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The influence of developer multi-homing on competition between software ecosystems

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ABSTRACT

Having a large number of applications in the marketplace is considered a critical success factor for software ecosystems. The number of applications has been claimed to determine which ecosystems holds the greatest competitive advantage and will eventually dominate the market. This paper investigates the influence of developer multi-homing (i.e., participating in more than one ecosystem) in three leading mobile application ecosystems. Our results show that when regarded as a whole, mobile application ecosystems are single-homing markets. The results further show that 3% of all developers generate more than 80% of installed applications and that multi-homing is common among these developers. Finally, we demonstrate that the most installed content actually comprises only a small number of the potential value propositions. The results thus imply that attracting and maintaining developers of superstar applications is more critical for the survival of a mobile application ecosystem than the overall number of developers and applications. Hence, the mobile ecosystem is unlikely to become a monopoly. Since exclusive contracts between application developers and mobile application ecosystems are rare, multi-homing is a viable component of risk management and a publishing strategy. The study advances the theoretical understanding of the influence of multi-homing on competition in software ecosystems.

1. Introduction

Competition in the mobile communication industry has been argued as turning from "a battle of devices to a war of ecosystems".[1] Hence, the sheer number of applications in the marketplace has become increasingly important in marketing new mobile devices (see e.g., Chen, 2010; Reuters, 2012; Lee, 2015; Smith, 2015). All leading mobile operating system providers have established application marketplaces such as Google Play, App Store by Apple and Microsoft's Windows Phone Store (previously Windows Phone Marketplace) with the aim of enticing a large number of content providers (e.g., application developers) in order to create their mobile application ecosystems. The logic behind establishing the ecosystems is grounded on the theory of network externalities (Katz and Shapiro, 1985). Due to network externalities, a large number of application developers within the ecosystem is expected to lead to a large number of applications that, in turn, will attract customers and drive device sales, leading to a virtuous circle (Holzer and Ondrus, 2011).

In this study, the concept of 'mobile application ecosystem' refers to "an interconnected system comprising an ecosystem orchestrator, mobile application developers, and mobile device owners, all of whom are connected through a marketplace platform" (Hyrynsalmi, Seppänen and Suominen, 2014). Hence, a mobile application ecosystem is a derivate of the more general concept of a 'software ecosystem' (Jansen, Finkelstein, and Brinkkemper, 2009; Bosch, 2009; Manikas and Hanssen, 2013).

The emergence of ecosystems has increased the complexity of revenue models, but also cooperation, competition and co-opetition between and within the ecosystems. The traditional value chain approaches (Porter and Millar, 1985; Porter, 2004), employed to describe the telecommunications industry (Barnes, 2002; Maitland, Bauer, and Westerveld, 2002; Funk, 2009), have been increasingly replaced by ecosystem approaches (Basole and Karla, 2011, 2012; Basole, Russel, Huhtamäki, and Rubens, 2012).

The increased complexity calls for a better understanding of the boundaries and structures of the ecosystems (e.g.,

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[1] Stephen Elop, the former Executive Vice President of Microsoft's Devices and Services and (at the time of the comment) the CEO of Nokia Corporation, speech at D9, June 1, 2011

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Jansen et al. 2009; Gueguen and Isckia, 2011; Hanssen, 2012). Prior research has investigated the success factors of the iPhone (Laugesen and Yuan, 2010; West and Mace, 2010), the distribution and capture of value in the mobile phone supply chains (Dedrick, Kraemer, and Linden, 2011), developers' perspectives on the mobile application markets (Lee, Lee, Shim, and Choi, 2010; Holzer and Ondrus, 2011; Schultz, Zarnekow, Wulf, and Nguyen, 2011), the dynamics of the application marketplaces (Järvi and Kortelainen, 2011; Hyrynsalmi, Suominen, and Seppänen, 2013; Jansen and Bloemendal, 2013), standard wars and platform battles (Heinrich, 2014; Gallagher, 2012; van de Kaa and de Vries, 2015; van de Kaa, van den Ende, de Vries and van Heck,. 2011) and cooperation within ecosystems (Gueguen and Isckia, 2011). However, there is a dearth of theoretically grounded literature offering foresight on the competition between software ecosystems that could guide mobile application developers to optimize their publishing strategies.

To fill this void in the literature, this study draws on theory about platform competition (Rochet and Tirole, 2003; Armstrong, 2006; Sun and Tse, 2009) and investigates application developers' multi-homing (i.e., the situation in which developers publish applications in two or more ecosystems) as well as the content of the most downloaded applications. According to the extant research, the success of network platforms, such as mobile application ecosystems, is determined by whether the market is single-homing or multi-homing in terms of volume (Sun and Tse, 2009). In other words, if application developers prefer to offer their products in one ecosystem, i.e. single-home, the market as a whole will, over time, develop into a monopoly of the leading ecosystem.

To gain a more accurate insight into the competition between software ecosystems, we advance the research on the influence of multi-homing on platform competition in two-sided markets (Sun and Tse, 2009). Software ecosystems are two-sided markets since two groups of agents, e.g. consumers and application developers operate in the market. Second, we contribute to the research on competition dynamics in the telecommunications industry (He, Lim, and Wong, 2006). Our point of departure is that, because only a small number of all applications available in the ecosystems are actually actively used by customers, consequently only a small number of all developers generate the majority of downloads. Thus, we particularly focus on the role of this group of developers that we define as '*nucleus developers*' since they have a central role in the success of an ecosystem. Hence, we shed light on the bargaining powers of the nucleus developers and ecosystem orchestrators such as Apple, Google, and Microsoft that host and maintain the ecosystems (Manikas and Hansen, 2013).

Against this backdrop, we empirically study more than one million applications from all three mobile application ecosystems, examining the level of multi-homing at the levels of the (1) mobile application ecosystem and (2) nucleus developer. We use web crawling to collect the data, and string matching algorithms to pair applications and developers of different ecosystems. We then move to examining how the dynamics of multi-homing change by analyzing the nucleus developers to determine whether they are particular to multi-homing and, thus, less dependent on a single ecosystem orchestrator. Finally, we investigate the content of the most successful applications and show that the content, i.e., the value propositions of the most popular applications can be classified into a relatively small number of categories.

Our results demonstrate that just three percent of the developers generate more than 80% of all installed applications. In addition, the results show that when regarded as a whole, only a small subset of application developers multi-home. However, among the nucleus developers, multi-homing is common. This indicates that mobile application ecosystems can be considered both single-homing and a multi-homing market depending on the level of analysis. We term markets like these '*multilevel two-sided markets*'. Taken as a whole, our results offer an explanation as to why several competing mobile application ecosystems can co-exist. For professional application developers, who have the resources to publish their applications in multiple ecosystems, this study implies that multi-homing is a viable component of risk management and a publishing strategy.

The remainder of the study is structured as follows. After this introductory section, we present the theoretical foundation of the study. The third section includes the methodology and data collection process. The results are presented in the fourth section. The fifth section comprises discussion on the results, implications for research and practice, and also limitations and avenues for further inquiry. The last section concludes the study.

2. Background

The number of application developers in mobile application ecosystems generally increases the number of applications available in the marketplace and, hence, the value of the ecosystem to the customer, and vice versa (Holzer and Ondrus, 2011; Cenamor, Usero and Fernandex, 2013). Therefore, it is paramount for ecosystem orchestrators to involve both customers and developers in their respective ecosystems. Thus, the success of an ecosystem is dependent on both developers and customers. As a result, mobile application ecosystems can be termed 'two-sided markets' (Rochet and Tirole, 2003; Armstrong, 2006).

Two-sided markets are economic platforms with beneficial cross-group network effects (Armstrong, 2006; Rochet and Tirole, 2003; Parker and Van Alstyne, 2005). In other words, the value of participating in a platform for agents in one group depends on the number of participants in another group. Network effects can accrue from direct externalities, whereby utility increases as the number of users consuming increases; and indirect externalities, whereby the demand for a product depends on the existence of another product (Katz and Shapiro, 1985). Hence, in the mobile application ecosystems context, two-sided markets can be conceptualized as markets where one or several economic platforms enable interaction between customers, developers, and an orchestrator (Rochet and Tirole, 2003, 2006; Armstrong, 2006).

To date, the managerial and scholarly debate on two-sided markets has followed the logic of the credit card business, where the absolute number of merchants accepting a credit card — or the number of applications available in the marketplace — determines the value of the credit card for the end user (see e.g., Chen, 2010; Reuters, 2012; Lee, 2015; Smith, 2015). However, this approach considers all applications equal and thus ignores the qualitative aspects of the market dynamics. Prior studies have examined winner-takes-all competition (Eisenmann, Parker and Van Alstyne 2006), i.e., a situation where one platform ultimately wins the platform race. Econometric modeling studies, such as Tse (2006) and Sun and Tse (2009) have created models of platform competition that emphasize the role of single- or multi-homing

As there are several competing mobile application ecosystems, customers and developers can participate in more than one ecosystem. Participation in more than one economic platform at a time is termed 'multi-homing' (Rochet and Tirole, 2003; Armstrong, 2006; Sun and Tse, 2009). Multi-homing in two-sided markets is a situation where more than one two-sided platforms exist in the same market, and the two sides of the market (e.g., buyers and sellers) are free to operate in several platforms. For example, an application developer is multi-homing when it offers products in both the Apple App Store and Google Play. Similarly, a customer is multi-homing when he/she utilizes several mobile devices operating in different platforms; however, with a single mobile device, the customer can typically participate in only one ecosystem. Single-homing is the opposite situation: an actor participates only in one ecosystem.