

Review

Unraveling Platform Strategies: A Review from an Organizational Ambidexterity Perspective

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Academic Editor: Barbara Aquilani

Received: 14 March 2017; Accepted: 20 April 2017; Published: 2 May 2017

Abstract: Platform strategies, which highlight the interdependence in and evolution of business ecosystems, are increasingly relevant for sustainable business models in the digital era. So far, platform research has existed as a fragmented body of insights from different fields, but an integrated theoretical perspective can lead to a more coherent understanding of the research overall. Organizational ambidexterity emphasizes the balance between exploration and exploitation, which is particularly conducive to understanding the sustainability of a firm. Using an organizational ambidexterity perspective, the authors analyze five platform strategies: pricing, openness, integration, differentiation, and envelopment. This paper provides a systematic review of the theoretical and empirical studies in leading management, economics, and information systems journals from 2000 to 2016. The findings show that platform strategies can help platform owners achieve ambidexterity by domain, temporal, and organizational separation. Finally, this paper proposes an agenda for future research.

Keywords: platform strategies; pricing; openness; integration; differentiation; envelopment; organizational ambidexterity

1. Introduction

Platform ecosystems have had a far-reaching impact on businesses over the last two decades. Subsequently, platforms are becoming ubiquitous in many industries, such as smartphones and apps [1], video consoles and videogames [2], and personal computers and software [3]. Platforms allow firms to create new interdependencies that make the task of designing a successful platform strategy more complex [4–6]. A platform-based strategy has the potential to increase a firm's competitive sustainability [7]. Driven by same-side and cross-side network effects, platform ecosystems feature inherent self-enhancing mechanisms. Once a platform starts a virtuous cycle, the positive feedback loop among different sides of users can help the platform sustain its user base growth and engagement.

Platform strategies have become a relevant and frequent topic in the literature over past two decades. Researchers from different fields have investigated platform strategies using many theoretical perspectives, empirical contexts, and methods (as shown in Appendix A). Specifically, platform research has emerged in strategic management, industrial organization, production and innovation, and information systems (IS) [8–10]. In this respect, recent research has identified the platform strategies of different platform owners and their consequences [11,12]; however, the diversity within these various fields has led to fragmented and isolated insights. The domain specificity of the results

makes it difficult to generalize them in a broad context [13]. Thus, a more integrated understanding of these insights on platform strategies is needed.

The purpose of this paper is to review the literature on platform strategies from a single, consistent perspective. Specifically, we aim to identify the essential tensions regarding platform strategies, and then we will analyze how to balance them within platform ecosystems. Divergent decisions regarding platform ecosystems may lead to vicious cycles that expel platform owners from the market [14]. For example, focusing on efficiency by standardization may result in a lack of variability, which could impede the sustainable evolution of platform owners. Thus, platform owners need to be able to identify and balance the tensions of specific platform strategies. We argue that organizational ambidexterity (OA), an interdisciplinary perspective, is the proper tool for integrating insights in platform strategies research. The OA perspective emphasizes the trade-offs between exploration and exploitation, both industry-specific terms that will be defined presently [15,16], and this emphasis helps individuals to understand tensions within platform strategies. Meanwhile, the literature concerning OA has explained domain, temporal, and organizational separation as ways to balance exploration and exploitation [17], inspiring platform owners to manage strategic tensions feasibly. Thus, these perspectives provide the background for explaining more clearly the sustainable, competitive advantage of emerging platform ecosystems.

Based on the OA perspective, we study how platform owners can explore and utilize resources and capabilities through platform strategies, and we address the management of tensions in strategies through different separations. We also identify the research questions that guide our proposed future agenda. To that end, we have reviewed papers from significant journals in the fields of management, economics, and IS. This paper identifies five platform strategies, extracts relevant contributions on each strategy, and explains the current state of the field in structural terms. As a result, our article makes three main contributions. First, to the best of our knowledge, this paper is among the first attempts to provide a holistic review of platform strategies. After nearly twenty years of platform research, recent papers have only provided different classifications of platforms based on diverse streams [8–10]. This paper takes a step forward by analyzing platform strategies investigated separately by scholars across the fields of strategic management, technological and innovation management, and the economics of industrial organization. Second, we contribute to platform literature by providing an integrated analysis of the insights on platform strategies from the OA perspective. This paper is unique because it offers an academic background connecting isolated insights through the interdisciplinary, broadly-accepted OA perspective. In this respect, researchers from different fields may benefit from a wider view of the various platform strategies. Third, by developing potential research questions, we provide a future agenda that platform researchers can use as a foundation for making new contributions.

The paper is organized as follows: first, we introduce the OA perspective as a theoretical tool for the review, the methodology for which is explained in the following section; next, we discuss the main findings of platform strategies; finally, we propose an agenda for future research and conclude our findings.

2. Theoretical Background

Platforms have been studied in many diverse contexts, and their definitions vary among different research streams [10]. In the field of economics, a platform means two-sided or multi-sided markets where two or more sides with cross-side network externalities can interact [18,19]. Different from a linear value chain, both sides of a platform can incur costs and accumulate revenue. The product or technology innovation literature defines a platform as the core module of a system that outsiders can easily connect to and build upon in order to expand the system of use [20,21]. As a core module, a platform not only performs the essential functions of the ecosystem but also establishes interface rules. This also appears in the business economics definition: A platform is a nexus of rules and architecture that exhibits network effects [22]. It must be open such that third parties can exchange value and it must

have governance such that participants abide by the rules [23,24]. A platform's ecosystem includes the partners who adhere to the rules as well as the competitors who do not. The above-mentioned definitions, developed in the economics or in the product and technology literature, fulfill the notions of a platform discussed here. Our review focuses on strategies of platform owners as distinct from those of supply- or demand-side partners. Among extant research, five platform strategies—pricing, openness, integration, differentiation and envelopment—have attracted the most attention; however, as previously discussed, extant research is disjointed, creating the need for a holistic review.

2.1. OA Theory

OA is an interdisciplinary theory that, consequently, has been applied to a wide range of fields since James March's [16] article in 1991. OA research focuses originally on organizational learning [25] and has been extended to innovation and strategic management [26–29]. Specifically, exploration and exploitation can be directly linked to sustainability from different perspectives [30]. From a stakeholder's orientation, sustainability requires identifying existing stakeholders, assessing their needs, and exploring the new needs and expectations of stakeholders. Regarding process management, a sustainable firm has to improve its existing processes continuously while also exploring new ways to improve them. From the angle of products and services design, sustainability requires making incremental improvements to existing products and services and seeking opportunities to develop new products and services. In relation to learning, a sustainable firm has to train and upgrade employees' current skills frequently while developing new knowledge.

Research on OA is characterized by assessing the balance between exploration and exploitation, which is particularly beneficial to firms focused on sustainable practices [30–32]. A firm's capability to formulate and implement paradoxical strategies is necessary in achieve business sustainability [33]. Specifically, the exploration approach can facilitate value creation while assuring value capture [15]. Firms inadequately seeking exploration may suffer the costs of experimentation without gaining many benefits, and firms inefficiently pursuing exploitation may depend excessively on existing resources while remaining vulnerable to environmental change [15,34]. Thus, firms capable of dynamically balancing exploration and exploitation can survive and thrive in both the short term and the long term.

This paper focuses on analyzing the exploration- and exploitation-oriented components of every platform strategy. Drawing on existing OA literature addressing strategic management [27,28], we define exploitation within platform strategies as the set of practices that leverage, refine, and extend existing resources and capabilities. In contrast, exploration pertains to practices that develop new resources and capabilities, including existing knowledge bases and markets. Sustainability practices must correspond with the needs of the environment while organizational ambidexterity is influenced by the environment. In the case of a highly stable environment, a firm can focus on efficiency improvement. When facing a changeable environment, a firm can emphasize innovation and the exploration of new opportunities [30]. A firm cannot be isolated from its environment, but it should interact with its environment. In an inter-firm network, a firm has access to resources and capabilities from related firms. Since integrating external resources can contribute to organizational ambidexterity [35], a firm's network position, such as centrality and the diversity of its ties, can influence its ambidexterity [31].

As our review indicates, OA literature has cumulatively identified three ways to cope with the trade-off between exploration and exploitation: organizational, temporal, and domain separation [15,17]. Through organizational separation, a firm can realize exploitation and exploration goals simultaneously while maintaining distinct organizational units, i.e., one organizational unit dedicated to exploration and another organizational unit dedicated to exploitation. With temporal separation, exploration and exploitation sequentially shift in the same organization, as when a firm applies both practices at different points in time. Domain separation means that an organization can separate exploration and exploitation across domains, simultaneously exploring one domain and exploiting another [36].

2.2. OA Perspectives for Platform Strategies

The OA perspective provides the theoretical background allowing us to investigate platform strategies for the following reasons. First, platform strategies involve compromises between otherwise divisive approaches, which may have either an orientation toward exploration or exploitation [18]. For example, the openness strategy has to manage the trade-off between closed and open platforms. Further, opening a platform can secure third-party participation and contribution, thus exploring new market opportunities. Closing a platform can protect the platform owners' exploitation of internal resources. In this way, platform owners face managing the delicate balance between exploration and exploitation.

Second, in a platform ecosystem, agents are interdependent and resources are shared to a large extent. It is common for platform owners to access and leverage external resources and capabilities owned by other agents in a platform ecosystem. In line with an extended resource-based view [37], resources and capabilities as discussed herein are not limited to meaning the internal resources of a firm but may also include external resources. This broader view of resources coincides with the fact that platform owners compete at an ecosystem level, which means that the success of their platforms depends on an ecosystem's, rather a platform's, resources. Therefore, platform owners should balance exploration and exploitation approaches with both internal and external resources.

Third, a platform strategy usually involves several sides or domains in an ecosystem, suggesting that domain separation may be a choice; in fact, a platform owner can simultaneously explore in one side or domain and exploit in another. For example, a platform owner can move into a new platform market by leveraging an existing platform market. In such cases, the platform owner can maintain a successful balance between exploring new market opportunities and exploiting resources in an existing market.

Fourth, during the lifecycle of a platform, platform owners may employ existing strategies in different ways [38]. For example, a platform owner may launch a platform by subsidizing one or even two sides of a platform. When the installed base reaches critical mass, an owner may decide to extract revenue from selected parties. This means that platform owners can achieve ambidexterity in a sequential model.

3. Methods

Our review covers the fields of management, economics, and IS between 2000 and 2016. Our reason for selecting this period of time is that the turn of the twenty-first century witnessed the emergence of two-sided market and platform research [39,40]. We collected sample papers published in academic journals catalogued in the Social Sciences Citation Index (SSCI). Then, we adopted a multi-stage approach to identify the final sample. To do this, we first searched for papers with titles, abstracts, or keywords containing the terms "platform", "two-sided market" and "multi-sided market." This step resulted in a preliminary sample size of 1812 papers over sixteen years. Second, to be sure that selected papers were both relevant and significant, we filtered our search by specific journal and number of citations. Regarding the journal filter, we focused on the top twenty academic journals in terms of impact factor in the SSCI ranking. We obtained ninety-nine papers in management journals, fifty papers in economic journals, and thirteen papers in IS journals by using this filter. Given that some journals are multidisciplinary, some papers are necessarily categorized in several different fields. As well, we sorted the papers by their total number of citations in order to identify those papers that had a consolidated influence. Since the number of relevant papers published has increased since 2008, we also ranked papers by average citations per year in order to locate the most significant papers published recently and to obtain a direction for future research. Consequently, we collected the top one hundred papers in terms of total citations and the top one hundred papers in terms of average citations per year. As a result of using the journal and citation filters (and, then, deleting duplicates), we arrived at a total of 230 papers. The papers are distributed as follows: 165 papers in management journals, sixty-seven papers in economic journals, and twenty-nine papers in IS journals.

Next, we adopted the definition of a platform explained in section two as a filter to eliminate papers not fitting within these parameters. To apply this concept filter, the authors read the abstracts of the pertinent 230 papers and made judgements based on their fitness separately. In any cases of discrepancies on the fitness of a paper, we examined the full text of the paper together in order to reach a consensus. In this process, we also eliminated papers discussing platforms generally in line with our notions but not focusing primarily on the strategies of platform owners, such as conduct of demand-side and supply-side agents. As a result of going through the process of creating and implementing a concept filter and completing our sample with suggestions from experts in the field, we reached a final list of 109 references. The final sample consisted of seventy-eight papers in management journals, twenty-six papers in economic journals, twenty-one papers in IS journals, and six other relevant references, such as books. This sample reflects the heterogeneity of perspectives contributing to platform research and different evolutions over time. Specifically, in economics and IS, the interest toward platform topics began earlier and has expanded progressively; in management, this attention gained focus in 2008, but the number of papers in the field has increased faster than we can review. In short, the origin of platform research is in economics and IS, and this research also has been extensively developed by researchers in management.

We adopted a concept-centric approach in synthesizing the literature that consists of compiling a concept matrix including the selected papers and extracting the main insights from each domain [41]. In crafting this matrix, all the papers were first read separately by the authors, and each author captured the following information from sample articles: research questions, key platform strategies, methodology, industry, findings, and future agenda. Each paper was permitted to make contributions to more than one strategy. Second, the authors of this review compared and combined their findings. Whenever discrepancies arose, the authors exchanged ideas in order to reach a common ground. Third, the authors separately reread the sample articles and applied the OA perspective to analyze platform strategies. We identified the exploration and exploitation components of every platform strategy in detail. Then, we extrapolated information from the conclusions concerning how a platform owner can leverage ambidexterity in light of three separation mechanisms: sequential, organizational, and domain separation.

4. Findings

We identified five main categories into which the insights from platform literature may be classified: pricing, openness, integration, differentiation, and envelopment. Pricing and openness are the most popular platform strategies in the literature, especially in economics and IS. Differentiation and integration are increasingly attracting the attention of researchers mostly in economics and management. Finally, we highlighted a platform strategy called envelopment, which can be understood as a multi-platform strategy.

4.1. Pricing

Platform-oriented literature emphasizes the complexity in and importance of pricing strategy in platform ecosystems. The interdependencies among platform participants and the lifecycle of platform ecosystems make pricing decisions exceedingly complex [19,38,42]. Pricing decisions greatly impact the size of customer bases, which are considered to be critical resources in network industries [9,43]. Based on pricing decisions, the literature has explained why some platforms have achieved exceptional market shares through virtuous cycles and why many firms have failed in this area [18,44,45].

To increase the installed customer base, platform owners can take advantage of asymmetric cross-network effects by subsidizing, i.e., keeping the price of one side below the price that would be charged in the absence of network effects [42,45,46]. Subsidies may also take the form of free information (at zero marginal cost) [42,47], privileged access to certain performance characteristics [48], and technical support [42]. In fact, under strong asymmetric network effects, platform providers may succeed by providing free goods to their customers [49]. Determining which side is to be subsidized is

critical for the success of a platform. The relevant literature finds that it is determined by own-price and cross-price elasticity of demand [42], quality sensitivity [18], multihoming [50], and substitutable or complementary relationships between applications [51,52].

Platform owners should also design pricing strategies to extract revenue from existing customer bases. Platform owners can choose between fixed or variable fees [53,54], or between penetration or skimming strategies [38]. Armstrong [55] argues that the crucial difference between fixed and variable fees is that cross-group externalities are weaker with per-transaction charges. Also, the selection of the pricing type may be driven by the level of competition in an industry. A monopoly platform can set negative variable fees while extracting any surplus created through fixed fees on both sides of a platform [56]. A platform owner can choose the penetration strategy of charging the party a low fee or the skimming strategy of charging a high fee. The effectiveness of any pricing strategy largely depends on price sensitivity for paying customers over time [57]. When paying customers become less price-sensitive, it is optimal for a platform firm to use a penetration strategy earlier and raise its rates later.

We found that platform owners can achieve ambidexterity in pricing by domain and temporal separation. Two- or multiple-sided markets allow platform owners to achieve ambidexterity through domain separation; platform owners can simultaneously exploit the market on one side and explore the market on another side. It is key for a platform owner to identify which side should be explored and which side should be exploited. Generally, platform owners can explore a side that is more valued by another side and, consequently, exploit a side that is more dependent on another side. Such decisions vary across industries [18]. In the video console industry, Microsoft explored the end user market by releasing a video console below its cost while charging a high royalty to developers. In the case of the PC industry, Microsoft explored the developer market by charging zero royalties for developer access while customers had to pay above marginal cost for their software.

Regarding temporal separation, pricing decisions change through the lifecycle of a platform ecosystem. To survive, platform owners may have to reach critical mass on both sides of the ecosystem early [58,59], meaning that a platform owner can first explore the size of the installed base and then exploit the potential value of that base. A penetration strategy works for this purpose by charging a low price early to attract customers and then raising rates over time [38]. For example, platform owners can release their platforms below marginal cost, as in the case of search and matching websites, and then design business models to profit from an established user base [60].

4.2. Openness

Platform ecosystems exhibit varying levels of openness depending on their participation rules [61]. Platform openness refers to whether and to what degree an outsider needs permission from a platform owner to access or build on the platform [7]. Platforms may differ in degrees of openness ranging from open to closed. In an open platform, third parties face soft requirements to access some platform owner's resources, such as information regarding its interfaces, and some may make complementary innovations to a platform. For example, Microsoft permits software developers to access portions of the source code of Windows, and licensed software developers can produce and distribute value-added applications for use with Windows without an approval process [62]. In the case of more closed platforms, third parties need to meet a list of requirements that limit the number of third parties in the ecosystem. For example, console providers, such as Microsoft and Nintendo, enforce a rigorous process of permissions to ensure the high quality of their games [2]. Moreover, platform owners can take a step further and facilitate, or limit, participation in the ecosystem based on inter-platform compatibility decisions [63]. In other words, platform owners may determine whether members of its ecosystem are allowed to interact with participants from other ecosystems [63–65]. Specifically, platform owners may also determine whether agents "on board" a platform can enter other platforms (multihoming) or if their participation must be exclusive (singlehoming). In this sense, compatibility

implies rules for interfaces to ensure that a platform's features fit well with those of other platforms, thus making them accessible to more agents [66].

Empirical evidence shows that opening up a platform to third parties can increase the rate of innovation around the platform [67]. So, on one hand, platform owners, together with third parties, can explore new innovations for the whole ecosystem; on the other hand, platform owners can exploit innovations by third parties to improve platforms, such as intellectual property sharing. The platform owner will benefit from such exploration and exploitation as platforms compete at the ecosystem level. Moreover, multihoming and compatibility mean that a platform owner has to share his or her customer base with other platforms [68]. Meanwhile, owners should be prudent enough to reject low-quality complements and avoid crowding effects that will lead to negative experiences from end users [2,44]. In this respect, platform owners can exploit the resources of their platforms by keeping a limited group of members that fit a specific list of requirements [8].

A platform owner can implement ambidexterity of openness strategies by organizational and domain separation. To encourage participation successfully, a platform owner must sustain a credible commitment not to engage in the squeeze *ex post* of entrants [69]. One solution is to establish an independent unit responsible for extending the size and power of the whole ecosystem. Thoroughly establishing an organizational unit, with the aim of growing the whole market, can help a platform owner better explore the market by leveraging third-party capabilities. Meanwhile, a platform owner can focus on exploiting internal resources and capabilities. For example, Intel Architectural Lab is a unit whose fundamental mission is to grow the overall market instead of just the market share of Intel.

Regarding domain separation, platform owners generally take a closed-oriented strategy in one domain to protect their exploitation while they may adopt an open strategy in another domain to explore new resources and capabilities. As for a technological platform, platform owners usually close the platform ecosystem's core module domain for proprietary exploitation and open complementary modules' domains to third parties for co-exploration. For example, major video console producers (i.e., Nintendo, Sony, and Microsoft) utilize a wholly closed strategy for their consoles but encourage open game development for licensed developers [62]. As for a marketplace platform, platform owners usually allow multihoming and compatibility on the side with small network effects, and take a more closed strategy toward the side with large network effects. For example, content platforms are motivated to sign exclusive contracts with quality content providers, but they are also less likely to restrict the multihoming of viewers [70].

4.3. Integration

Platform owners can sometimes enter complementors' product and service spaces, which is regarded as vertical integration [70]. Essentially, vertical integration and multi-sided platforms are two distinct business models [71,72]. As ecosystem orchestrators, platform owners should be cautious about moving into the spaces of their complementary products as this will squeeze incumbent complementors and reduce the incentives of potential complementors [69]. Extant literature discusses several incentives for platform owners to move into complementary markets [73–76]. When starting a platform, platform owners usually provide complementary products or services by themselves to facilitate adoption by demand-side users and to compensate for the difficulty in attracting third-party suppliers [77,78]. First-party content is common in such platform industries, like game consoles offering games, operating systems producing software applications, and e-commerce sites supplying goods [79–81]. When a platform ecosystem is well established, platform owners usually have the momentum to generate revenue by imitating successful complementary products or by improving the platforms' overall quality in targeting poor-performing complementary parties [82,83]. For example, Amazon chooses a follower strategy by providing popular or high-rated products on its own.

Generally, a platform owner can simultaneously exploit his or her platform resources and explore complementary markets by moving into them; exploitation and exploration approaches here are

interlinked. In comparison with third-party suppliers, platform owners possess advantageous positions in complementary markets. For example, a marketplace platform like Amazon has excellent knowledge regarding customers with complete data of their sales and could easily promote products on its own site [83]. In this way, exploiting platform resources can help a platform owner to explore a specific complementary market.

As for organizational separation, a platform owner can use a dual structure to realize exploration and exploitation concurrently. A platform can be regarded as an organizational structure storing organizational capabilities [10,84]. The core business of a platform owner is to build up its platform capabilities and encourage and facilitate these capabilities on a large scale [8,85]. To develop platform capabilities for the whole ecosystem, a platform owner must establish a unit committed to serving the whole ecosystem. When moving into complementary markets, a platform owner has to establish an organizational unit that is intended to independently develop the capabilities for exploring these markets. Thus, platform owners can achieve ambidexterity in integration strategies by establishing a specific-purpose organization unit.

4.4. Differentiation

Differentiation, which has been present in platform research as an alternative to pricing [86–88], refers to a strategy that aims to provide a unique ecosystem attracting users to adopt it. For example, quality differentiation may be a strategy to overcome a latecomer disadvantage and challenge an incumbent's dominant position [2].

In our review, we found that platform owners can ground differentiation on the platform itself or on the ecosystem sides. On the one hand, differentiation in the platform means enhancing the value offered to agents by improving the platform's intrinsic characteristics; platform owners can utilize their investments to improve the platform's main features and offer a high-quality product [89–91]. For example, video consoles have provided increasingly better features for users and developers over several generations [2]. On the other hand, a platform owner can also intentionally choose to implement differentiation on one side of the ecosystem in order to explore new resources and capabilities [90,92]. In this instance, platform owners may take advantage of a particular type of agent, known as a marquee, which has greater influence on other agents' value [93,94]. Specifically, platform owners can identify, attract, and sign exclusive contracts with quality suppliers and marquee customers [18]. In sum, platform owners may face a trade-off between investing in high-quality platforms to exploit their features and focusing on differentiating the sides to take advantage of new content development [48].

It is essential to remember that platform owners can utilize ambidexterity in the differentiation strategy through domain separation. In this respect, heterogeneity of agents within the ecosystem can be a source of ecosystem differentiation [90,95,96]. Specifically, when customers have different preferences for a platform's particular characteristic, platform owners can simultaneously launch different versions of the platform that better fit the needs of different types of users [97]. Platform owners can explore new markets by launching trial versions for potential adopters [98] and basic versions for beginners and exploit their existing resources and capabilities with premium versions for experts [99].

4.5. Envelopment

Platform owners can achieve growth by designing an envelopment strategy [18,43,100], which is a platform strategy wherein platform owners gain a competitive advantage by operating in multiple platform-based markets simultaneously. Specifically, platform owners can move into another platform-based market by bundling their extant platform's functionality with that of the target's [43]. A real-life instance of this is when Microsoft conquered Real Networks, a once-dominant media platform, by bundling Windows Media Player with its complementary Windows platform. In fact, it is not necessary for a platform owner to bundle two platforms to take advantage of

an established platform [100]. A platform owner can develop a new, standalone platform with carefully designed interfaces and functions so as to leverage the existing resources of an established platform and create synergy between both. For example, Alibaba has increased the attractiveness of its business-to-consumer platform Tmall.com by building on and leveraging its installed base, the consumer-to-consumer platform Taobao.com. Further, small companies that lack a large installed base may piggyback on an existing platform and provide new services without creating a new demand. Specifically, some firms can use the features and users of an established platform to build and launch their own platforms successfully [101]. In the case of the room reservation service Airbnb, they launched by integrating themselves into Craigslist. Also, PayPal piggybacked on eBay before it was acquired, and the payment service, Square, launched on top of the iPhone and Android platforms. Envelopment strategies are frequently used by digital platforms. By moving into new platform markets, a platform owner can extend their business scope to dynamic ecosystems that cross traditional industry boundaries [102].

In our review, two important domains are identified: existing and new platform markets. First, a platform owner has an established position in the original platform market where it began by accumulating resources and capabilities including customer bases, components, knowledge, and governance capabilities [103]. In addition, though, a platform owner has to search, learn, and develop new resources and capabilities when moving into an adjacent platform market. During this process, a platform can link resource exploitation in established platform markets with resource exploration in new markets. This ensuing linkage hinges on the relationship between established and new platform markets: whether they are complements, weak substitutes, or functionally unrelated. Linking these markets will likely bring scope economies, price discrimination benefits, and attractive tying prices [43].

In short, such domain separation is accompanied by temporal separation. A platform owner must have an established position in one platform market at an early stage, and later the platform owner can move into a related platform market. To gain an established position in a platform market, platform owners have to explore the market and then exploit the market by envelopment. In the case of piggybacking, a platform builder establishes a platform by exploiting the customer base of other platforms at an early stage. At a later stage, the platform builder can focus on exploring his or her own platform when it has developed a reputation elsewhere.

5. Future Research

5.1. Managing Several Platform Strategies

One platform strategy can bring temporary advantages for a firm; combining different platform strategies can benefit a firm greatly. Truthfully, designing a holistic approach for platform strategies is complex because it entails considering the trade-offs of several platform strategies simultaneously. In this respect, many firms usually choose to focus on one strategy, and a significant portion of platform-oriented literature has analyzed the consequences of such strategic decisions [104]. Specifically, any change in openness, integration, differentiation, or envelopment may influence the value proposition or creation of products and services offered by a platform owner, resulting in potential changes to price and structure. In this way, investigating the different combinations of pricing strategies, among other strategies, can be a direction for future research. Recent research focuses on the interdependencies between different strategies leading to complementarities [105]. In other words, the platform's success can be only explained by untangling the complementarities between strategies instead of focusing on the trade-offs offered by a single strategy.

The OA perspective provides the tools for platform owners to design their own holistic approach to platform strategies. Consequently, platform owners will have more exploration and exploitation choices due to an efficient combination of strategies, but, they will have to balance exploration and exploitation in sequential, domain, or organizational dimensions. In some instances, bundling two platforms may involve both envelopment and pricing decisions, both of which imply sequential

and domain separations to fully utilize OA. Under such circumstances, platform owners will have more ambidexterity choices while they balance exploration and exploitation in more dimensions, e.g., between two sides and across markets. By drawing on emerging papers that have studied the joint management of different platform strategies, such as pricing and differentiation [2,106,107], future research may shed light on the specific interdependencies between platform strategies and the appropriate ways to balance exploration and exploitation orientations in order to evolve with highly changeable platform ecosystems.

5.2. Interactions between Supply-Side Agents and Platform Owners

The outcomes of platform strategies also depend on the approaches of the supply-side agents. Suppliers and platform owners have a particular relationship entailing both cooperation and competition. In some ways, mutual cooperation is required for both sides to succeed in platform ecosystems; platform owners can benefit from the network value of a large number and varieties of supply-side agents in multi-sided markets, and they can also take advantage of the innovations by suppliers in technology and product platforms. By leveraging platforms' resources and capabilities, supply-side companies can harness the hidden value of their resources and abilities [108] and expand the boundaries of their own businesses [109]. However, platform owners may also directly compete with suppliers by moving into complementary markets [110], while suppliers may threaten the position of a platform owner by creating a new platform [111,112]. Thus, a deeper understanding of the strategies of supply-side agents is needed for platform owners to balance competition and cooperation successfully.

The OA perspective can help individuals better understand the interaction between supply-side agents and platform owners. First, a platform owner can have adequate knowledge of the potential impacts of platform strategies on suppliers, which will greatly enhance the incentives for suppliers and advance the sustainable evolution of platform ecosystems [113]. For example, when a platform owner decides to explore supply-side agents, he or she should be aware of all potential choices like subsidizing, opening the complementary domain or moving into the complementary market by itself, and selecting proper strategies in line with the exploration policy. In this way, investigating the combined effects of platform strategies on suppliers can be a promising avenue for further research. Second, a platform owner can predict the potential impacts of suppliers' conduct on platform owners, which will greatly augment the position of and governance by platform owners. In this respect, using an OA perspective to analyze suppliers' conduct and their impact on platform owners is a necessary and promising avenue for the future.

5.3. Roles of Demand-Side Agents and Implications for Platform Strategies

The demand side is no longer restricted to traditional consumers but is made up of agents playing multiple roles, such as users, innovators, and partners. This gives rise to some interesting and relevant research questions. For example, user heterogeneity is one of the key ideas for understanding interactions among the demand-side agents because it affects the platform owners' decisions. Extant research has examined user heterogeneity and its impact on pricing, differentiation, and openness [49,114–116], but there is room for deeper and broader examinations of this subject. Specifically, future research may delve into the multiple dimensions of user heterogeneity and their impact on the different sides of the ecosystem. As well, future research may look into the co-evolution of multiple roles and relationships and their impacts on the decision making of platform owners. One relevant platform phenomenon is the effort that owners make to convert demand-side users into supply-side users, and future research may consider how best to facilitate users' participation, engagement, and innovation in a platform ecosystem with evolving roles [117]. Specifically, researchers may study the barriers around and facilitators for creating and maintaining trust in various online transactions [118]. The multiple roles of demand-side agents, also, have significant implications regarding the business sustainability of platform ecosystems. A platform that can facilitate the multiple

roles of demand-side users can better leverage overall network effects. More research may investigate how these multiple roles can help platform startup in the short term and evolve fully in the long term. For example, these multiple roles may reduce the number of critical masses occurring in platform launch, and they can potentially impact platform stickiness and durability at various stages in the process [7].

The OA perspective can help interested participants comprehend the multiple roles of demand-side agents and the implications for platform strategies. Further, demand-side agents may be encouraged to contribute to various platforms through resource exploitation, like in cases of routine consumption or exploration in innovation. Platform owners can drive demand-side agents, either at an individual or team level, to pursue exploration or exploitation simultaneously or sequentially in an organizational context, which is a process OA researchers call contextual ambidexterity [17]. To enable contextual ambidexterity, platform owners must provide supportive infrastructure including well-designed systems and processes. Investigating how demand-side agents' process exploration and exploitation and how a platform owner can facilitate these processes can be a promising avenue for future research [119].

6. Conclusions

The widespread and fast evolution of platforms has attracted the attention of researchers from many different fields. So far, platform research has been fragmented and insights on platform strategies are isolated [10]. Adopting a rigorous procedure for sample selection, we identified five significant strategies espoused by platform owners: pricing, openness, integration, differentiation, and envelopment. Platform strategies are different from the strategies firms offer for ordinary products or services. The difference comes from the fact that platforms can be conceptualized as evolving organizations effectively and efficiently federating and coordinating the interaction, innovation, and competition of participants [8]. With the OA perspective, this paper presents an integrative review of the current position of platform strategy studies. Further, the OA perspective emphasizes exploration and exploitation in a complementary way, which is critical for business sustainability. The OA perspective allows us to open the black box of any particular strategy and provides us with a tool to analyze the potential trade-off of this specific strategy. In doing so, we examined the explorative and exploitative components of each strategy and investigated how a platform owner can utilize ambidexterity in each and every strategy. Further, we identified three important and promising avenues for future research and analyzed these avenues with the OA perspective. Overall, we are confident that our study offers a valuable systematization and consolidation of extant research on platform strategies, and we firmly believe it can serve as a foundation for future research.

Acknowledgments: The authors thank for the comments and the ideas provided by the participants in Platform Symposium at Boston University in 2013, 2014 and 2015. The authors owe their thanks to the financial support provided by the National Science Foundation of China (NSFC project Nos. 71103079, 71173036, 71331003 and 71671081), and the Humanities and Social Science Project of Ministry of Education (No. 15YJA630065 and 16YJA630050). This study has been partially supported by financial aid from the Spanish Ministry of Education with the FPU program scholarship AP2010-1091.

Author Contributions: All the authors conceived and designed the study's aim and main topics. Xing Wan and Javier Cenamor conducted the sample selection and executed the analysis process; Geoffrey Parker and Marshall Van Alstyne added trending topics and emerging research.

Conflicts of Interest: The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretations of data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A. Diversity of Platform Ecosystem Research

Table A1. Platform Ecosystems in the Literature.

Type of platform	Function	Theory and Perspective	Methodology	Ref.
E-commerce	Facilitate same-side interaction	Two-sided markets	Analytics, simulations, case study	[43]
	Facilitate information exchange	Transaction cost theory	Case study	[53]
	Facilitate matching	Two-sided markets	Statistical test	[90]
	Allow operational and strategic benefits	Technology adoption	Logit model	[120]
	Facilitate information aggregation	Information systems; Two-sided markets	Game model	[99]
	Facilitate collaboration	Information systems	Game model	[121]
	Facilitate information exchange	Information systems; Agency theory; Interpersonal communication	Lab experiment	[122]
	Allow operational and strategic benefits	Institutional theory; Structuration theory of technology assimilation	Structural equation model	[123]
Online community	Enable incomplete designs that lead to continuous evolution	Organizational perspective	Case study	[124]
	Facilitate user innovation	Social theory	Case study	[125]
	Facilitate same-side interaction	Business model; Socioeconomic approach	Case study	[126]
	Facilitate information aggregation	Marketing approach of new-product diffusion; Sociology perspective of social network analysis	Hazard-rate model	[127]
	Facilitate information exchange	Attribution theory	Lab experiment	[128]
	Enable firms to strengthen their innovation process	Information approach; Social psychology; Behavioral economics	Statistical test	[129]
	Motivate knowledge co-creation	Knowledge based view; Organizational perspective	Statistical test	[130]
	Facilitate information exchange	Opinion-leader theory; Cognitive dissonance; Organizational psychology	Structural equation model	[131]
	Create business opportunities for other firms	Austrian economics theory of entrepreneurial discovery; Creative collective theory;	Case study	[132]
	Facilitate information aggregation	Interactionist theory of place attachment	Lab experiment and structural equation model	[133]
	Trigger effective entrepreneurial thinking and action	Decision making	Interviews	[134]
	Facilitate user innovation	Social network	Theoretical framework	[135]
Payment cards	Facilitate matching	Marketing perspectives	Theoretical framework	[136]
	Exploit network effects	Two-sided markets	Game model	[137]
	Create specific roles with particular characteristics, like platform providers and platform sponsor	Two-sided markets	Game model	[54]
	Facilitate same-side interaction	Two-sided markets; Transaction costs	Statistical test	[52]

Table A1. Cont.

Type of platform	Function	Theory and Perspective	Methodology	Ref.
Software	Exploit complementarities	Resource based view; Complementarity approach	Statistical test	[138]
	Provide profitability and utility to developers and users	Network effects; Systems perspective	Game model	[51]
	Motivate value co-creation and signaling	Resource based view; Institutional theory; Intellectual property rights	Statistical test	[109]
	Facilitate recombination and reuse	Two-sided markets	Statistical test	[98]
	Facilitate same-side interaction	Organizational perspective; Two-sided markets	Logit model	[139]
	Facilitate recombination and reuse	Two-sided markets; Platform architecture approach	Statistical test	[44]
Video console	Attract valuable participants	Network theory	Logit model	[140]
	Facilitate matching	Two-sided markets; Contracts	Statistical test	[141]
	Create new mechanisms of entry and defense for entrants and incumbents	Expectation-driven view; Network effects; Dynamic competition; Technology adoption	Structural econometric model	[2]

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