Towards an Integrated View of Multi-Sided Platforms Evolution

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Completed Research Paper

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Abstract

How do Multi-Sided Platforms (MSPs) evolve over time? Although MSPs are perceived as highly evolvable socio-technical systems, Platform Evolution remains an elusive topic in the MSP literature with many unanswered questions. In particular, Platform Evolution (PE) as a concept has not been explicitly defined in the MSP literature. Rather, there is multiplicity of views, which contributes to the lack of conceptual clarity. In order to address this shortcoming, we put forward a new, integrated conceptualization of PE as a complex, multi-faceted and dynamic process. Rather than proposing yet another view on PE, we adopt a “concept reconstruction” approach, which allows us to integrate the existing work on PE in a coherent manner, and to propose a comprehensive conceptualization of PE.

Keywords: Multi-Sided Platforms, Platform Evolution, Hermeneutic Literature Review

Introduction

Multi-Sided Platforms (MSPs), which function as complex socio-technical systems that enable interactions between various affiliated constituencies through developing and managing an underlying infrastructure, have emerged as some of the most powerful and valuable business models around (Hagiu and Wright 2011, 2013). Just consider that sixteen out of the twenty-five most valuable brands for 2014, as pronounced by BrandZ Top 100, function as MSPs (Taube 2014). Yet, despite their increased importance, our knowledge of this phenomenon remains scant as the existing literature on MSPs fails to capture its complexity, with many important problems being understudied (Thomas et al. 2014; Sriram et al. 2014).

Platform Evolution (PE), for example, has remained an elusive topic in the MSP research, with only few models and prescriptions guiding the platform throughout its evolution (Gawer 2014). Although early work on MSPs view platforms as being static, a growing number of researchers recognize MSPs as evolving entities (Eck et al. 2015; Gawer 2014; Smedlund and Faghankhani 2015; Tiwana 2014). Understanding the evolutionary path of MSPs, and the changes, which such a journey brings is of importance in order to ensure the long-term success and survival of MSPs (see, e.g., Han and Cho 2015; Smedlund and Faghankhani 2015; Tan et al. 2016). Indeed, as Hagiu (2014) points out MSPs that manage to become successful in the long term are rather a rare phenomenon. Although this is partially attributed to failures in the initial design of MSPs and ill-planned ignition strategies (see, Evans 2009), the platform’s inability to evolve over time also influences its vitality (Tiwana 2014).

Despite the importance of this topic, researchers have failed to capture the complexity of PE (Gawer and Cusumano 2007). In particular, PE as a concept has never been explicitly defined in the MSP literature. Rather, scholars have investigated the phenomenon under different terms (e.g., platform development (Ruutu et al. 2017; Watanabe et al. 2017), platform expansion (Hagiu 2006), platform evolution (Tiwana 2014), etc.). They have also studied various aspects of PE in fragmented manner, without providing a
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comprehensive understanding of MSPs’ evolutionary paths. Thus, we formulate the following research question (RQ):

*How do MSPs evolve over time?*

To address this RQ, we propose a new, integrated conceptualization of PE as a complex, multi-faceted and dynamic process. Rather than introducing yet another view and thus, diluting the concept of PE even further, we aim to “reconstruct” it by limiting the present concept stretching (Welch et al. 2016). To do that, we review the existing research in order to identify the various views on PE and further test empirically whether these perspectives can fully capture the evolutionary path of a MSP. Based on our exhaustive literature review and empirical investigation of exemplary MSPs, we put forward a general model, which, in our view, depicts the essence of PE.

This paper proceeds as follows: First, we outline the theoretical foundations of this paper. We, then, present the methodology we use to carry out our study. As a next step, we introduce the results of the conducted exhaustive literature review and the subsequent empirical investigation of the selected case studies. In the final sections of the paper, we discuss our findings, offer some conclusions and suggest promising areas for further research.

**Multi-Sided Platforms**

The literature on MSPs has studied platforms from two different theoretical perspectives. Under the economic perspective, MSPs are investigated as two-sided markets (Evans 2009; Hagiu 2006, 2014; Rochet and Tirole 2003). Most of the researchers’ efforts in this stream are focused on designing pricing strategies (Rochet and Tirole 2003, Weyl 2006) and investigating strategies for achieving same-side and cross-side network effect, platform envelopment and platform design (Eisenmann et al. 2011, Evans 2009; Hagiu 2006, 2014). Platforms are also studied as technological architectures (Gawer and Cusumano 2007), which can be modular (Baldwin and Woodard 2009) or layered (Yoo et al. 2012). The technological view on MSPs puts emphasis on investigating the platforms’ architecture as consisting of core and periphery (Gawer 2014; Staykova and Damsgaard 2015), the recombination of which facilitates platform innovation (Gawer and Cusumano 2007; Tiwana et al. 2010; Yoo et al. 2012). Researchers belonging to either of the two MSP streams have also delved into common topics such as platform-based ecosystems (Ceccagnoli et al. 2011, Cennamo and Santalo 2013, Isckia and Lescop 2013, Tiwana et al. 2010), platform business models (Eisenmann et al. 2011, Evans 2013, Hagiu 2014, Tiwana 2014) and platform governance (Boudreau and Hagiu 2009; Hagiu 2014; Tiwana 2014). Bridging the economic and technological perspectives on MSPs, Gawer (2014) proposes a new conceptualization of MSPs as evolving organizations or meta-organizations that coordinate multiple agents and are characterized by modular architecture. Building upon this, we investigate MSPs as socio-technical entities, which facilitate the interactions between various affiliated constituencies through developing and managing of an underlying infrastructure (Eaton et al. 2015, Hagiu and Wright 2011).

**Method**

Concepts are foundational elements of theory creation (Welch et al. 2016) and constitute the “basic unit of thinking” (Sartori 1984, p. 74). They are characterized by certain level of abstraction and thus observable only through set of shared attributes or characteristics (Gerring 1999, Posdakoff et al. 2016, Sartori 1984; Welch et al. 2016). To conceptualize Platform Evolution, we adopt pragmatist-interactionist approach to concept reconstruction, proposed by Welch et al. (2016), which incorporates investigation of the usage of the PE concept in the existing literature and empirical exploration of the manner in which MSPs evolve. While the conducted literature review is used for identifying and clustering the attributes (or characteristics) related to PE, the subsequent empirical investigation is to inquire about the suitability and accuracy with which these attributes portray the complex nature of PE. We also utilize some of the prescriptions put forward from Podsakoff et al. (2016) for identification and analysis of the related to the concept attributes. As a final step, we propose a new definition of the PE concept.
Hermeneutic Literature Review

To identify the existing views on PE, we conduct a hermeneutic literature review, which presents an interactive process consisting of two intertwined phases - “search and acquisition circle” and “analysis and interpretation circle” (Boell and Cecez-Kecmanovic 2014, p. 258). Thus, the analysis of the initially selected articles leads to the identification of new search criteria, which expand the scope of the literature review. Unlike other approaches (e.g., systematic literature review, see, Levy and Ellis 2006), this approach allows for continuous enrichment of our understanding of the investigated phenomenon though the discovery of new insights (Boell and Cecez-Kecmanovic 2014). Thus, we deem the hermeneutic approach more appropriate due to the multiplicity of views in the MSP literature and due to the complex, multi-faced nature of the PE.

Our initial search strategy consisted of identifying all the relevant articles discussing “platform evolution” in the AIS Library. The analysis of the initially selected articles helped us expand our search strategy by including new keywords (e.g., “platform formation”, “platform development”, “platform growth”, platform expansion”, etc.). As the literature on MSPs is spread across various disciplines other than Information Systems (see, Section Multi-Sided Platforms), we also expanded our search by including multiple other databases (ACM Library, EBSCO Host, Emerald Insights, Google Scholar, Oxford, Sage Journals, Science Direct, Scopus, Springer, Taylor and Francis, Web of Science, Wiley). Thus, our literature review entered into a hermeneutic cycle where new keywords and search databases were identified based on ongoing analysis of the selected articles. We terminated our search once we could not identify more articles, which contain different information from the ones already gathered. As a result, we identified 98 articles in total, which provide insights into how MSPs evolve over time. To the best of our knowledge, we consider this literature review to be exhaustive.

We adopted an inductive approach to analyze the gathered data, thus we “allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies” (Thomas 2006, p. 238). We first analysed the selected articles using a coding scheme based on the prescriptions set by Welch et al. (2016). As the purpose of the literature review is to investigate the manner in which researchers conceptualize a phenomenon, Welch et al. (2016) recommend that the analysis should focus on investigating how the concept is used (see, View on Evolution, Table 1), what its attributes are (see, Attributes, Table 1), and what theoretical assumptions are made (see, Table 1). Although the authors provide a framework to guide analysis, they do not pose constraints on the process of data interpretation.

<table>
<thead>
<tr>
<th>Author</th>
<th>View on Evolution</th>
<th>Attributes</th>
<th>Theoretical Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gawer (2015)</td>
<td>Shift of platform boundary</td>
<td>Change in the MSP scope and MSP openness</td>
<td>MSPs’ boundary shifts in relation to competition and innovation</td>
</tr>
<tr>
<td>Inoue and Tsujimoto (2017)</td>
<td>PE as developing a platform-based ecosystem</td>
<td>Adding third-party complementors</td>
<td>Self-reinforcing loop between users and complementors</td>
</tr>
</tbody>
</table>

Table 1. Example of Coding Scheme Adapted from Welch et al. (2016)

We, then, group the identified attributes in several themes based on the observed commonalities among them (Podsakoff et al. 2016). The emerged themes and the associated with them attributes capture the variety of perspectives (or views) on PE among the researchers in the field. We use further the results from the analysis as a basis for the subsequent empirical investigation.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of complementors</td>
<td></td>
</tr>
<tr>
<td>Evolution of boundary resources</td>
<td>Evolution of Platform-Based Ecosystem</td>
</tr>
<tr>
<td>Growth of user base</td>
<td></td>
</tr>
<tr>
<td>Critical mass of users</td>
<td>Growth Models</td>
</tr>
</tbody>
</table>
Table 2. Example of Organizing Attributes into Themes (adapted from Podsakoff et al., 2016)

**Empirical Investigation Through Case Studies**

Case Study research aims at providing in-depth understanding of complex phenomena by allowing researchers to analyze them within their context of emergence and existence (Baxter and Jack 2008), based on collection and detailed analysis of rich data sources (Yin 2003). Thus, case study research is suitable method for empirical investigation of concepts (see more, Podsakoff et al. 2016; Welch et al. 2016).

The selection of specific case studies is guided by the findings of the conducted literature review (see more, Welch et al. 2016). Based on our initial analysis, we adopt a “most-likely” case design (Welch et al. 2016) as we do not find evidence for overlapping of PE with other concepts, but rather for lack of concept clarity, which stems from the presence of multiple (not contradicting) views about the essence of PE (see, below). Thus, we initially hypothesize that all of the identified attributes constitute composition elements of the PE concept. The purpose of the “most-likely” case study is to verify to what extent the outlined attributes capture correctly the complex nature of PE.

Although a single in-depth case study is deemed sufficient (see, Welch et al. 2016), we chose to focus on two case studies in order to strengthen the conclusions we draw from our findings. As Welch et al. (2016) argue the cases, underlining the empirical investigation, should be exemplary and “provide the richest opportunity for questioning existing assumptions about how concepts are constituted” (p. 120). Thus, we select YouTube and Twitter as two exemplary cases of MSPs, which have relatively long and diverse evolutionary paths, and which are often viewed as prominent cases of MSPs (see, e.g., Evans and Schmalensee 2016; Hagiu 2006, etc.). Furthermore, we select YouTube and Twitter as their evolutionary paths cover approximately the same time span (YouTube is founded in 2005, while Twitter is founded in 2006) and both operate as social media platforms.

To conduct our investigation, we rely on large set of secondary qualitative data, which we gathered from official blog posts from the two MSPs. We collected 424 blog posts for Twitter and 346 blog posts for YouTube for the period between their launch and the end of 2016. We construct the evolutionary paths of YouTube and Twitter as a series of events and we code each one of them based on whether they refer to a certain identified attribute or not. During the data analysis process, we also adopt an open coding as we also look for previously unidentified attributes.

**The Concept of Platform Evolution in the Existing Literature**

Based on the conducted literature review, we identify 12 distinct views, outlining the manner in which MSP evolve over time (see Table 3). For clarity reasons, we present them in two groups: PE as stage models, which view PE as a continuum, and PE as standalone issues, which focus on studying particular aspects of PE. We also present the attributes associated with each of the views summarized in Table 3. When presenting the attributes, we aim at connecting given set of attributes to specific view as they are found in the literature, even though that may lead to a repetition of some attributes. We reduce this repetition at a later stage for conducting the empirical investigation (compare Table 3 and Table 4). We also adopt the labels of the attributes as the original authors first introduced them. Although this may lead to lack of clarity, we think it is necessary to adhere to the initial wordings, as we do not want to overlook involuntarily a given aspect of PE. The purpose of the literature review and the empirical investigation is to identify the attributes and provide evidence for their accuracy, while the final parts of the paper (see, Discussion) concludes whether they are relevant or not and in what form.

**Platform Evolution as Stage Models**

A significant part of the MSP literature emphasizes on the nature of PE as a gradual, modular process, which consists of several stages (Miguel and Casado 2016). We identify inductively several PE stage models: growth models, maturity models, transformation models, wide-ranging models and reconfiguration models.
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Growth Stage Models

Upholding the evolution-as-growth view, researchers such as Evans (2009), Casey and Töyli (2012), Vogelsang (2010), etc., investigate PE as a model, consisting of several interconnected stages. The first phase encompasses the launch of a platform (Evans 2009) (also known as market entry (Vogelsang 2010) or platform formation (Casey and Töyli 2012)), as well as the initial efforts to attract significant number of platform participants. The pre-condition to transitioning to the next phase of rapid growth (or ignition stage (Evans 2009)) is the achievement of critical mass of users (Evans 2009, Evans and Schmalensee 2010). In a similar manner, Ruutu et al. (2017) argue that until a MSP reaches a critical mass of users, its development is fragmented. If a platform survives, it reinforces positive feedback loops between the different constituencies affiliated to the platform during its next development cycle.

While mostly pre-occupied with investigating the initial growth path of a platform until it reaches a critical mass of users, researchers do not elaborate profoundly on the next stages of PE when critical mass of users is ensured. In his early work, Evans (2009) states that a MSP ignites after it reaches a critical mass of users and eventually achieves a long-term equilibrium. Later, Evans and Pirchio (2014) further refine this model by outlining two possible paths for platform growth in the ignition stage – explosive growth or slow growth, which are both dependent on the presence of strong cross-side network effects. For Eisenmann (2006) and Ruutu et al. (2017), the ultimate goal of any MSP is to establish winner-takes-it-all market by capturing the largest market share. Vogelsang (2010) argues that once a critical mass of users is achieved, a platform can exploit the monopolistic rents (e.g., transaction fees) it has earned and establish a viable business model in order to become profitable. A number of researchers also emphasize on the interdependency between MSP growth and MSP profitability (Bhargava 2014, Cuthbertson et al. 2015).

Maturity Stage Models

MSP’s evolutionary journey can be presented as a maturity model, where the platform’s main purpose is to reach a certain level of maturity. Researchers view maturity in different manners – from optimal user growth (Zhu and Mitzenmacher 2008) and business model maturity (Muzellec et al. 2015) to diversification of MSP services portfolio through the attraction of third-party complementors (Cennamo and Santaló 2013, Tan et al. 2015).

Muzellec et al. (2015), for example, propose a PE stage model consisting of four stages – embryonic stage, emergent stage, growth stage and maturity. The different stages are characterized by change in the platform’s focus from creating value primarily for users during the early stages to shifting to serving business customers in later stages of PE. In the maturity stage, MSP caters to both business customers and users in order to maximize the value that is created through their interactions. This value optimization allows for MSP to establish a profitable business model, which is business oriented.

MSP’s maturity can also be measured by the level of achieved user growth. While Zhu and Mitzenmacher (2008) view maturity as market equilibrium where a platform is established as a dominant firm based on its ability to achieve optimal growth rate, Cennamo and Santaló (2015) argue that MSP reaches a maturity level when the growth of its user base decreases. At the same time, Cennamo and Santaló (2015), who distinguish between stages of early and late platform maturity, also argue that the user growth rate is driven by availability of high quality external complementors.

To a certain degree, maturity models can be seen as extension (or spin-off) of the above described growth models. Thus, platforms tend to develop constantly until they reach a certain mature stage of their evolution. Not all platforms, however, can reach maturity as there are numerous examples of platforms, which fail at the initial stages of their development (see, Evans 2016; Hagiu 2014).

Transformation Stage Models

PE is seen as a process of transformation, which changes the nature of the MSP through attracting new types of platform participants (e.g., Gawer and Cusumano 2015, Tan et al. 2015, Yang et al. 2015). Tan et al. (2015) propose a PE stage model, which traces the MSP development from “hub and spoke MSP”, to network platform, and finally to symbiotic platform (service providers, buyers, sellers) (more like MSPs). This transformation journey is marked by three separate stages – nascent stage, where a platform is
characterized as being two-sided, formative stage and a maturity stage, which is characterized with the introduction of new services offered by complementors. Gawer and Cusumano (2013) argue that internal platforms (platform targeting key users) can evolve to supply-chains (number of suppliers) and then gradually to industry platforms, leveraging a huge network of external complementors.

**Wide-Ranging Stage Models**

Researchers often deduct a platform evolutionary model based on their investigation of particular cases. The proposed models reflect the characteristics of the specific cases and signal for the diversity of evolutionary paths, which a platform owner can undertake. Thus, rather than focusing on investigating one particular element of PE, these models reconstruct PE as a sum of multiple varied attributes. For example, Leong et al. (2013), who investigate the development of the largest Chinese online ticketing firm, argue that MSP evolves through the introduction of various elements - new features (group-buy feature), website reorganization, introduction of a forum, feedback, polling (community-building), building a distribution system.

Zhu et al. (2016) investigate the evolutionary path of a Chinese online shopping mall, which consist of establishing of logistics and distribution system, geographical expansion to multiple cities, and the establishing of a supply chain for offering of finance service. Han and Cho (2015) view the evolution of the most popular messaging app in South Korea, KakaoTalk as consisting of several phases: expanding to new business domains (service diversification), bundling services, becoming distribution platform and engaging in open innovation (building an ecosystem of actors). Wang et al. (2015) study E-Commerce Platforms suggest that PE encompasses continuous launch of products, multi-channel expansion, multi-brand expansion, and geographical expansion. Constantiou et al. (2016) propose a two-stage evolutionary model based on their study of Airbnb’s evolution. During the first stage after the platform launch, Airbnb followed a zig-zag strategy by introducing various features and functionalities in order to attract users and host. In the second phase (augmentation phase), the platform engages in active exploration phase (e.g., introducing new feature and functionalities, horizontal acquisitions, geographical expansion, community building) in order to augment its services.

**Reconfiguration Stage Models**

PE is also investigated as a continuous change across (or re-configuration of) multiple platform dimensions related to the platform itself (e.g., Gawer 2014), its ecosystem of external partners (Ghazawneh and Henfridsson 2011), the technology that supports the platform’s offerings (e.g., Tan et al. 2016), and the environment, in which a platform operates (e.g., Tiwana et al. 2010). Gawer (2014), for example, view PE as reconfiguration of various platform elements – organizational forms, capabilities, access to innovative actors, types of governance, degree of interface openness. Kim et al. (2013) investigate the evolutionary path of online social networks as a configuration of three dimensions (technology, suppliers, and users) that change throughout the span of PE. Tiwana et al. (2010) see PE as a co-evolution of platform governance (decision rights, control, and ownership), platform architecture (decomposition, modularity, design rules) and environmental dynamics. Wang et al. (2015) also view PE as co-evolution of various elements - firm entrepreneurial action, organizational agility, digital options, and IT competence.

A significant part of the reconfiguration models put emphasis on the reconfiguration (or evolution) of the technology (or IT) which supports the services enabled through the platform (Hanseth and Lyttinen 2010, Sedera et al. 2016, Tan et al. 2016b, Yang et al. 2015). Tan et al. (2016b), for example, argue that during the initial stages of platform development, developing IT capabilities is not in focus, as platform owner needs to solve issues such as user adoption and achievement of viable business models. As the platform’s user base grows in size (and as they face scaling issues, see Furstenau and Auschra 2016), the platform needs to optimize its IT capabilities to support that growth. The establishment of ecosystem of external developers also puts restraints onto the IT resources and requires their further optimization to correspond to the business development of the platform. They argue that during the evolutionary path of the platform, IS capabilities are transformed and sometimes replaced (Tan et al. 2015). Tan et al. (2016a) view PE as a three-stage model, where the MSP and the infrastructure, which supports it, co-evolve: 1) reinforcing digital platforms – reinforcing digital infrastructure, 2) organizing business ecosystems – reciprocating digital infrastructure, 3) establishing networked community – reproducing digital infrastructure.
Platform Evolution as Standalone Issues

A number of researchers also delve into the topic of platform evolution by investigating standalone issues. Thus, they focus on providing in-depth insights into diverse topics from growth of platform constituencies and the establishment and evolution of platform-based ecosystem to platform entry into geographical markets.

Platform Evolution as the Ability to Grow the MSP’s Constituencies

Several researchers, adopting predominantly the economic perspective of MSPs, view PE as the ability of the platform owner to grow the size of its constituencies over time (e.g., see, Casey and Töyli 2012, Chu and Manchanda 2016, García-Swartzza and García-Vicente 2015, Ting et al. 2014). The difference between this view and the growth stage model is that the former does not view the MSP growth as a stage-based process, but rather as an undetermined process that is dependent on several conditions.

Eisenmann (2006) and Kumar et al. (2010), for example, stress out the importance of achieving rapid growth through the execution of user acquisition strategies. The process of platform growth, which is also referred to as platform diffusion (see, Casey and Töyli 2012), however, requires to grow the size of all of the distinct types of participants affiliated to the platform. Thus, for example, Chu and Manchanda (2016) argue that a MSP grows as it manages to attract increased numbers of both buyers and sellers, while Cennamo and Santalo (2013) argue that platforms evolve through the growth of their installed base (users) and the growth of the external complementors. MSP’s growth is driven by the presence of strong same-side (within one group of platform participants) and cross-side (between two or more distinct groups of platform participants) network effects, which create positive feedback loops (Chu and Manchanda 2016, García-Swartzza and García-Vicente 2015).

The growth of the MSP’s constituencies is also investigated in connection to the establishment and further development of platform-based communities around the different distinct types of platform participants (e.g., users, developers, advertisers, etc.). For example, Leong et al. (2013) and Kyriakou (2015) argue that building a platform-based community constitutes an important part of the platform’s evolution path. The establishment of these communities is usually associated with the achievement of a certain level of growth of the platform constituencies. Yang et al. (2015), for example, view the establishment of platform-based community as one of the stages of PE, which occurs when a platform reaches a certain level of maturity. The communities around the various platform constituencies serve the purpose of strengthening the value proposition towards the platform participants. In particular, Constantiou et al. (2016) in their investigation of the evolution of Airbnb identify the building of community as one of the manners in which a platform owner augments its services.

Platform Evolution as a Shift in the Platform Boundary

A number of researchers view PE as a shift of the platform boundary (Gawer 2015, Eisenmann et al. 2011, Um and Yoo 2016). From economic perspective, platform boundary encompasses all the functionalities offered by and through the platform (Eisenmann et al. 2011). Thus, a change in platform boundary is associated with the introduction of new functionalities and features. The stream of platform literature, which views MSPs as modular system, considers the interface as marking the platform boundaries (Gawer 2015). From the technological perspective, the shift in the platform boundary means a change in the degree of platform openness, which is realized through the availability of various APIs and SDKs (Gawer 2015). Thus, for example, Um and Yoo (2016) view platform boundary as not only encompassing the platform, but also its ever-growing ecosystem of external complementors.

Platform Evolution as Introducing New Features and Functionalities

A number of authors associate PE with introduction of new features and functionalities, which enrich the platform offerings and thus, increase its value proposition to both present and future participants (Edelman 2015, Eisenmann et al. 2011, Evans 2013, Cuthbertson et al. 2015, Davis and Murphy 2002, Leong et al. 2013, Miguel and Casado 2016, Ozer and Anderson 2015, Saarikko 2014, Sen et al. 2011, Scholten 2011, Smedlund and Faghankhani 2015, Song and Wildman 2012). The novel features can be offered by the
platform owner itself (see, Ozer and Anderson 2015), or by third-party complementors (see, Smedlund and Faghankhani 2015)).

This view of PE implies that the platforms commence with relatively few core functionalities, which constitute the MSP’s main value proposition (Bhargava 2014, Olleros 2008, Gawer and Cusumano 2007, Sen et al. 2011, Staykova and Damsgaard 2015). This minimalistic platform core, hosting relatively few functionalities, gradually expands over time to incorporate variety of novel offerings. Ozer and Anderson (2015), for example, discuss the platform’s ability to offer new exploratory features, novel complementary functionalities and a bundle of these features. The new features are introduced to support each of the affiliated to the platform constituencies (see, platform depth (Hagiu 2006); platform range (Staykova and Damsgaard 2016)). MSP can also expand by offering spin-off functionalities, or standalone (additional) platforms in addition to the main platform (e.g., UberEats) (Staykova and Damsgaard 2016, Watanabe et al. 2017).

Ozer and Anderson (2015) argue that platforms cannot survive by solely offering innovative features. Rather, through a process of platform envelopment, a platform can bundle functionalities offered by other platforms operating in adjacent markets into its initial value proposition (Eisenman et al. 2011). A platform can envelop complements, weak substitutes and unrelated platforms (Edelman 2015, Eisenmann et al. 2011, Schiborr 2016), or enter into rival markets in order to attract rivals’ users (Bar-Gill 2014, Ozer and Anderson 2015). Similarly, Dietl et al. (2009) discuss “tying of a service supplied in a primary market with another service supplied in a secondary market” (p. 9) as a type of defensive move a platform can adopt if it is simultaneously present in more than one market. In connection to this, Smedlund and Faghankhani (2015) discuss MSP’s ability to establish interconnectivity to other MSPs.

**Platform Evolution as Development of an Ecosystem of External Complementors**

A number of researchers view the emergence, establishment and development of an ecosystem of third-party complementors as stage of the MSPs’ evolution (see, e.g., Boudreau and Jeppesen 2015, Gawer and Cusumano 2015). In particular, Kim (2016) states that “after building a two-sided market, a business is required to complete its ecosystem to enable itself to continue its platform business in the market”. Smedlund and Faghankhani (2015) upheld the same view by arguing that platform’s growth patterns change over time as platform evolves from being focused exclusively on creating and executing platform-centered strategies to developing a robust ecosystem of external complementors.

The development of a robust ecosystem is based on the MSP’s ability to attract external complementors (e.g., Ccecagnoli et al. 2012, Inoue and Tsujimoto 2017, Manner et al. 2013, Tiwana et al. 2010, Zhu et al. 2016), which is dependent upon the establishment of generative capabilities (Eck et al. 2015, Holmström 2013). An example of such generative capabilities are technical boundary resources such as APIs and SDKs (e.g., Gawer 2015) and social boundary resources, such as intellectual property rights (IPR) and agreements with third-party complementors (Ghazawneh and Henfridsson 2011). Furthermore, Gawer and Cusumano (2015) argue that the development of robust ecosystem is facilitated by the degree of platform openness (which is connected to APIs) and the modular nature of its architecture, which allows numerous third-party developers to join the platform.

**Platform Evolution as Platform Ecosystem Evolution**

After a platform-based ecosystem (PBE) is established, the platform and its ecosystem continue to co-evolve (Gawer and Cusumano 2015). Similarly, Isckia and Lescop (2015) also view PE as continuous innovation, which can be provided by both the platform owner and external complementors. Thus, a number of researchers focus on studying the evolution of the platform-based ecosystem itself (e.g., Lee and Hwang 2016, which is primarily associated with the dynamics in the number and quality of external complementors (Inoue and Tsujimoto 2017, Lee and Hwang 2016, Cennamo and Santaló 2015). Studies investigate platform-based ecosystems’ emergence, growth and contraction over time in response to various events. Scholten and Scholten (2012) argue that a platform-based ecosystem develops through continuous innovation, renewal and service portfolio optimization, while Lee and Hwang (2016) view the formation of PBE as a process of variance (introducing large number of complementors) and selection (reducing the overall number of external complementors by keeping only those preferred by users). Similarly, Cennamo
(2017) argues that although platform owner can benefit from attracting and leveraging a huge network of external complementors during the initial stages of platform evolution, this may lead to market saturation prematurely. As a result, the diversity and the number of third-party complementors can significantly diminish at later stages and this can jeopardize the sustainability of the platform over time.

The development of PBE is dependent upon the degree of platform openness, which also changes over time (Parker and van Alstyne 2008). In particular, the evolution (or change) of the degree of platform openness impacts (West 2003) the evolution of the PBE as it influences the number of complementors, affiliated to the platform (Ondrus et al. 2015). West (2003), for example, argues that platforms can start as being relatively closed (or proprietary) and later, open up to various degrees. As platform openness is achieved mainly through the availability of boundary resources (e.g., APIs, SDKs), Eaton et al. (2015) investigate the development of PBE through the evolution of boundary resources (e.g., APIs). Um and Yoo (2016) further develop this view in a study, which investigates the PBE evolution through the introduction of external and internal APIs and the interconnectivity among them.

The growth of the PBE is also seen as co-evolution between the platform owner and external developers (Scholten and Scholten 2012). Uphelding that view, Lindgren et al. (2015) study the change in the organization identity caused by the transformation of the relationships between the platform owner and the various actors, who take part of the PBE.

Apart from investigating platform ecosystems as consisting of third-party developers, researchers also view the platform ecosystem in broader terms as encompassing various business partners (that is, not only external complementors). Thus, PBE is also associated with the development of an overall ecosystem of multiple stakeholders around the platform.

Tan et al. (2013), for example, study platform development from the perspective of collaboration with various external partners (e.g., customers, partners, stakeholder, etc.). Based on their empirical-based model, they argue that during the early stages of platform development a MSP is focused in building a critical mass of users and engages in low levels of external collaboration. During the next development stage, a platform owner integrates services by partners to help platform constituencies develop their business (e.g., advisory services offered by third-party experts). The level of collaboration with external partners increases when the platform commences to build capabilities by collaborating with various actors (e.g., offering financial services) and by engaging in value-adding collaborations, which expand the initial value proposition of the platform.

Lihua et al. (2010) also propose an evolutionary model for business ecosystem development consisting of four stages: birth, expansion, coordination/maturity stage and evolution or death. During the birth stage of the business ecosystem, the platform focuses on diversifying its offerings to growing number of users. Thus, the ecosystem consists of the platform, its customers, and various players who supports the functioning of the ecosystem. During the next phase of expansion, various external players join the platform business ecosystem. As the number of partners grows, MSP needs to establish and maintain an array of coordination mechanisms to ensure the vitality of its ecosystem. The evolution stage is associated with the platform’s ability to reshuffle its existing ecosystem by abandoning some its key elements in favour to new technologies, products, partners.

**Platform Evolution as Entry into Geographical Markets**

Entry into geographical markets (or global expansion) constitutes a significantly less researched aspect of PE. Watanabe et al. (2017), for example, investigate Uber’s global expansion strategy. They argue that the success of platform’s global expansion strategy is dependent upon “balance of timing, pace, and selection of the host suitable enough to constructing a co-evolutionary acclimatization” (p. 45). Seamans and Zhu (2014) study the Craigslist’s entry into several U.S. markets and the impact of this move on the local newspapers industry. Although Seamans and Zhu (2014) do not study PE, their study shows that a platform can evolve by entering various geographical markets.
Platform Evolution as Mergers and Acquisitions

Mergers and acquisitions (M&A) between two or more platforms can also occur throughout the PE (Beschorner 2008; Chandra and Collard-Wexler 2008; Eisenmann, 2006; Evans 2013; Evans and Noel 2008; Miguel and Casado 2016). Although M&A among platforms are primarily investigated from antitrust perspective (e.g., Evans 2013; Evans and Noel 2008), they also represent the platform’s owner efforts to diversify its service portfolio (Beschorner 2008) and strengthen its technological capabilities (Toppenberg et al. 2016). Miguel and Casado (2016), who investigate the evolutionary paths of the GAFA companies (Google, Amazon, Facebook and Apple) also view acquisitions as complementary to the innovation efforts undertaken by the platform owner. Thus, M&A are related to the perspective that platforms evolve through addition of functionalities.

<table>
<thead>
<tr>
<th>Platform Evolution Views</th>
<th>Attributes</th>
<th>Authors (e.g.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PE as Stage Models</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PE as Standalone Issues</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE as the ability to grow MSP’s user base</td>
<td>Growth of number of MSP participants based on same-side and cross-side effects, Building communities around users, developers, partners</td>
<td>Chu and Manchanda (2016), Garcia- Swartz and Garcia- Vicente (2015), Ting et al. (2014), Kyprianou, 2015, Leong et al. (2013), Yang et al. (2015)</td>
</tr>
<tr>
<td>PE as a shift in the platform boundary</td>
<td>Introducing new features, Degree of platform openness</td>
<td>Gaver (2015), Eisenmann et al. (2011), Um and Yoo (2016)</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>PE as development of an ecosystem</th>
<th>Features for all platform participants</th>
<th>Scholten (2011), Smedlund and Faghankhani (2015), Song and Wildman (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Features offered by platform owner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Features offered by third-parties</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tech boundary resources (API, SDK)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social boundary resources (IPR, agreements)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality of complementors (governance)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evolution of boundary resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relationship between MSP owner and complementors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External partners (e.g., suppliers, stakeholders, distribution partners, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M&amp;A of new tech capabilities</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Overview of the Views on PE and Their Attributes

General Notes on Platform Evolution

The analysis of the selected articles confirms the lack of unified, comprehensive view of platform evolution. Rather, researchers tend to label the journey, which MSP undergoes as part of its development (from launch to demise), with various terms: shift of platform boundaries (Gawer 2015), platform maturity (Cennamo and Santalo 2015), platform development (Ruutu et al. 2017, Watanabe et al. 2017), platform expansion (Hagiu 2006), platform evolution (Tiwana 2014), etc. Apart from the existence of multiple labels to denote this phenomenon, there is also a variety of views on what platform evolution constitutes. Some researchers (see, e.g., Evans 2016) associate it with growing the size of the affiliated to the platform participants and adding new types of platform participants. Other researchers (e.g., Gawer and Cusumano 2014) view platform evolution in terms of adding external complementors who increase the value proposition of the platform. Studies demonstrate that platform evolution is also concerned with the development of the platform itself (e.g., adding new functionalities (e.g., Hagiu 2006), increasing platform openness through the evolution of its boundary resources (e.g., Ghazawneh and Henfridsson 2011), or the development of specific IT capabilities (e.g., Tan et al. 2016b) and the possibilities of M&A (e.g., Beschorner 2008). Different studies emphasize on one or several of these views when discussing platform evolution, but, in reality, platform evolution encompasses to a certain aspect almost all of them (for further discussion, see Empirical Investigation of Exemplary MSPs).

Researchers also outline different reasons, which prompt a MSP to evolve. Variety of factors, either imposed externally, or stemming from internal considerations, drive the evolution of MSPs. The main reason why MSPs evolve is to ensure that they survive, when facing internal and/or external challenges (Han and Cho 2015, Tiwana 2014). Platform’s successful existence can come under threat due to environmental changes (Tan et al. 2015) such as imitation of rivals (Smedlund and Faghankhani 2015) or competitors shifts (Eisenmann et al. 2011). Platform owners also engage in subsequent development of their business in order to address internal inefficiencies. In particular, they focus on improving the capabilities of a platform to innovate and strengthen the governance mechanisms needed to operate an ecosystem of external complementors (Gawer 2015).

While MSP evolution is rarely a matter of choice (that is, platforms tend to evolve to one degree or another rather than remain static), a number of authors point out that the decision to evolve or not in a particular
direction (e.g., enter complimentary market) is a strategic one (see, Bar-Gill 2014; Bhargava 2014; Gawer 2015; Sen et al. 2011). Thus, platform owners face numerous evolutionary options, which they can choose either to pursue or not to pursue. A number of researchers, however, view PE as being path dependent (Dobusch and Sydow 2011, Song and Wildman 2012, Hanseth and Lyytinen 2010). For example, Dobusch and Sydow (2011) view PE as path dependent phenomenon, characterized by three distinct phases - preformation (path emergence), formation, and lock- in to a specific path. Thus, the emergence of certain path is determined (enabled and restricted) by the strategic choices taken during the earlier stages of platform evolution (see, e.g., Dobush and Sydow 2011; Wang et al. 2015). Path dependency, however, locks the platform to a certain path, which can reduce significantly the number of option available for further evolution (Dobusch and Sydow 2011).

The timing of platform evolution (e.g., early or delayed expansion, see Bhargava 2014), is also an important strategic consideration. As MSPs can choose to evolve in multiple ways (Evans 2009, Gawer 2014, Hanseth and Lyytinen 2010), their evolutionary paths will not follow a uniform pattern, but rather they evolve in a diverse manner. For example, even though Evans (2009) sees platform evolution as a stage model with several distinct phases (see above, Growth Stage Models), he argues that different platforms do not exhibit the same evolutionary path as they adhere to different strategies to achieve critical mass of users (Evans, 2009) and to sustain growth once they manage to ignite (Evans and Pirchio 2015). Thus, different strategies are applied to different stages of the evolutionary path of a particular platform. We argue that platform evolution is a distinct concept from platform strategy as while platform evolution deals with the nature of platform development, platform strategy prescribes how such a development is to be carried out. For example, MSPs tend to evolve as to add external complementors (e.g., Gawer and Cusumano 2014), which constitute a specific instance of platform evolution. This process is associated with a number of strategic decisions such as prescriptions for degree of platform openness (how open a platform should be) and recommendations for exerting the right level of control over the activities of the external complementors. Despite being distinct, the two concepts are clearly interrelated as evident from the example above.

Although the topic of PE has a recent uptake, there are a number of significant gaps in the literature on platform evolution, which needs to be addressed further. Few of the selected studies have PE as their specific subject of investigation, with majority of them focusing on separate issues and processes associated with PE (e.g, acquisitions (see, Toppenberg et al. 2016)). Thus, there is a lack of comprehensive view of what platform evolution constitutes. Few authors also recognize the diversity of evolutionary trajectories, which a MSP can choose to undertake (Gawer 2014), as most of the work focuses on investigating separate modes of evolution in isolated manner (e.g., introducing innovative features, diffusion of innovation, etc.). There is also a lack of research investigating under which conditions certain evolutionary paths emerge and unfold. Topics such as platform evolution through entry into geographical markets and through M&A remain largely under-researched with only few studies addressing limited number of issues. There is also a lack of thorough integration of the two distinct streams in the platform literature (economic and technical) concerning platform evolution.

**Empirical Investigation of Exemplary MSPs**

The purpose of the empirical investigation is to validate the accuracy with which the above-identified attributes (see Table 3) capture the nature of PE. To do that, we conduct in-depth case studies of two exemplary MSPs – YouTube and Twitter. Our findings, summarized in Table 4, demonstrate that the majority of the identified PE attributes are present throughout the evolutionary paths of the two MSPs (see, YouTube and Twitter). This conclusion illustrates the complex and multi-faceted nature of PE as encompassing numerous, diverse attributes. Thus, none of the identified views on PE (and its attributes) captures in its entirety the actual evolutionary path of a MSP. Rather, the evolutionary path is constructed from a combination of multiple attributes, which span across all the identified views on PE.

While conducting the empirical investigation, we notice that while some of the identified attributes (e.g., acquisitions, introduction of spin off products, etc.) can be observed as events, others, such as critical mass of users, optimal user growth rate, etc., need to be further operationalized. While we argue that they are important for the PE, we could not provide more information about them due to the nature of the data we gathered. We also identify an attribute “building a logistics and distribution system”, which although was mentioned by several researchers (e.g, Han and Cho, 2015; Leong et al. (2013)) was not part of the
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<table>
<thead>
<tr>
<th>Attributes</th>
<th>YouTube</th>
<th>Twitter</th>
<th>AirBnb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth of participants</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Optimal Growth Rate</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Initial growth</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Critical mass of users</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Post growth</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Business Model Evolution</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Profitability</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>New types of MSP participants (other than complements)</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Building a logistics and distribution system</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Multi-channel expansion</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Evolution of platform architecture (infrastructure)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Environment Dynamics Evolution</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Governance Mechanisms Evolution</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Core features</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Complementary features</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Exploratory features</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Spin Off products</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Envelopment</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Bundling of features</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Integrating features to third-parties</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Features for all platform participants</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Features offered by platform owner</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Features offered by third-parties</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Adding third-party complementors</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Tech boundary resources (API, SDK)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Social boundary resources (IPR, agreements)</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Growth of complementors</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Governance Mechanisms for complementors</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
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Table 4. Overview of the Evolutionary Paths of YouTube, Twitter and Airbnb

<table>
<thead>
<tr>
<th>Evolutionary Path</th>
<th>YouTube</th>
<th>Twitter</th>
<th>Airbnb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boundary Resources Evolution</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Business Ecosystem</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Building community</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Entry in geographical markets</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>M&amp;A for new features</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>M&amp;A for tech capabilities</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Unidentified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimization of features</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Optimization of channels</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Evolution of participants affiliation</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Evolution of spin-off products</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Connectivity between spin-off product and main product</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4. Overview of the Evolutionary Paths of YouTube, Twitter and Airbnb

The comparison between the evolutionary paths of YouTube and Twitter indicates that these paths are constructed of similar attributes as the majority of the identified and the unidentified attributes are present (see, Table 5). Some of the attributes, however, are configured differently during the separate stages of PE. For example, after its launch YouTube added advertisers as a third distinct group of MSP participants (after users and developers) during the first phase of its development, while Twitter added advertisers during the second stage of its evolutionary path. The launch of spin-off products in different stages (YouTube in second phase, Twitter in third phase) also confirms this observation.

Despite these differences, the evolutionary paths of YouTube and Twitter exhibit a high level of similarity. To further investigate the presence or absence of similarity across MSP’s evolutionary paths, we decide to construct the evolutionary path of another exemplary MSP – Airbnb (see, Table 5). To this end, we utilize exclusively the study conducted by Constantinou et al. (2016), which provides a rich historical account of the Airbnb’s evolutionary path from its launch until 2014. As the authors divide Airbnb’s evolutionary path
in two stages, we adopt this approach for consistency with their data. Furthermore, as we use the case of Airbnb to compare across evolutionary paths rather than across stages of evolutionary paths, the difference between the time span of the stages in comparison to YouTube and Twitter are of no significance.

Airbnb’s evolutionary path differs from the evolutionary paths of YouTube and Twitter as it is composed of different configuration of attributes (see, Table 5). In particular, unlike YouTube and Twitter, which initially targeted specifically users, Airbnb was launched as a two-sided platform catering to two distinct types of platform participants (hosts and dwellers). Thus, Airbnb’s efforts were concentrated on catering to these two sides from the onset, while YouTube and Twitter both catered initially to their users and gradually added advertisers as new types of platform participants. Airbnb also does not operate an ecosystem of external complementors and does not offer spin-off products. Thus, we find evidence about the presence of various MSP’s evolutionary paths, which is consistent with the views of a number of researchers (e.g. Evans, 2009; Gawer, 2014; Hanseth and Lyttinen, 2010). The purpose of this study, however, is not to investigate the existing types of evolutionary paths, their stages and the attributes, which belong to them. Due to the limited empirical evidence and the lack of comprehensive insights from previous work, we abstain from assigning given attributes to specific evolutionary phases and leave the investigation of this matter for future studies. We, however, used the observed heterogeneity of evolutionary paths to put forward our proposal of PE concept.

**Discussion**

As none of the identified views on PE captures in its entirety the nature of PE (see Table 5), we deem it necessary to propose an integrated view of MSP evolution as a complex, multi-faceted and dynamic process. The need for conceptualization of PE is further evident from the lack of coherence among the identified attributes associated with certain PE views (see, Table 3). The unsystematic presentation of these attributes as a list, indicating for no correlations among them, combined with the diverse nature of the attributes, cannot itself constitute a conceptualization of PE. Rather, building upon the conducted hermeneutic literature review, the identified attributes and the subsequent empirical investigation of three exemplary case studies, we propose an integrated, comprehensive view on PE.

**Figure 1. Conceptualization of Platform Evolution**
Towards an Integrated View of Multi-Sided Platforms Evolution

We conceptualize PE as a process of co-evolution of MSP attributes, which is realized through the introduction and subsequent reconfiguration of various Platform Evolution attributes (see, Figure 1). In order to construct this conceptualization, we first draw a distinction between platform attributes (MSP attributes) and Platform Evolution attributes (PE attributes). We base this distinction on the analysis of the evolutionary paths of YouTube, Twitter and Airbnb, which indicates that MSP constituencies, infrastructure, functionalities and governance regimes, as core characteristics of MSPs, co-evolve over time. For example, YouTube initially catered to one distinct type of platform constituencies (that is, users) and later introduced developers and advertisers as additional platform constituencies. Thus, we argue that the MSP constituencies has evolved in a particular manner. YouTube has also continued to evolve both its infrastructure and its governance regime (see, Table 4). We view these attributes as core characteristics of any MSP rather than PE attributes. That is, all MSPs can be characterized by the affiliated to them constituencies, the activities that those constituencies can engage in and which are enabled by the underlying infrastructure, and the governance regime, which regulates the functioning of the MSP. This conclusion also stems from the definition of MSPs as socio-technical entities (see, Section Multi-Sided Platforms). Researchers have already argued that PE can be presented as co-evolution of various attributes (see, Reconfiguration Model), but there is a lack of a model, which provides comprehensive account of such co-evolution. To address this, we present PE as a process of co-evolution of the core characteristics of MSP (MSP attributes), namely constituencies, infrastructure, functionalities and governance regime. It is important to note that as MSPs attributes co-evolve, there is a certain level of interdependency between them. For example, the introduction of new types of platform participants, such as third-party complementors, which form an ecosystem around the platform, requires a change in its underlying infrastructure and in its governance regime.

Such a general presentation of PE as a co-evolution of MSP attributes, however, does not take into account the observed heterogeneity of MSP evolutionary paths (see, Empirical Investigation of Exemplary MSPs). Furthermore, this approach “black boxes” the evolutionary process and hides the multi-faceted nature of PE (e.g., YouTube’s evolutionary paths consists of multiple attributes - change in infrastructure, addition of core, complementary, exploratory features, spin-off products, acquisitions, entry into geographical markets, etc.). While all MSPs are characterized by the presence of MSP attributes, their evolutionary paths vary due to the different configurations of PE attributes (compare YouTube and Airbnb, Table 4). While it is appropriate to view, on a general level, PE as a process of co-evolution of MSP attributes, we argue that the manner, in which these co-evolution is realized is though PE attributes, such as addition or removal of functionalities, opening to third-party complementors, building a community around each of the MSP constituencies, etc. For example, the affiliated to YouTube constituencies (MSP attribute) have evolved through the introduction of new types of platform participants, such as advertisers (PE attribute). In another example, the number of guests on Airbnb grew from 800,000 in 2011 to 3 million in 2012 (Constantinou et al., 2016), thus leading to an increase in the size of each of the platform constituencies (or user growth, which constitutes a PE attribute). Twitter, for example, extended the technical capabilities of its infrastructure (MSP attribute) by acquiring various start-ups (acquisition, which is a PE attribute). Thus, while the MSP attributes point to what changes during the PE, the PE attributes identify how this change is carried out. Due to the limited empirical evidence, identifying an exhaustive list of PE attributes is beyond the scope of this study. The main goal of this paper is to present a general conceptualization of PE, whose operationalization, based on various empirical instances (from which various PE attributes are identified) is a subject of future studies. We, however, try to demonstrate how some of the identified attributes (see, Table 4) relate to the MSP attributes (see, Figure 1) based on the literature review and empirical investigation. A more thorough revision and classification of the list of identified attributes in Table 4, however, is needed once more empirical data are collected.

We also present PE as a process influenced by certain drivers (PE drivers) and leading towards a certain outcome (PE maturity) (Figure 1). For example, due to the “undeniable need to search and filter” (Twitter, 2008, para 6) (PE driver - internal optimization), Twitter strengthened the technical capabilities of Twitter’s infrastructure (Evolution of Infrastructure as Platform Attribute) through the acquisition of Summize (PE – acquisition). Such a representation of PE also stems from the conducted literature review (see, section 4, Platform Evolution as a shift in platform boundary and Maturity Stage Models). Similar to the PE attributes, we do not aim to provide a comprehensive overview of the PE drivers. Rather, we categorize some of the identified attributes as PE drivers. For example, a change in the environment (see, Tiwana, 2014) and the need for internal optimization of the MSPs’ capabilities (Gawer, 2015) constitutes
such PE drivers rather than PE attributes (see, Table 3, Reconfiguration Models). We apply the same logic to categorize PE outcome. We further argue that PE drivers and PE outcomes as a certain level of maturity remains two understudied topics in the MSP literature.

Conclusion

We contribute to the growing body of literature on MSPs by proposing a comprehensive conceptualization of platform evolution as a complex, multi-faceted and dynamic process. To do that, we build upon the existing fragmented views on PE and conduct further empirical investigation in order to precise the PE concept. We present PE as a process, triggered by various PE drivers and leading towards a certain outcome (Platform Maturity). Furthermore, we provide a general view of PE as co-evolution of platform constituencies, infrastructure, functionalities and governance regime as attributes, common to all MSPs. In order to account for the observed heterogeneity of MSP evolutionary paths, we introduce the notion of PE attributes, which MSPs introduce and re-configure differently. We argue that the evolutionary path of particular MSP is determined by the presence (or absence) of particular PE attributes and their re-configuration throughout the different evolutionary stages.

Our research is not without limitations. We focus on conceptualizing PE, but, although our proposal is based on empirical evidence, we did not verify the validity of the concept more thoroughly. We have also based our empirical investigation on three case studies relying exclusively on secondary data, which can restrict the generalizability of the model and diminish its explanatory powers when it comes to capturing the evolution occurring on all types of MSPs. Thus, although we have selected representative platforms, future work can focus on studying empirically multiple cases of diverse platforms in order to verify and/or improve the proposed conceptual model of platform evolution.

A fruitful avenue for future research is to adopt Qualitative Comparative Research (QCA) approach, which can be used to outline various configurations of PA and PE attributes and thus, outline various types of evolutionary paths, which platforms can follow. An in-depth case study, which provides a detailed and comprehensive account (that is, including multiple PA and PE attributes) of the evolution of a single platform over time can also be used for further developing the model. Furthermore, due to the lack of sufficient empirical evidence, we abstain from providing an exhaustive list of PE attributes and PE drivers and from discussing them in details. As this is beyond the scope of this study, we leave these issues for future research.

A possible avenue for future research is the full-fledged integration of the different streams of platform literature. Although the proposed model of platform evolution (see, Figure 1) incorporates both perspectives on platforms (economic and technological), future research can improve further the integration of the two literature streams. In particular, an interesting matter for investigation is the interdependencies between the PA elements; for example, how the growth of user base (economic view) poses challenges for the platform technology (technology view) in terms of scaling and future development.
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