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Platform Adoption by Mobile Application Developers: A Multimethodological Approach

Abstract

This paper investigates the factors that influence the adoption of IT platforms by software developers and how those factors differ from those that influence IT adoption by end-users. We take a multi-methodological approach, beginning with an interpretive field study where we interview mobile application developers. In the initial interpretive phase, we identify a comprehensive set of influences on IT platform adoption, comparing them with the factors that have been identified in previous studies of end-user adoption, noting key differences. In the second phase, we empirically test the factors identified in our interviews. We find several key differences between end-user adoption and developer adoption of IT platforms. Most notably, we observe the importance of network externality considerations when developers make an adoption decision, a consideration that is largely absent for end-users.

Keywords: IT platform adoption, mobile applications, multi-methodology, quantitative research, network externalities

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1. Introduction

The rising importance of development platforms for application software (software commonly referred to as “apps” or add-on “extensions”) represents a major shift in software development. Rather than hardware or software firms overseeing the majority of software development, independent third-party developers now play a substantial role. Since the launch of the Apple iPhone in 2007, Apple alone has paid out more than $16 billion in royalties to app developers, and has created or supported over 1.5 million jobs in the US (Apple, 2017). In Europe, the “app economy” has created over 1.6 million jobs and continues to grow (Mandel, 2016). Both Apple and Android platforms have achieved considerable scale, with each having over 100 billion downloads of over 2 million available applications (Statista, 2016). Given the number of applications, the amount of revenue generated, and the number of new developers, there is clearly a need to understand why developers choose particular platforms to develop and distribute their applications.

In this research project, we examine two key research questions. The first is, “What factors influence the adoption of IT platforms?” IT adoption has been thoroughly studied by researchers, and numerous theoretical explanations have been developed. These theories include the technology acceptance model (Davis, 1989), the unified theory of technology acceptance and usage (Venkatesh et al., 2003), diffusion of innovations theory (Rogers, 1995), and social cognitive theory (Bandura, 1986; Compeau and Higgins, 1995). One common theme in this extant research is that each of these explanations focus on how the characteristics of the IT influence its adoption. Additional factors, however, may also be important when considering the adoption of IT platforms. Unlike IT that is adopted for its own sake, platforms are chosen for the purpose of building end-user applications that may be monetized for profit. That is, technologies are adopted by technology consumers – while platforms are adopted by technology producers. The value of an IT platform to a developer depends largely on the expected user base of that platform. Value accrues in the future and may not be certain or apparent in the present. Platform adoption may also differ from IT adoption because utilizing an

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IT platform for development often requires advanced technological knowledge in programming languages, software development, and various operating systems. Thus, the adoption of IT platforms may be influenced more by network externality and knowledge barrier considerations than by the technology characteristics identified in research that studies IT adoption. Therefore, our second research question is, "How do the factors that influence IT platform adoption differ from those that influence IT adoption?"

If IT platform adoption differs systematically from IT adoption, an opportunity exists to build a theoretical explanation of IT platform adoption. Identifying and testing the factors that influence platform adoption, then describing any differences when compared to the factors that influence IT adoption, and subsequently developing a theoretically-based explanation of these influences is the primary intended contribution of this research. Towards that end, we employ a multi-methodology approach. In the first phase of our study, we interview mobile application developers, noting their reasons for choosing to develop for a particular platform. We also compare these developers' reasons with those that have been identified in prior research on IT adoption. After identifying a comprehensive set of factors related to platform adoption, we test these factors in a second phase by surveying mobile application developers. We then discuss the differences in the factors that we have found to influence platform adoption and those that influence IT adoption. The demonstration of this multimethodology approach is a secondary contribution.

The paper proceeds as follows. In our Literature Review section, we define and describe IT platforms, then describe foregoing research on IT adoption. In our Research Methodologies section, we explain the initial interview phase of our research and the subsequent survey phase. Findings from our interviews and statistical results from our surveys are presented as well. We then discuss the theoretical and practical implications of our findings, highlighting key differences between IT adoption and IT platform adoption. We note future research plans before concluding.

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2. Literature Review

2.1 IT Platform Adoption

An IT *platform* is the "extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the interfaces through which they interoperate" (Baldwin and Woodard, 2009; Tiwana et al., 2010, p. 676). It is a general purpose technology that enables application software with relevant business opportunities (Fichman, 2004). Apple's iOS and the Android operating system are examples of platforms for the development of modules for smartphones and tablets; Mozilla Firefox is an example of a platform for the development of modules for internet browsers. A *module* is "an add-on software subsystem that connects to the platform to add functionality to the platform" (Tiwana et al., 2010, p. 676). Smartphone apps, tablet apps, and browser extensions are examples of modules. The platform, the modules specific to that platform, and the hardware on which the modules run is known as the platform's *ecosystem* (Gawer and Cusumano, 2002; Tiwana et al., 2010). Platform-centric ecosystems are a reality of competition in many industries (Katz and Shapiro, 1994). This is particularly evident in software development and distribution (Tiwana et al., 2010).

The adoption of IT platforms to date has been considered largely an organizational decision, because software development has historically taken place within organizations to enhance organizational capabilities and business value (Dedrick and West, 2004; Fichman, 2004). Indeed, researchers have suggested that IT platform adoption is an organizational decision that can be explained from the perspectives of technology strategy, organizational learning, technology bandwagon, and adaptation (Fichman, 2004). However, since many mobile applications are built by individual developers in a freelance manner outside of organizational constraints, individual-level factors may also be critical to understanding platform adoption. Indeed, individuals are one of the major driving forces behind the "app economy" (Streitfeld, 2012).

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Given that the development of software applications and other types of software modules is increasingly being driven by individuals, it is important to examine how individuals choose a development platform. Platforms must actively compete for developer adoption (Tiwana et al., 2010) and since IT products have little or no value in isolation, factors such as popularity and compatibility intensity significantly influence developers' adoption decisions (Katz and Shapiro, 1994). Individual characteristics such as knowledge barriers, personal benefit, and enjoyment also influence adoption decisions (Kogut and Metiu, 2001). In IT adoption literature, research has consistently shown that interactions in society influence technology adoption decisions (Barnett et al., 2015; Davis, 1989; Junglas et al., 2013). Furthermore, platform adoption choice is market-driven because IT product developers adopt platforms to develop IT products for profits (Fichman, 2004). Researchers have shown that people tend to adopt more marketable software (Agarwal and Prasad, 2000). To attract end-users, developers are likely to adopt platforms that have great market potential and provide advanced technical support (Agarwal and Prasad, 2000; Kalish, 1985). In sum, IT platform adoption might differ from IT adoption and be influenced by factors such as platform characteristics, individual characteristics, social interaction, and network externalities. Since decisions about adopting development platforms are made by individuals and should ideally consider individual-level factors, we next review theories of individual adoption.

2.2 IT Adoption

The factors that influence individuals' IT adoption decisions have been studied extensively by IS researchers. Some of the most often-cited theories for adoption include the Technology Acceptance Model (TAM), and its extensions TAM2, TAM3, and the unified theory of acceptance and use of technology (UTAUT). This family of theories has identified perceived usefulness, perceived ease of use, subjective norm, image, job relevance, computer self-efficacy, facilitating conditions, computer anxiety, and perceived enjoyment, among others, as the key drivers of individuals' intention to use IT and indirectly, as drivers of individuals actual IT adoption behavior (Davis et al., 1989; Venkatesh

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and Bala, 2008; Venkatesh and Davis, 2000). Voluntariness and experience are noted as the key moderating factors in several models. TAM-related research has continued to evolve, identifying other important attributes, such as uncertainty in online systems adoption (Sun, 2013), predisposing factors, reinforcing factors, enabling factors in eHealth systems adoption (Kelly et al., 2011), and demographic characteristics in e-government adoption (Sipior et al., 2011).

Other researchers have developed Innovation Diffusion Theory (IDT), which describes relative advantage, complexity, image, compatibility, and results demonstrability as important predictors of individuals' IT adoption (Moore and Benbasat, 1991, 1996; Rogers, 1995). In social cognitive theory (SCT), outcome expectations, self-efficacy, affect, and anxiety influence adoption (Bandura, 1986; Compeau and Higgins, 1995). Each of these theories of IT adoption may be relevant when considering IT platform adoption.

When considering individual-level theories of adoption, an important consideration to note is that end-users adopt technologies for the sake of the specific technology. In contrast, developers adopt platforms in order to build end-user applications. In the present research study, adopters are not consumers choosing among various platforms or ecosystems (Xu et al., 2010); instead, here adopters are individual software developers who must decide which platform to adopt. Developers are technology producers, not technology consumers. Thus, the software developer adopter of the IT platform is distinct from the end-user adopter of an IT. This is one reason why the factors influencing IT platform adoption may differ from those that influence IT adoption.

We therefore surmise that the adoption of IT platforms is influenced not only by the specific characteristics of those platforms, such as the characteristics identified in TRA, TPB, TAM, UTAUT, IDT, and SCT, but also by the platform's popularity, network externalities, and potential future value (Eisenmann et al., 2006; Katz and Shapiro, 1994; Rochet and Tirole, 2006). Indeed, it has been observed that the software developer's adoption decision is one fraught with uncertainty about the

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unknown future benefits of the platform, potential costs of making the wrong decision, and the irreversibility of the decision (Fichman, 2004).

Additionally, a developer must have a certain level of technical knowledge and programming skills in order to utilize a platform properly. Technical skills such as these are largely irrelevant for an individual end-user. Thus, again, developers have different considerations when adopting an IT platform than end-users do when adopting an IT. For this reason, we now begin our investigation of the factors influencing IT platform adoption.

3. Research Methodologies

The overall goal of this research project is to develop a theoretical model of IT platform adoption. Towards that end, we conduct two separate studies with differing methodologies. First, we take an interpretive approach in order to gain a comprehensive understanding of the influences on developers' platform adoption decisions. Despite numerous technology adoption studies, there remains a lack of knowledge about IT platform adoption (Dedrick and West, 2004). We summarize this earlier work below in the Study 1 subsection. Building on the model that we were able to develop using this approach, we then move to test a research model using survey data, described in the Study 2 subsection. By utilizing a mixed methods approach across two studies, we are able to evaluate the robustness and generalizability of our theoretical model (Bhattacherjee and Premkumar, 2004; Venkatesh et al., 2013).

3.1 Study 1 – Interpretive Field Study

In the interpretive approach, researchers collect and analyze data to identify concepts and categories that are evident in data. In our study, interview data was collected and then analysis proceeded through a series of steps, including: (a) iterative data collection, (b) generation of concepts, (c) development of categories and relating these categories to concepts, (d) theoretical sampling, and (e) use of the coding paradigm of conditions, contexts, strategies, and consequences to

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discuss the phenomenon of interest, each according to recognized best practices (Corbin and Strauss, 1990; Crook and Kumar, 1998; Klein and Myers, 1999; Walsham, 1995, 2006).

3.1.1 Data Collection

In study 1, data was collected from 35 developers currently involved in application development for the Apple iPhone, Google Android, or the Microsoft Windows Phone platforms in South Korea. Semi-structured interviews were used. Interviewees' ages ranged from 31 to 42, with a mean of 36.08. All held either bachelor's or master's degrees, with most holding bachelor's degrees. Full-time professional work experience ranged from 1 to 38 months with a mean value of 18.38 months.

Interview subjects were asked a series of questions about their platform adoption decision (see Appendix A for the interview protocol). They were asked which platforms they considered; they were asked about their experience with their chosen platform, and about their future platform usage intentions. Interviews were conducted in the Korean language and translated into English for coding. A professional translator translated the original interviews into English; another translator then translated them back to Korean to ensure equivalence of translations.

3.1.2 Data Analysis – Generation of Concepts and Development of Categories

Interview transcripts were analyzed using open, axial, and selective coding (Corbin and Strauss, 2008). This coding was conducted by two researchers experienced in the analysis of qualitative data. The initial coding phase, *open coding*, involves each coder examining the interview transcripts line by line to uncover *concepts* that potentially explain developers' platform adoption decisions. Each concept was discussed and labeled by consensus. After the process of open coding, concepts that were similar to one another were grouped into broad, generalizable, higher order *categories,* which are akin to theoretical *constructs.* The development of these categories helped reduce the large number of concepts to a more manageable list, from which a pattern could be discerned of the influences shaping platform adoption. Wherever possible, we employed construct names from existing literature to label our categories, since the goal of our research was to extend current theories

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of adoption. We also did this to avoid duplication of terminology and the confusion that could result. During open coding, we also identified the *characteristics* or properties of each category to identify patterns of covariation among these constructs. Additionally, to understand the relative salience of a concept, we also tabulated the number of respondents mentioning that concept.

Our open coding process identified 62 concepts that were grouped into 27 categories. To focus on the more salient predictors and to ensure parsimony, we decided to only consider those categories that were mentioned by five or more respondents. This resulted in the selection of 15 categories that were codified as constructs of interest. Among these 15 categories were “IT security” (susceptibility to hacking, viruses, and app replication) and “platform potential” (potential for the platform to be a leader or part of future technology trends). Because interviews revealed that these characteristics share some similarities with “relative advantage”, they were not included in the survey phase. Additionally, “forced choice” (where company directives mandated developers to use a specific platform) was among the reasons mentioned by some developers. Since such circumstances do not reflect a free adoption choice, it was dropped from further analysis. The remaining 12 categories are listed in Table 1, below.

The categories are numbered and grouped into four broad sets: perceived platform characteristics, perceived network externalities, individual characteristics, and social interaction. The number of respondents that mentioned each predictor is noted in parentheses. An examination of the frequency counts suggested that network externalities (market potential, marketability, and developer tools) are the dominant drivers of mobile platform adoption, followed by relative advantage and related knowledge, while other predictors played a lesser role.

Table 1. Predictors Identified in Open Coding

<u>*Perceived platform characteristics*</u> refers to salient technological attributes that influenced adopters’ choice of that platform. In our sample of application developers, these characteristics included:
1. Relative advantage: the perceived strength of an IT platform relative to competing platforms; this included IT platforms’ performance, debugging capability, convenience of use, and ease of development. (mentioned in 27 interviews)

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2. *Platform innovativeness:* the perceived novelty of the platform, containing useful functions, innovative image, and benefits. (7)
3. *Technical compatibility:* the extent to which a platform was compatible with or could be integrated with other programming technologies. (6)
4. *Platform openness:* the extent to which a platform used open source software. Boudreau (2010) stated that "openness relates to the easing of restrictions on the use, development, and commercialization of a technology." (6)

<u>*Perceived network externalities*</u> refer to direct or indirect value expected from a large network of adopters for a given IT platform. For network-hosted applications, network externalities are presumably a key driver of adoption that is often overlooked in technology acceptance research. Three network externality factors emerged from our analysis as salient to IT platform adoption:

5. *Market potential:* the expected size or growth of the future market for the platform. More platform users translate into greater revenue opportunities for application developers. (21)
6. *Marketability:* the existence of a current market or app ecosystem based on the IT platform where developers are willing to pay to enter in order to obtain the desired good or service (Mundt and Houston, 2010). (16)
7. *Developer tools:* the availability of tools to support application development and implementation. A large network size motivates vendors to supply tools that can boost developers' presence and participation in the network. (25)

<u>*Individual characteristics*</u> are personal characteristics that explain differential patterns of adoption across the developer population. In this category, two motivational forces and two individual differences emerged from our analysis:

8. *Personal benefit:* the potential of earning revenue through application deployment on a platform (an extrinsic motivation). (15)
9. *Enjoyment:* personal expectations of fun or goal achievement from developing applications (an intrinsic motivation). Prior research suggests that both extrinsic and intrinsic motivations are key drivers of IT adoption (Davis et al., 1992), and that the same appears to hold true for IT platform adoption. (5)
10. *Related knowledge:* developers' prior knowledge of web services, Java, and related tools which are needed to build and deploy applications on their intended platform. (20)
11. *Personal innovativeness:* developers' propensity to experiment with and try out a new platform. This construct is also known to influence IT adoption (Agarwal and Prasad, 1999). (6)

<u>*Social interaction*</u> is a link or complex interaction established via reciprocity behavior between two actors who perceive themselves to be interdependent (Ling et al., 2009; Thompson and Fine, 1999). From our analysis, this interaction refers to:

12. *Social influence,* which can be defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003). From our analysis, social influence (mentioned in 9 interviews) influences IT platform adoption, because developers typically get new information regarding platforms and application markets from their professional peers and colleagues. (8)

3.1.3 Data Analysis - Use of Conditions, Contexts, Strategies, and Consequences

The next phase of our coding was *axial coding,* where we linked our categories using casual relationships to develop an initial explanation of platform adoption. Categories were classified as either causes, effects, or conditions (circumstances in which the phenomenon is embedded).

Selective coding was the last step of interpretive analysis, where we aimed to integrate the categories and relationships identified into a holistic theory. Designating IT platform adoption as our

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central category, we systematically and logically related this category to other categories representing its causes. We employed diagramming as an integration technique, where a pictorial diagram was used to depict relationships between categories, organized around our central category. This diagram, shown in Figure 1, represented our interpretive theory of IT platform adoption, and, along with Table 1, is the primary outcome of study 1.

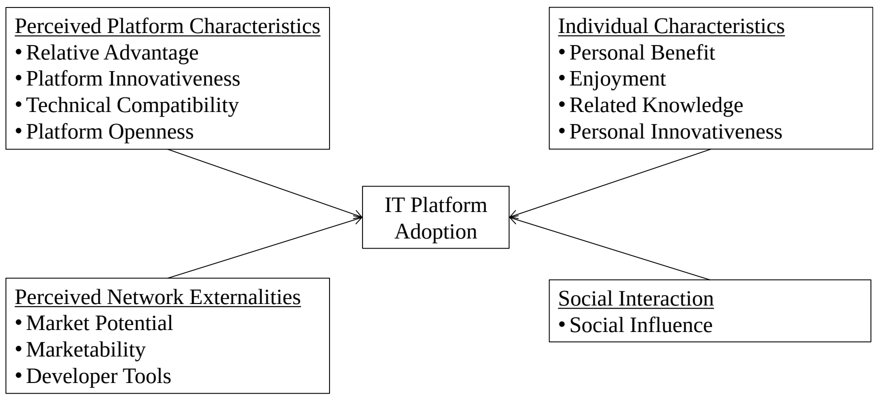

Fig. 1. Preliminary model of IT platform adoption

3.2 Study 2 – Quantitative Study

After building the model in Study 1, we examined existing literature to see if the relationships indicated in our model had been previously studied. While none of the relationships have, to our knowledge, been studied in our specific context of platform adoption by developers, we nevertheless want to be informed by work on IT adoption. Therefore, as an initial step in our second study, we sought to turn our model into formal hypotheses, relying on extant literature where possible.

As we engaged in this process, we discovered interrelationships between several of the concepts that we had uncovered. The additional detail provided in this foregoing research enabled the development of a more nuanced model where some concepts/constructs influence others (for instance, some of the concepts/constructs listed as “perceived platform characteristics” influence one another, while some influence adoption directly). We now formally present our hypotheses and a refined research model.

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3.2.1 Hypothesis Development

Relative advantage is one of the concepts that we identified within the larger grouping of *platform characteristics*. Relative advantage, which is defined as "the extent to which an innovation is perceived as being better than its precursor" (Moore and Benbasat, 1991 p. 195) and has been considered an important antecedent of innovation adoption (Agarwal and Prasad, 1998; Choudhary and Karahanna, 2008; Moore and Benbasat, 1991; Rogers, 1995; Thong, 1999). Researchers have stated that relative advantage is similar to the notion of perceived usefulness in technology acceptance (Moore and Benbasat, 1991; Venkatesh et al., 2003). Innovation studies indicate that different types of innovation generate different degrees of advantage.

Researchers have argued that more radical innovations lead to greater potential for competitive advantage. Specifically, the characteristics of an innovation have a significant impact on the firm's strategic orientation (Gatignon and Xuereb, 1997). Thus, the relative advantage of a platform can be determined by the *platform innovativeness*. Therefore,

H1a: Relative advantage is positively associated with on platform adoption.

H1b: Platform innovativeness is positively associated with relative advantage.

In diffusion of innovation literature, Rogers (1995) defines compatibility as "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" (p.224). He asserted that compatibility is one of the major drivers for people to adopt innovations or new technologies. Elsewhere, compatibility is similarly defined as "the perceived cognitive distance between an innovation and precursor methods for accomplishing tasks" (Karahanna 2006, p.784), and prior studies have found that compatibility is positively related to individuals' adoption behavior. That is, an innovation is more likely to be adopted when it is perceived as consistent with existing systems, procedures, and values of the potential adopters (Karahanna et al., 2006; Moore and Benbasat, 1991; Premkumar et al., 1994; Rogers, 1995). *Technical compatibility* is an innovation's compatibility with present system including hardware and

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software (Bradford and Florin, 2003). Therefore, technical compatibility produces organizational benefits by enabling individuals or organizations to easily integrate new technologies with existing technologies or systems (Bradford and Florin, 2003; Tornatzky and Klein, 1982). In line with this, defining technical compatibility as the extent to which a platform is compatible with or could be integrated with other programming technologies, we propose that individuals are more likely to adopt the IT platform that is technically compatible.

At the organizational level, openness refers to the extent to which an organization exchanges information with its environment (Rogers, 1995) . The openness of organizations, systems, and technologies has been regarded as a key factor of adoption behaviors in various contexts such as innovation diffusion (Rogers, 1995), technology adoption in healthcare (England et al., 2000), IT adoption at the firm level (Olivera and Martins, 2011), and Internet adoption (Teo et al., 1997-98). Researchers have stated that the openness of a technology makes it easy for individuals to exchange the ideas and knowledge across organizational and geographical boundaries (Teo et al., 1997-98). As a result, technology openness motivates and facilitates organizational adoption of the technology. Previous research proposed that openness encourages the organization to (1) exchange new ideas, (2) evaluate new ideas more easily, and (3) more rapidly adopt the innovations (England et al., 2000; Rogers, 1995). Some have proposed that openness offers the technical value of benefiting from the collected information as well as the psychological value of promoting trust, which in turn increases the chances of adoption (Lai and Guynes, 1997; Saleh and Wang, 1993). In this regard, *platform openness* provides greater opportunities for individuals to assess and adopt a new platform; it enables them to assess the compatibility of a new platform with other platforms. We hypothesize,

H1c: Technical compatibility is positively associated with platform adoption.

H1d: Platform openness is positively associated with technical compatibility.

Marketability refers to the existence of markets with the ability and willingness to pay to obtain the assets, products or services (Mundt and Houston, 2010). More specifically, marketability enables

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firms to decide which technologies would be appropriate in commercializing new products or services (Bastic, 2004; Cho and Lee, 2013; Parry and Song, 1994; Sohn et al., 2007). Researchers have examined the effect of marketability when firms commercialize new technology products (Cho and Lee, 2013), noting that it plays an important role in determining the development and commercialization of new technologies (Kumar and Jain, 2003). Still others have empirically tested the role of marketability of technology on financial performance in small or medium-sized enterprises (SMEs) (Sohn et al., 2007). In addition, IT-driven marketability stimulates herding behavior (Marinc, 2013), and leads to the expansion of market size. Conversely, people are likely to perceive greater risk of using a software when it loses marketability; thus, people tend to adopt and use more marketable software (Agarwal and Prasad, 2000). Marketability is therefore a salient factor in determining individuals' adoption of new technologies or products. In the current study, we extend the notion of marketability into the context of IT platform adoption. Defining marketability as the existence of a current market or app ecosystem based on a development platform, we therefore propose that marketability is an influential factor in IT platform adoption.

H2a: Marketability is positively associated with platform adoption.

The influence of marketability has been explained by factors such as market potential, entry barriers, market attractiveness, market competition, customer needs, and legal regulation (Cho and Lee, 2013; Cooper, 1984; Sohn et al., 2007). The marketability of technology is specifically influenced by market potential, market characteristics, and product competitiveness (Sohn et al., 2007). Based on prior literature, and on the findings of study 1, we propose that, in the context of development platforms, marketability can be influenced by two factors: market potential and the availability of developer tools.

Market potential has been studied primarily in the marketing literature. Market potential represents the attractiveness of a market and it influences firms' marketing expansion strategy when new products are diffused across products and countries (Talukdar et al., 2002). Market potential is

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also regarded as a critical determinant of target market selection and its relevant investment (Malhotra et al., 2009; Whitelock and Jobber, 2004). For instance, a firm may be willing to take risks for marketing and financial investments when the market potential gives opportunities for returns (Malhotra et al., 2009). In the IS literature, researchers define market potential as the total number of potential users expected during the entire product lifetime (Niculescu and Whang, 2012). Market potential affects a new product adoption based on the framework for innovation diffusion (Kalish, 1985). Market potential is represented by market growth and future market size (Cho and Lee, 2013), and it has been considered a key dimension of marketability (Bastic, 2004; Cho and Lee, 2013; Cooper, 1984; Sohn et al., 2007). Therefore, in this study, we define market potential as the expected size or growth of the future market for the development platform; and we propose that market potential influences platform marketability.

Second, *developer tools* are the availability of tools to support application development and implementation. The adoption of a development platform is likely to be market-driven and depends on the characteristics of available platforms (Gavalas and Economou, 2011). Developers will adopt and use new tools and methods with sufficient technical support and availability (Agarwal and Prasad, 2000). The availability and popularity of development platforms attract more people to develop, thereby enabling the platform to be more marketable by offering more numerous applications, as well as ones of higher quality and with lower prices. This expands the user pool who purchase more applications for the specific platform, which motivates more developers to participate in the platform. This virtuous cycle indicates that developer tools can be regarded as a critical factor of marketability in the context of IT platform adoption. Taken together, we propose that market potential and developer tools influence marketability, which in turn, influences platform adoption.

H2b: Market potential is positively associated with marketability.

H2c: Developer tools are positively associated with marketability.

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Social influence refers to "perceived pressure from social networks to make or not to make a certain behavioral decision" (Lu et al., 2005, p.249). It has been regarded as a salient factor in technology and innovation adoption in IS literature (Lu et al., 2005). A number of research studies investigate the role of social influence in technology adoption. Social influence is a form of subjective norm in the TRA (Taylor and Todd, 1995); others examine its influence on individuals' commitment to and use of new IT (Malhotra and Galletta, 1999); still others extended the effect of different types of social influences, including subjective norm, image, and voluntariness, to individuals' pre- and post-adoption beliefs and attitudes. Finally, social influence has been embedded in theoretical perspectives such as TAM2 and UTAUT (Karahanna and Straub, 1999; Lu et al., 2005; Moore and Benbasat, 1991; Taylor and Todd, 1995; Venkatesh and Davis, 2000; Venkatesh et al., 2003). Thus, when there is uncertainty about platform adoption, individuals are likely to interact with their social network to help them decide. Therefore, we hypothesize that:

H3: Social influence is positively associated with platform adoption.

According to cognitive evaluation theory (Deci, 1971), individual motivations can be classified as either extrinsic or intrinsic motivations (Deci and Ryan, 1985). The former drives an individual to perform a behavior to achieve specific goals such as rewards, whereas the latter relates to perceptions of pleasure and satisfaction from performing a behavior. Prior IS research indicates that extrinsic and intrinsic motivations play a critical role in determining individuals' behavioral intention to adopt a technology (Agarwal and Karahanna, 2000; Kim et al., 2007; Venkatesh and Davis, 2000). For both motivations, previous studies have identified perceived benefits (Kim et al., 2007; Lee, 2009; Mehrtens et al., 2001) and perceived enjoyment (Agarwal and Karahanna, 2000; Kim et al., 2007; Lin and Lu, 2011; van der Heijden, 2004; Venkatesh and Davis, 2000) as major factors that influence adoption.

There has been evidence in various contexts that perceived benefits have a positive influence on individuals' adoption. Perceived benefits include lower transaction costs, faster transaction speed,

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and better information transparency, each of which have been shown to significantly affect online banking adoption (Kim et al., 2007; Lee, 2009). Perceived benefits, including benefits that arise from technological factors, influence technology and innovation adoption (Beatty et al., 2001; Sharma and Citurs, 2005). Thus, individuals are likely to adopt specific platforms when the platform provides greater benefit than existing platforms or competing platforms.

IT knowledge helps individuals to form a clear perception about IT adoption; it amplifies the perception of potential benefits and increases their confidence (Lu et al., 2005). In addition, since individuals' knowledge or experience using IT is related to their receptivity toward a change, their knowledge of IT and receptiveness to information about IT may alleviate a negative attitude toward new technologies or innovations (Jeong et al., 2009). Thus, higher IT knowledge, which provides a familiarity with current technologies, helps individuals evaluate the benefits of adopting new technologies (Bassellier et al., 2001). Individuals who are educated about the benefits of IT would be more willing to adopt (Thong, 1999). Therefore, individuals' *relative knowledge* influences the perceived *personal benefits* of IT, which in turn leads to platform adoption. We, therefore, hypothesize

H4a: Perceived personal benefit is positively associated with platform adoption.

H4b: Relative knowledge is positively associated with perceived personal benefit.

Perceived enjoyment refers to "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis et al., 1992 p. 1113). Individuals' perceived enjoyment of the interaction with the technology has been confirmed as a significant antecedent in adopting and continually using technology (Agarwal and Karahanna, 2000). Individuals who feel pleasure when engaging in a particular behavior are likely to adopt the technology or innovation (Kim et al., 2007; Moon and Kim, 2001). In hedonic information systems, perceived enjoyment has been regarded as a salient affective and intrinsic factor that leads to adoption (Lin and Lu, 2011; van der Heijden, 2004).

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Personal innovativeness refers to an individual trait that reflects an intrinsic willingness to try out new technologies (Agarwal and Prasad, 1998); it has been extensively examined as an IT-specific trait triggering intrinsic motivation (Jia, 2009). Innovations or new technologies are inherently risky even though individuals recognize the potential benefits from adoption (Agarwal and Prasad, 1997). Personal innovativeness enables individuals to be more willing to adopt the innovations or technologies in the face of uncertainty about benefits (Lu et al., 2005). More specifically, personal innovativeness is an individual's affective trait that determines their affective states such as perceived enjoyment and computer anxiety (Hwang and Kim, 2007). Furthermore, perceived (heightened) enjoyment can be a consequence of personal innovativeness in the domain of IT ((Agarwal and Karahanna, 2000). Therefore,

H4c: Perceived enjoyment is positively associated with platform adoption.

H4d: Personal innovativeness is positively associated with perceived enjoyment.

3.2.2 Scale Development

We developed items for the constructs by applying the operational definitions that are in line with the findings from Study 1. To generate a list of potential survey items, we reviewed existing literature. Where constructs exist that are similar to the ones that we have identified through our interviews, we evaluated the use of existing items.

Perceived *relative advantage (RA)* is measured by asking respondents to indicate whether the platform enables them to accomplish their task quickly, whether it could improve their quality of work, and whether it can enhance their effectiveness on their job (Moore and Benbasat, 1991). Perceived *platform innovativeness (PI)* measures whether the adopted platform is highly innovative compared to other platforms, whether the platform is frequently updated with new functions, whether it is supplemented with new functions, and whether new functions add value to the platform (Stock, 2011). We measured *technical compatibility (TC)* by asking respondents to indicate whether the platform is compatible with other programming technologies, whether it is compatible with other

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software, and whether the platform fits the way respondents work (Taylor and Todd, 1995). We measured *platform openness (PO)* as the degree of perceived openness by application developers (Hilkert et al., 2011). These and all other items appear in Appendix B. We measure all constructs with a seven-point Likert scale ranging from strongly disagree to strongly agree.

Perceived *market potential (MP)* is measured using four items (Song and Parry, 1997) by asking respondents to indicate whether applications developed on this platform have many potential customers, whether customers have a large number of potential needs, whether they perceive the potential size of the market as being large, and whether they perceive the market as having the potential to grow very quickly. Perceived *marketability (MKT)* was gauged by asking questions similar to those for perceived market potential, but emphasizing the current rather than the potential size of the market (Eby et al., 2003). We operationalized perceived *developer tools (DT)* as addressing the importance of having a platform for development, using a platform for a low price, and using platform when they need it (Taylor and Todd, 1995).

Perceived *personal benefits (PERB)* were measured by asking respondents' to indicate the level of expected monetary rewards, extrinsic benefits, and personal benefits (Bock et al., 2005). *Enjoyment (ENJ)* is measured by asking respondents about their level of enjoyment, fun, pleasantness, and liking when developing applications using the platform (Compeau and Higgins, 1995). Finally, *related knowledge (RK)* is measured by assessing respondents' level of prior knowledge in using the platform they adopted (Faullant et al., 2012). We operationalize perceived *personal innovativeness (PERI)* by assessing respondents' eagerness to experiment with new IT, eagerness to try out new IT, and hesitancy to explore new information (Agarwal and Prasad, 1999).

Social influence (SI) is measured using four items asking respondents about the influence they received from their peers (Venkatesh et al., 2003).

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The dependent construct, *platform adoption (ADOPT)* is operationalized using three items measuring respondents' level of favorable attitude toward the particular platform they adopted (Srinivasan et al., 2002).

3.2.3 Data Collection

A pilot study was conducted with 10 mobile application developers who had not participated in Study 1. The participants in the pilot study were recruited from mobile application online communities in which professional developers share their knowledge and experiences developing applications. After modifying the instrument based on feedback and results from the pilot study, we sampled from the mobile application development community in South Korea. We identified 52 companies currently developing mobile applications. We contacted them individually and 38 companies allowed us to distribute our survey to their developers. We contacted 173 individuals from those companies, making sure that they were actual developers. After screening potential participants, we invited them to participate in our study and sent out the survey instrument. We collected 159 responses and used them for analysis (response rate of 91.9%).

3.2.4 Data Analysis

The average age of the participants was approximately 31. Average job experience developing mobile application was 21.8 months. The average number of applications each individual had developed was 4.2. Most developers use Java as a primary language in developing application (Java = 84, iOS = 31, Others = 28, multiple = 16).

Reliability was assessed using internal consistency scores, calculated by composite reliability scores. Internal consistencies of all variables are considered acceptable if they exceed 0.70 (Nunally 1978). As shown in Table 2, the values of Cronbach's alpha for all constructs are greater than or equal to 0.80. All items exhibit high loadings on their respective constructs. Thus, all constructs in the model exhibit good internal consistency. We assessed discriminant validity between the constructs using the square root of AVE. Table 2 indicates that the AVE for each construct exceeded

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the correlations between that and all other constructs (Fornell and Larker, 1981). Comparing inter-construct correlations with AVEs in Table 2 reveals that all constructs share more variance with their indicators than with other constructs.

Table 2. Reliability and Construct Correlations

Constructs	Alpha	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Adoption	0.89	**0.90**												
2. Developer Tools (DT)	0.90	0.13	**0.91**											
3. Enjoyment (ENJ)	0.95	0.30	0.39	**0.95**										
4. Marketability (MKT)	0.88	0.31	0.42	0.42	**0.90**									
5. Market Openness (MO)	0.88	0.30	0.42	0.39	0.58	**0.90**								
6. Personal Benefits (PB)	0.88	0.15	0.34	0.42	0.47	0.44	**0.90**							
7. Platform Openness (PO)	0.75	0.28	0.27	0.36	0.39	0.33	0.27	**0.89**						
8. Personal Innovativeness (PerI)	0.87	0.20	0.05	0.34	0.18	0.21	0.15	0.28	**0.85**					
9. Platform Innovativeness (PI)	0.89	0.52	0.27	0.36	0.40	0.39	0.30	0.40	0.17	**0.86**				
10. Relative Advantage (RA)	0.87	0.46	0.23	0.41	0.29	0.28	0.22	0.36	0.20	0.56	**0.85**			
11. Relative Knowledge (RK)	0.92	0.29	0.31	0.49	0.36	0.34	0.22	0.40	0.58	0.37	0.44	**0.90**		
12. Social Influence (SI)	0.83	0.41	0.17	0.40	0.37	0.26	0.40	0.12	0.42	0.32	0.30	0.33	**0.86**	
13. Technical Compatibility (TC)	0.91	0.43	0.32	0.47	0.30	0.31	0.26	0.40	0.24	0.52	0.62	0.48	0.28	**0.87**

[a] Note. The diagonal elements (in bold) represent the square root of the AVE.

We used SmartPLS for data analysis. We conducted our analysis in two stages. First, we tested the measurement model to ensure that the constructs had sufficient psychometric validity and then we addressed the structural model in which the hypotheses were tested. To ensure the stability of the model developed to test the research hypotheses, we used the PLS bootstrap resampling procedure with an iteration of 1000 sub-samples drawn with replacement from the initial sample to generate percentile bootstrap *p* values. The summary of factor analysis for testing the validity of our constructs results is shown in Table 3.

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Confirmatory factor analysis (CFA) was performed to test reliability and construct validity for all items. As shown in Table 3, all factor loadings are significant and exceeded 0.70. Composite reliabilities for each construct exceeded 0.80, and average variance extracted for each construct exceeds 0.50, meeting commonly established reliability thresholds (Fornell and Larcker, 1981).

Table 3. Item Loadings and Cross Loadings

Constructs	Items	ADO	DT	ENJ	MKT	MP	PB	PO	PERI	PI	RA	RK	SI	TC
Adoption	ADOPT1	**0.90**	0.07	0.23	0.24	0.24	0.10	0.25	0.15	0.38	0.39	0.20	0.37	0.35
	ADOPT2	**0.92**	0.09	0.25	0.29	0.25	0.14	0.23	0.13	0.49	0.38	0.24	0.37	0.36
	ADOPT3	**0.89**	0.19	0.33	0.32	0.32	0.17	0.29	0.24	0.49	0.37	0.33	0.38	0.46
Developer Tools (DT)	DT1	0.17	**0.90**	0.41	0.43	0.44	0.35	0.29	0.09	0.25	0.19	0.37	0.18	0.39
	DT2	0.07	**0.93**	0.32	0.35	0.37	0.31	0.23	0.04	0.16	0.17	0.26	0.15	0.23
	DT3	0.10	**0.91**	0.33	0.37	0.33	0.24	0.20	0.07	0.18	0.17	0.18	0.12	0.24
Enjoyment (EJ)	EJ1	0.30	0.37	**0.94**	0.43	0.41	0.39	0.36	0.28	0.28	0.31	0.43	0.34	0.46
	EJ2	0.28	0.37	**0.96**	0.39	0.34	0.40	0.33	0.32	0.29	0.31	0.40	0.38	0.40
	EJ3	0.28	0.37	**0.94**	0.38	0.37	0.41	0.33	0.33	0.36	0.36	0.41	0.40	0.42
Marketability (MKT)	MKT1	0.27	0.44	0.35	**0.88**	0.47	0.36	0.31	0.14	0.21	0.17	0.36	0.29	0.22
	MKT2	0.30	0.37	0.38	**0.91**	0.52	0.45	0.35	0.12	0.33	0.15	0.38	0.27	0.23
	MKT3	0.28	0.34	0.40	**0.90**	0.57	0.44	0.39	0.14	0.34	0.27	0.27	0.35	0.28
Market Potential (MP)	MP1	0.25	0.34	0.30	0.50	**0.89**	0.35	0.25	0.16	0.29	0.16	0.28	0.20	0.18
	MP2	0.26	0.43	0.41	0.53	**0.92**	0.41	0.30	0.21	0.32	0.17	0.33	0.23	0.25
	MP3	0.29	0.37	0.34	0.53	**0.89**	0.42	0.34	0.18	0.37	0.27	0.33	0.24	0.34
Personal Benefit (PB)	PB1	0.13	0.27	0.34	0.50	0.43	**0.90**	0.22	0.17	0.23	0.14	0.28	0.30	0.24
	PB2	0.17	0.35	0.40	0.42	0.44	**0.94**	0.31	0.18	0.26	0.16	0.25	0.37	0.26
	PB3	0.10	0.28	0.39	0.34	0.31	**0.86**	0.20	0.12	0.31	0.10	0.14	0.34	0.17
Platform Openness(PO)	PO1	0.30	0.23	0.38	0.38	0.29	0.28	**0.95**	0.32	0.34	0.32	0.34	0.13	0.41
	PO2	0.18	0.26	0.22	0.32	0.31	0.18	**0.82**	0.17	0.30	0.18	0.32	0.08	0.27
Personal Innovativeness (PERI)	PERI1	0.26	0.01	0.19	0.16	0.17	0.16	0.20	**0.86**	0.16	0.05	0.46	0.42	0.12
	PERI2	0.17	0.04	0.38	0.15	0.21	0.15	0.29	**0.90**	0.21	0.22	0.52	0.42	0.34
	PERI3	0.08	0.04	0.30	0.09	0.16	0.15	0.29	**0.91**	0.13	0.18	0.48	0.29	0.23
Platform Innovativeness (PI)	PI1	0.47	0.15	0.26	0.24	0.32	0.35	0.28	0.16	**0.88**	0.36	0.25	0.29	0.36
	PI2	0.41	0.23	0.31	0.33	0.35	0.20	0.35	0.17	**0.90**	0.45	0.37	0.27	0.41
	PI3	0.49	0.21	0.32	0.32	0.32	0.28	0.33	0.17	**0.94**	0.39	0.29	0.33	0.39
Relative Advantage (RA)	RA1	0.38	0.26	0.33	0.18	0.22	0.14	0.22	0.16	0.44	**0.89**	0.35	0.20	0.59
	RA2	0.42	0.12	0.30	0.20	0.20	0.13	0.29	0.15	0.42	**0.91**	0.32	0.21	0.49
	RA3	0.31	0.13	0.28	0.21	0.16	0.12	0.30	0.14	0.34	**0.87**	0.31	0.27	0.48
Related Knowledge (RK)	RK1	0.19	0.27	0.42	0.32	0.34	0.26	0.31	0.49	0.29	0.29	**0.92**	0.29	0.40
	RK2	0.28	0.32	0.45	0.37	0.34	0.19	0.35	0.48	0.36	0.42	**0.94**	0.33	0.43
	RK3	0.31	0.26	0.35	0.34	0.30	0.23	0.36	0.54	0.30	0.33	**0.91**	0.29	0.41
Social Influence (SI)	SI1	0.28	0.08	0.35	0.30	0.23	0.24	0.05	0.29	0.19	0.18	0.25	**0.84**	0.18
	SI2	0.43	0.13	0.31	0.32	0.24	0.40	0.13	0.34	0.33	0.25	0.28	**0.90**	0.23
	SI3	0.34	0.22	0.37	0.25	0.17	0.31	0.13	0.47	0.30	0.20	0.31	**0.84**	0.23
Technical Compatibility (TC)	TC1	0.37	0.27	0.41	0.25	0.27	0.17	0.33	0.23	0.37	0.58	0.48	0.21	**0.92**
	TC2	0.44	0.32	0.45	0.28	0.31	0.26	0.40	0.27	0.36	0.53	0.42	0.24	**0.93**
	TC3	0.38	0.30	0.37	0.22	0.21	0.24	0.35	0.22	0.45	0.49	0.32	0.24	**0.87**

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There is a potential for common method bias when using self-reported data (Podsakoff et al., 2003). Common method bias is "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff et al., 2003 p. 879). In order to test for this bias, we performed a Harman's one-factor test in which all items were entered into an un-rotated exploratory factor analysis. This analysis determines whether a single factor emerges or accounts for the majority of the variance. The results showed 38 factors emerged, the largest accounted for 31% of the variance. In addition, we followed the unmeasured latent method construct (ULMC) approach (Liang et al., 2007) shown in Appendix C. In this approach, "if the method factor loadings are insignificant and the indicators' substantive variances are substantially greater than their method variances, we can conclude that common method bias is unlikely to be a serious concern" (Liang et al., 2007 p. 87). Appendix C demonstrates the results of common method bias analysis including constructs, the substantive factor loadings, and the method factor loadings. The results reveal that only 24 (out of 38) of the method factor loadings were statistically significant ($p < 0.01$). The results also demonstrate that the variances of the indicators (average of 0.818) are substantially greater than their method-based variances (average of 0.003). Given the results, we assert that common method bias is not a serious concern for this study.

In a PLS structural model, paths are interpreted as standardized beta weights in a regression analysis. The path coefficients present the estimates obtained from PLS analysis (Figure 2). For further analysis, a boot-strapping procedure generating 1000 random samples of size of 159 was used to estimate the significance of the coefficients and the weights of the dimensions of constructs. All hypotheses were supported with the exception of H4a and H4c. The model explains 20.2% of the variance in relative advantage, 15.6% in technical compatibility, 37.3% in marketability, 7.1% in personal benefit, 11.8% in enjoyment, and 34.4% in platform adoption. Implications of these results are presented in the upcoming Discussion section.

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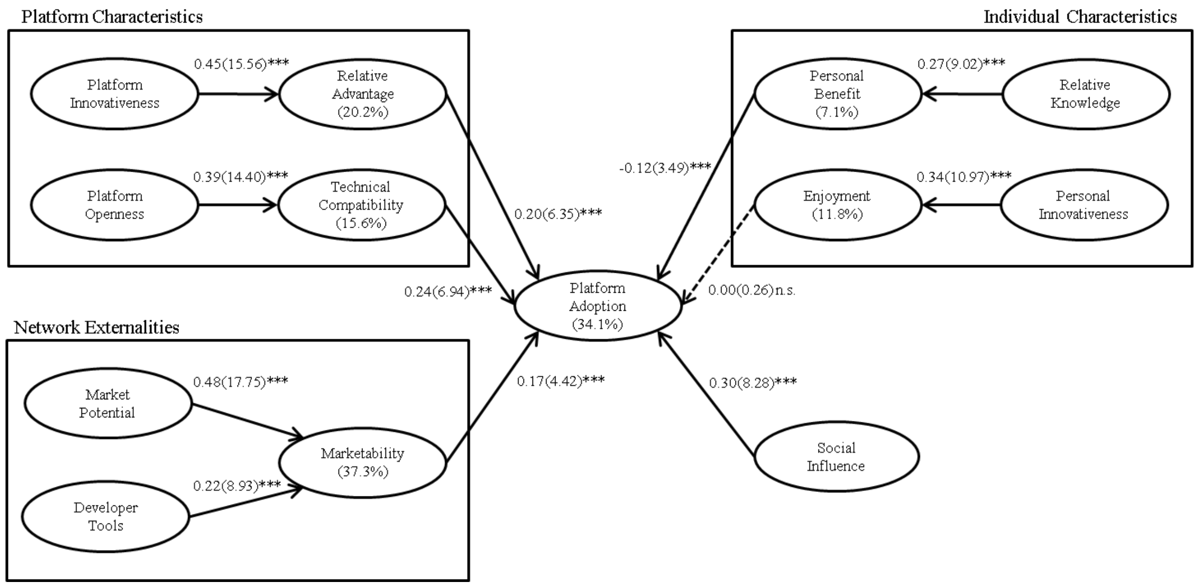

*p < 0.10, **p<0.05, ***p< 0.01

Fig. 2. Research model results

4. Discussion

4.1 Theoretical Implications

Our review of prior literature suggests that despite much progress in IT adoption literature, research opportunities still remain. IT platform adoption is different from IT adoption since developers adopt platforms for further IT product development and need to meet end-users' expectations. Our work is related to but distinct from prior research investigating technology adoption because we analyze the adoption behaviors from an IT platform developer's perspective by noting several key factors that differ from prior findings. Our findings do, however, share some similarities with foregoing research on IT adoption. Specifically, our study provides evidence that perceived technology characteristics, individual characteristics, and social influence all play a role in the adoption of IT platforms. This confirms much foregoing work on IT adoption, and confirms the importance of these constructs in the study of platform adoption as well.

The positive and significant relationship from perceived network externalities to platform adoption, however, is an important distinction between IT adoption research and our platform

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adoption research. Our paper is among the first to highlight the importance of network externalities when individuals make an adoption decision. By observing a link between network externalities and adoption, our paper identifies that some of the factors that are considered relevant in diffusion of innovations research apply to the adoption of platforms.

An additional difference between our work on platform adoption and foregoing work on IT adoption is that we did not find a significant link from perceived enjoyment to platform adoption. Perceived enjoyment is an intrinsic motivation construct has been noted in TAM2 (Venkatesh and Davis, 2000). Given that developers are adopting a platform with the intent of developing an application commercially, rather than an end-user adopting a technology with the simple intent of using it, perceived enjoyment may be less important. They may consider specific technology characteristics, but we surmise that they find there are more utilitarian rather than hedonic motivations involved here. Platform adopters are primarily profit-seeking developers. They are making a business decision by adopting; they are not simply considering their personal preferences. For these reasons, the relationship between this sub-construct and platform adoption is weakened.

In sum, this study has served to refine our understanding of the factors influencing platform adoption. While most adoption studies (from an end-user perspective) have emphasized the roles of ease of use and usefulness-related factors, our theoretical development emphasizes the characteristics of the technology itself and its network effects. In adoption studies from the end-user perspective, the role of technology characteristics has not been identified. Nevertheless, such characteristics are understandably important to developers because they shape their perceptions about their ability to successfully utilize a particular platform. We also found the importance of network externalities by considering perspectives and rationales from other studies. Market potential indicates whether developers can expect financial, reputational, or other benefits with a given platform.

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4.2 Methodological Implications

Mixed methods approaches help researchers to understand novel and complex phenomena (Venkatesh et al., 2013). This paper demonstrates the use of sequential mixed methods, allowing a comprehensive initial explanation of a phenomenon to be compared to existing theory. In study 1's interpretive approach, not only were well-researched factors (technology characteristics, individual characteristics, and social interactions) revealed to be influential in platform adoption decisions, but a largely uninvestigated factor in individual adoption, perceived network externalities, was also identified. The demonstration of a mixed-methods approach is a secondary contribution of this study.

4.3 Practical Implications

The practical implications of our study are primarily for those who own, manage, or otherwise oversee the various platforms that developers choose to adopt. Clearly, an understanding of developers' wants can help platform mangers to attract a critical mass of developers to ensure the viability of their platform. One need look no further than the fall of BlackBerry to see this illustrated. A paucity of app developers limited BlackBerry's revenue and growth, and was one of the reasons why it was unable to keep pace with competitors like Apple. The needs of the developer community were perhaps equal in importance to the development of innovative new devices (Bent, 2011). Platform owners should focus intently on building a critical mass of users and aggressively market information about their user base to potential developers.

4.4 Limitations and Future Research

One limitation of this research study is that we only consider developers who develop for a single platform. In future research, it would be possible to seek information about developers who choose to simultaneously develop for multiple platforms, a phenomenon known as multi-homing. While multi-homing was not seen in our initial interviews, and was only seen to a very limited degree in our surveys for this project, it seems plausible that multiple-platform adoption will be driven by factors similar to the ones we have identified for single-platform adoption. In addition, when platforms

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allow for apps to be easily ported from one platform to another, we surmise that this technological characteristic of the platform will facilitate multi-homing.

An additional limitation is that we did not examine differences in the drivers of platform adoption between professional developers, part-time commercial developers, and hobbyists or open-source idealists who have no expectation of remuneration. Yet another focus of investigation in future research would be developers who are users in multiple ecosystems, such as those who use an iPhone as well as an Android device, but choose to develop within one ecosystem or the other, but not both.

5. Conclusion

The adoption of IT platforms is a phenomenon with far-reaching implications. For developers, a well-chosen platform provides considerable competitive benefits, while a poorly-chosen one puts them at a disadvantage. When a critical mass of developers begins to utilize a particular platform, certain ecosystems become dominant. The rise and fall of firms like Palm, BlackBerry, Apple, and Google, and their associated hardware manufacturers, can be better understood by examining how many developers choose to develop apps for each platform. And for consumers, the choices that they have in the market for mobile technologies are determined, at least in part, by the size of the developer group for a given platform. If researchers can understand the reasons why certain platforms are adopted (or not), they may be able to identify emerging trends in IT at an early stage.

Because of the importance of platform adoption for developers, for consumers, for platform creators, and for hardware manufacturers, we continue to seek to develop a theory of IT platform adoption. A well-developed theory will help the stakeholders in each ecosystem better understand how to compete in this dynamic marketspace.

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Appendix A – Study 1 Interview Protocol

1. Do you use Apple iPhone or Google Android for application development? When did you first start using this technology platform?
2. What reasons motivated you to choose this technology platform?
3. Was your decision influenced by technology reviews in the popular press or the internet, the choices of your fellow developers, experts' suggestions, and/or others?
4. Did you consider any alternative technology platform? If so, which ones? Why did you not choose those platforms?
5. What problems did you encounter with your choice of technology platform compared to alternative platforms?
6. To what extent did your prior IT knowhow and knowledge required to use your technology platform influence your platform choice?
7. To what extent did your expectations of the future popularity of your technology platform and availability of future applications on this platform influence your platform choice?
8. Are you satisfied with your choice of technology platform? Why or why not?
9. How do you foresee your future use of this platform? Do you plan to try or switch to alternative platforms?
10. Tell me anything else if you have other comments.

Appendix B: Constructs and Measures

Table B.1
Reliability and Validity Measures

Item	Mean	Standard Deviation	Weight	Loadings	Instrument Items
Relative Advantage (RA)					
RA1	5.25	1.15	0.40	0.89	Using the platform that I have chosen enables me to accomplish tasks more quickly
RA2	5.17	1.15	0.41	0.91	Using the platform that I have chosen improves the quality of the work I do
RA3	5.14	1.12	0.32	0.87	Using the platform that I have chosen enhances my effectiveness on the job.
Platform Innovativeness (PI)					
PI1	4.52	1.15	0.33	0.88	The platform that I have chosen is highly innovative compared to other platform
PI2	4.78	1.03	0.41	0.90	The platform that I have chosen is frequently updated with new functions that provide new alternatives for developers.
PI3	4.52	1.16	0.36	0.94	The platform that I have chosen frequently incorporates new functions that are valuable to the platforms.
Technical Compatibility (TC)					
TC1	5.41	1.12	0.34	0.92	The platform that I have chosen is compatible with the other programing technologies that I use.

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TC2	5.45	1.08	0.40	0.93	For me, the platform that I have chosen is compatible with the other software that I use.
TC3	5.55	1.17	0.35	0.87	I think that using the platform that I have chosen fits well with the way that I like to work.
Platform Openness (PO)					
PO1	4.67	1.16	0.67	0.95	Developers are given clear requirements for using the marketplace.
PO2	4.76	1.23	0.44	0.82	The processes of uploading and downloading applications to the marketplace are straightforward.
Market Potential (MP)					
MP1	5.19	1.09	0.35	0.89	There are many potential customers for applications developed on this platform.
MP2	5.07	1.02	0.38	0.92	Potential customers have a great need for applications on this platform.
MP3	5.19	1.13	0.38	0.89	The potential dollar size of the market for applications developed on this platform is very large.
Marketability (MKT)					
MKT1	5.48	1.16	0.36	0.88	Currently, There are many customers for applications developed on this platform.
MKT2	5.09	1.17	0.37	0.91	Currently, customers have a great need for applications on this platform.
MKT3	5.36	1.11	0.38	0.90	The current dollar size of the market for applications developed on this platform is very large.
Developer Tools (DT)					
DT1	5.62	1.11	0.41	0.90	For me, having a platform for development is important
DT2	5.55	1.07	0.34	0.93	For me, being able to use a platform for a low price is important
DT3	5.65	1.09	0.35	0.91	For me, being able to use a platform when I need it is important.
Personal Benefits (PERB)					
PERB1	4.75	1.48	0.44	0.90	I will receive monetary rewards in return for application development by using the platform.
PERB2	4.89	1.23	0.43	0.94	I will receive extrinsic benefit for application development by using the platform.
PERB3	5.09	1.27	0.23	0.86	The extrinsic rewards in return for application development using the platform are important.
Enjoyment (ENJ)					
ENJ1	5.06	1.11	0.34	0.94	I find that using the platform to develop applications is enjoyable.
ENJ2	5.08	1.14	0.35	0.96	The actual process of using the platform to develop applications is pleasant.
ENJ3	4.97	1.14	0.36	0.94	I have fun using the platform for developing application.
Related Knowledge (RK)					
RK1	5.03	1.16	0.43	0.92	I have a good technical knowledge concerning the platform for developing application.
RK2	5.08	1.05	0.29	0.94	I have a good knowledge of the materials that are required in order to use the platform.
RK3	5.21	1.13	0.36	0.91	I have a good knowledge that helps me build my intended applications.
Personal Innovativeness (PERI)					
PERI1	4.75	1.09	0.24	0.86	If I hear about a new information technology, I look for ways to experiment with it.
PERI2	4.81	1.10	0.49	0.90	Among my peers, I am usually the first to try out new information technologies.
PERI3	4.86	1.06	0.38	0.91	I am hesitant to try out new information technologies. (reverse scale)
Social Influence (SI)					
SI1	4.91	0.95	0.31	0.84	People who influence my behavior think that the platform that I have chosen is better than other platform.
SI2	4.88	1.02	0.47	0.90	People who are important to me think that the platform that I have chosen is good for application development.
SI3	4.81	0.98	0.37	0.84	I think that others' influences are important to me in selecting a platform for developing applications.
Platform Adoption (ADOPT)					

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ADOPT1	4.74	1.25	0.36	0.90	I seldom consider switching to another platform.
ADOPT2	4.48	1.24	0.36	0.92	When I need to develop applications, this platform is my first choice.
ADOPT3	4.87	1.22	0.39	0.89	To me, the platform that I have chosen is the best platform on which to develop applications.

Appendix C. Supplemental Analysis

Table C.1
Testing for Common Method Bias

Constructs	Items	Substantive Factor Loading (R1)	$R1^2$	Method Factor Loading (R2)	$R2^2$
Adoption	Adop1	0.902***	0.814	-0.084***	0.007
	Adop2	0.920***	0.846	-0.033	0.001
	Adop3	0.884***	0.781	0.120***	0.014
Development Tools (DT)	DT1	0.881***	0.776	0.144***	0.021
	DT2	0.936***	0.876	-0.052***	0.003
	DT3	0.922***	0.850	-0.087***	0.008
Enjoyment (EJ)	EJ1	0.947***	0.897	0.015	0.000
	EJ2	0.963***	0.927	-0.048***	0.002
	EJ3	0.940***	0.884	0.033**	0.001
Marketability (MKT)	MKT1	0.894***	0.799	-0.054***	0.003
	MKT2	0.913***	0.834	-0.006	0.000
	MKT3	0.889***	0.790	0.060***	0.004
Market Potential (MP)	MP1	0.894***	0.799	-0.094***	0.009
	MP2	0.923***	0.852	0.010	0.000
	MP3	0.880***	0.774	0.084***	0.007
Personal Benefit (PB)	PB1	0.907***	0.823	0.007	0.000
	PB2	0.940***	0.884	0.034**	0.001
	PB3	0.848***	0.719	-0.045**	0.002
Personal Innovativeness (PERI)	PERI1	0.861***	0.741	-0.030	0.001
	PERI2	0.901***	0.812	0.077***	0.006
	PERI3	0.915***	0.837	-0.049***	0.002
Platform Innovativeness (PI)	PI1	0.893***	0.797	-0.044**	0.002
	PI2	0.884***	0.781	0.052**	0.003
	PI3	0.941***	0.885	-0.008	0.000
Platform Openness (PO)	PO1	0.898***	0.806	0.087***	0.008
	PO2	0.892***	0.796	-0.089***	0.008
Relative Advantage (RA)	RA1	0.878***	0.771	0.058**	0.003
	RA2	0.910***	0.828	-0.020	0.000
	RA3	0.880***	0.774	-0.039***	0.002
Related Knowledge (RK)	RK1	0.920***	0.846	-0.039***	0.002
	RK2	0.949***	0.901	0.037***	0.001
	RK3	0.905***	0.819	0.001	0.000
Social Influence (SI)	SI1	0.862***	0.743	-0.080***	0.006
	SI2	0.882***	0.778	0.038	0.001
	SI3	0.846***	0.716	0.041	0.002
Technical Compatibility (TC)	TC1	0.917***	0.841	-0.012	0.000
	TC2	0.935***	0.874	0.035	0.001
	TC3	0.897***	0.805	-0.024	0.001
Average		0.904	0.818	0.000	0.003

** $p < 0.05$, *** $p < 0.01$