for both demonstrating gaps and aligning avenues for further research. Moreover, the design issues presented provide insights for ecosystem design in various industries. This study also offers practitioners insights for ecosystem development. Figure 4.2 summarizes specific ecosystem design topics and thus supports development and resource allocation in projects for establishing an ecosystem. In other words, the findings of this study and Figure 4.2 represent a possible design framework for developing an ecosystem.

The findings suggests that detailed design topics and related recommendations for ecosystem design depend on the research perspective, value proposition, and industry context. This implies that there may be a need for more research to explore the various perspectives, value propositions, and industry contexts that can influence ecosystem design. A possible question could be how do different research perspectives, value propositions, and industry contexts impact ecosystem design, and what are the most effective strategies and approaches for designing ecosystems that are tailored to specific contexts and stakeholder needs? In addition, the existing framework used to study ecosystem design can be extended by adding further dimensions. One possibility is to add a temporal dimension to explore how ecosystem design topics change over time in response to market, technological, and social conditions and investigate the effectiveness of different ecosystem designs in different stages of the ecosystem's life cycle. Another option is to add a cross-industry dimension to examine how ecosystem design differs in industries with different market structures, levels of technological innovation, regulatory environments, and cultural contexts. Additionally, future research can explore how ecosystem performance can be measured and optimized, and how different design choices may impact ecosystem outcomes such as innovation, growth, and profitability.

However, this study suffers from some limitations. The literature review conducted depends on the quality and performance of the scientific database used. The authors considered publications with a certain string [(*smart\**, *digital\**, *iot\**, *sided*, *cloud\**) AND (*platform\**, *market\**) AND (*taxonom\**, *typolog\**, *classif\**)] in the title, keywords, or abstract. Readers should not rule out the possibility that there are publications available that discuss the unit of analysis but which do not contain this string. The authors also believe that more research is required to detail our understanding of the design of an ecosystem in an SCM context. The authors identified a number of design topics in the structural elements of *activities* and *actors*; however, they identified fewer topics in the structural elements of *positions* and *links*. Consequently, avenues for further research might focus especially on these structural elements and point out ecosystem-related design topics. In other words, scholars could examine which roles and positions are suitable for certain companies of a specific industry. Considering the life cycle of an ecosystem, scholars could also investigate how strategic positioning and related links change over time. They could also address the issue of resilience (Wieland and Durach, 2021) and analyze how the links of an ecosystem could be dynamically managed in terms of disruptions. Moreover, researchers could investigate possible interdependencies between the design topics presented. Finally, the study did not focus on a certain industry. Thus, the presented design topics could be specified to a certain industry, such as chemicals, manufacturing, or healthcare.

## 6 ONLINE APPENDIX

The online appendix is available at <https://figshare.com/s/86905d5102bac2d6570f>

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