

A study of advantages of app development

Jason K.C. Liang, Shari S. C. Shang

Abstract—The application (apps) on smartphones exhibit many kinds of innovation. With the powerful features of Smartphones, people can easily access the internet, social networking, email, and instant messaging. The introduction of the App stores has broken the barriers of big investments in hardware and software for software development and made software development simple and easy with only a few people or even a single person doing the work and quickly reaching users directly around the world. These unique features of app innovation make us to explore whether the first-mover advantages exist in app development, and if the first-mover advantages can be sustained.

This exploratory research reviewed literature about first-mover advantages in products, services, and e-commerce innovation. First-mover advantages often arise from sources as follows: technological leadership, resources preempting, switching costs, network externalities, and pricing advantages. With the objective to understand whether first-mover advantages exist in app innovation and how first movers sustain advantages, we collected data about top-ranked apps of different kinds and analyze their competitiveness and form findings about first mover's situation in the app market.

Keywords—First-mover advantage, apps, app store

I. Introduction

A. Research motivation and research purpose

In the booming market for mobile apps, users can find numerous powerful, innovative, and entertaining apps that cost only few dollars—or are even free—on application platforms such as the App Store and Google Play. With the introduction of the app store, the development of app innovation has several differences from innovation patterns in manufacturing and service industries. Developers who engage in app development now only need to pay the annual fee and learn a specific programming language; then they can develop the innovative app in the free integrated development environment (IDE). Furthermore, they can publish apps to innovative distribution platforms, i.e., App Store, where consumers can buy and browse apps easily. These unique features of app innovation make us to wonder whether the first-mover advantages exist in app development, and if the first-mover advantages can be sustained. To seek answers to “what are the first-mover advantages” and “how are these advantages sustained” with app

innovation, this study reviewed past research and examined first-mover apps to test the existence of advantages and the strategies for sustaining advantages. Based on past literature, first movers enjoy several advantages, including technological leadership, preemption of scarce resources, switching cost, pricing, and network externalities. They try to sustain these competitive advantages and leading position by raising entry barriers, increasing user switching costs, and enhancing service diversity and quality. We collected data about top-ranked apps of different kinds and analyze their competitiveness and form findings about first mover's situation in the app market.

II. Literature Review

A. Apps development market

1) Development of app stores

According to research by [1], smartphone owners in the U.S. now make up the majority (53%) of mobile consumers with Social Networking (85%), Maps/Navigation/Search (85%), Productivity (74%), Video/Movie (65%), and Games (61%) being the most-used types of app among American smartphone users. These apps are released mainly in the two major app stores by Apple and Google.

a) App Store

With 500 native applications for iPhone and iPod touch available at launch, the iOS App Store opened on July 10, 2008 [2], allowing users to browse and download useful apps. So far, there are more than a million apps that have been seen on the App Store. The App Store now offers more than 800,000 apps for iPhone, iPad, and iPod touch users, with customers having downloaded over 40 billion apps.

b) Google Play

The Android Market was announced by Google in August 2008, and was made available to users in October 2008. Along with the development of techniques, Google introduced Google Music and online movie rentals successively. To redirect its services, Google rebranded the Android Market as Google Play in March 2012, upgrading the music, videos, and books services to play music, movies, and books. So far, Google Play's application number climbed even faster. In September 2012, Google announced that Google Play hit 25 billion app downloads and offers more than 675,000 apps to Android users.

2) Apps innovation and development

Innovation has long been primary resources of competitive advantages in general industries [3]. There have been many reviews of literature regarding the difference between product innovation and service innovation. These reviews often focused on the degree of separability of production and consumption, or tangibility [13]. In general, there is no physical product associated with a service innovation to carry a brand name, and services must be produced and consumed simultaneously.

Jason K.C. Liang
National Chengchi University
Taiwan, R.O.C.
mrfour0004@outlook.com

Shari S. C. Shang
National Chengchi University
Taiwan, R.O.C.
sshang@nccu.edu.tw

However, with the rapid growth of the app store, several literature considered apps as new integrative perspectives combining production and service element [14]. The development of app innovation has several unique features, differentiating it from innovations in the manufacturing and service industries. First, developers engage in app innovation not only for making a profit, but also for self-achievement in the global network. Second, the development of the innovation is quite simple and easy in comparison to innovations with goods, which require huge investment in technology and innovations or in services which involve changes in the processes and human interactions. Developers who engage in app development only need to pay the annual fee and learn a specific programming language on the free integrated development environment (IDE) and publish apps to app stores in which consumers can buy apps directly.

B. *First-Mover Advantage*

The first-mover advantage can be defined as the ability of early entry into a market to earn positive economic profits and is used to discuss the benefits that an early entrant gains when releasing new products or services [4]. Consolidating past studies about first-mover advantages in the product and service industries shows that early entrants enjoy advantages, including technological leadership, resources preempting, switching cost, network externalities, and pricing advantages.

1) **Technological leadership**

Lieberman and Montgomery [5] noted that first-movers can gain advantages from sustainable in innovative technology. They considered two mechanisms: ‘learning’ or ‘experience’ curve and R&D patenting. First, in the standard learning-curve effect, the first-movers can reduce unit production costs with cumulative experience, and (thereby) enjoy a long-term cost advantage in the physical market environment [9]. In addition, other literature mentioned that learning curve can build substantial barrier to entry when learning can be kept proprietary [7]. Second, first-movers can enjoy advantages in the form of R&D or patent-races through patenting or maintaining technology as trade secrets.

2) **Resources preempting**

First-mover advantages may stem from preemption of scarce assets that already exist [5]. These assets could be physical resources, process inputs, or related to positioning in space. With superior information, first-movers can achieve a competitive cost advantage by purchasing preemptive assets, e.g., natural resource deposits and prime retailing or manufacturing location, below prices that would be faced by potential competitors.

Some essays mentioned that first-movers can also gain advantage from preempting spatial resources. In many markets, only a limited number of profitable firm could survive. First-movers establish position in geographic or product space to limit the amount of available space for later entrants [8].

3) **Switching costs**

First-movers can also gain advantages from buyers’ switching costs [5]. Switching costs is defined as “One-time costs that customers associate with the process of switching from one provider to another.” [4]. Switching costs include

several costs as follows . First, evaluation costs stem from buyers’ initial transactions or investments with some ancillary products [5]. Second, set-up costs stem from the process of building relationship with an alternative product or setting up a new product for initial use [4]. Third, learning costs are the extra effort to learn the new products. Customers are reluctant to make an effort to switch from a current brand’s products to other brands’ product after consumers are accustomed to the products which they are using [4]. Forth, uncertain costs stem from the buyers’ insufficient information of product quality. Under conditions of information asymmetry, buyers do not have enough knowledge about the performance of competitive products [9]. They are thus willing to choose products performed satisfactorily that they encountered first.

4) **Network Externality**

First mover advantages can stem from network externalities [9], which occurs when a product, industry standard or service becoming more influential and valuable to its current and potential users as the size of network increases [6]. Network externalities are considered as a more potential source of first-mover advantages in the Internet-enabled markets, and in technology or communications-related industries than in the physical markets [9]. Under the traditional constraint of physical market, it is inconvenient for buyers and sellers to congregate in a market exchange due to the factor of distance between sellers and buyers. However, the spatial separately transactions are allowed in the internet-enabled markets. Evidence showed that sellers and buyers are more likely to choose a market exchange which attracts most of counterparties. In addition, competition between network externalities can be specific in different categories of products, technology, or market exchanges [9].

5) **Pricing advantage**

Pricing strategies also play an important role in bringing advantages to first-movers. Theoretical research suggests that customers will be willing to purchase the products at higher price due to established brand loyalty or the uncertainty risk of alternative products [12]. A strong brand loyalty will be established once customers were accustomed to the first brand that perform satisfactorily. Owing to lack of information, customers will not be willing to make a switching decision even they have to pay more for the brands that they have been accustomed to use. In this scenario, later entrants also need to concentrate to attract customers with more outstanding features.

C. *Sustaining the competitive advantages of first-mover*

Although first movers enjoy many advantages relative to later entrants, not every first mover can sustain their competitive advantages, especially in industries with low entry barriers, i.e., app development. The challenge for first movers is to sustain the advantages. In order to further understand how first movers sustain their competitive advantages, we review the research in past studies and organize the strategies into three prospects: raising entry barriers, increasing user switching costs, and enhancing services. The first-mover advantage sustaining strategies are organized as follows.

1) **Raising barriers to entry**

In order to deter potential competitors from entering markets, first movers can adopt some strategies. The most frequently adopted strategies are reinvestment of innovative technology in R&D, patent protection and resource preempting [9]. With leadership in technology, first-movers have superior performance to later entrants, they thus have slack resources to reinvest in R&D and innovation to sustain the elevated position in technological leadership. To keep these technological advantages, patent protection can provide first-movers with legal framework and make them have a monopoly on particular technologies. In addition, another strategy for first-movers to deter subsequent entrants from entering the market is preempting desirable resources. By entering early stage market, first-movers can gain superior information about those attractive resources [10].

2) Increasing user switching costs to lock in customers

First movers can also achieve competitive advantages and maintain market leadership by establishing switching costs to lock in clients, preventing clients from switching to other suppliers. When a first mover manages to lock in its clients, analysis tools are implemented to collect behavior and preferences of clients. It is especially easier for first movers to collect personal information and preferences data in an Internet-enabled market environment since data collection happens automatically when customers surfing the web sites of a first mover [9].

Another approach that first movers may use to enlarge switching cost is investing to shape information asymmetry. Under the conditions of information asymmetry, consumers tend to stay loyal to products that they have understood sufficiently. In this way, brand equity will become a sources of competitive advantages while products are literally undifferentiated in markets [9].

3) Enhancing services to customers

Information has been shared openly and in a timely and detailed manner, enabling companies to analyze the links between all the businesses and industries and to provide customize services to the final consumer. First movers can offer innovative service that strongly integrate with service providers and external consumers based on ICT service innovation [11].

III. Methodology

A. Research Process

This research is exploratory, with the objective to understand whether first-mover advantages exist in app innovation and how first movers sustain advantages. To answer these questions, this study is conducted in six stages summarized in Table I which includes the purpose, process, and deliverables of each stage. The first stage is to review past research to understand what advantages first movers enjoy and how first movers sustain these advantages. The second stage is to understand the development of the app development market. The third stage is to track the market positions of different kinds of apps. The fourth stage is to analyze first-mover advantages of apps developers and their strategies for sustaining advantages. The fifth stage is to analyze first-mover advantages of apps

developers and their strategies for sustaining advantages across different categories. Then, expert interviews are conducted to validate the findings.

TABLE I. DESCRIPTIONS OF RESEARCH PROCESS

Activities	Why	How	Result
Literature Review	To understand existing knowledge about first-mover advantages	Review literature about first mover advantages in products, services, and e-commerce innovation	A preliminary understanding of first-mover advantages and strategies for sustaining advantages
Study of App market	To build insights about the app development and app competitive market	Assess reports, market analysis and official releases about the app market	App development and the competitive positions of app developers
Tracking app developers	To track the market positions of different kinds of apps	Collect top 300 lists on the first day of every month Filter the apps in the list	List of top apps that stayed on the top list more than 24 months
Data analysis	To analyze first-mover advantages of apps developers and their strategies of sustaining the advantages	Analysis of app market position on App Annie for each category from literature review	Preliminary findings of each first-mover app
Cross case analysis	To analyze first-mover advantages of apps developers and their strategies of sustaining the advantages across cases of different categories	Compare and develop patterns of app innovation and strategies applied in sustaining customer usages	Findings of first-mover advantages and sustaining strategies across different categories of apps
Expert interview	To validate the findings.	Interview five experts regarding the answers to the two research questions	Verified findings
Conclusion	To organize findings and draw a conclusion	Consolidate preliminary findings with previous theories of first-mover advantages	Findings and implications

B. Tracking app developers

To track the market position of different kinds of apps, we used apps' ranking data as an indicator of market position. There are several organizations and websites that provide reports or statistics about app stores. However, we chose App Annie, a website that provides daily and hourly ranking data for apps collected from the App Store and Google Play, to derive the ranking data we need. App Annie also helps enrolled developers to track their apps' downloads and revenues and

provides mobile analytics for iOS and Android. Furthermore, App Annie revealed that more than 200,000 apps use App Annie Analytics and 80% of top app publishers use App Annie.

As Apple's App Store is the first and has the most downloads among app stores, this study chose the ranking data on Apple's App Store as our data source. First, we collected the top 300 free and paid apps lists for all categories. However, the earliest top ranking lists we can derive from App Annie is from March 2010. We collected the ranking data on the first day of every month from March 2010 to October 2012. Second, we calculated how many months each app had ever been listed in the top 300 ranking lists. We found that there are 2,278 paid apps and 3,147 free apps which have ever been in the top list. We identified 58 free apps and 76 paid apps that had been in the top list more than 24 months.

C. Data analysis

To build insights about the app development and app competition, this study assessed reports, market analysis, and official releases about the app market. We focused on the reports on the App Store and Google Play because they have 85% of the market share. We summarized reports and official releases about the App Store and Google Play as follows.

To analyze first-mover advantages of app developers and their strategies for sustaining the advantages. We analyzed the 58 free apps and 76 paid apps identified in the previous stage based on the line chart of rank history that includes the price and version changes. First, we examined the fluctuation of each app rankings through the rank history to understand the ranking trends of each app. Second, we observed each app's rank fluctuation caused by change in price and version to understand whether price or version changes have influence on the rank. Third, we compared first-mover apps to apps entering later to verify whether the first-mover apps enjoyed the first-mover advantages summarized in the literature review.

D. Cross case analysis

To analyze first-mover advantages of app developers and their strategies for sustaining advantages across categories, we explored whether there are differences among first-mover advantages and sustaining strategies between different categories of apps, based on the preliminary findings of first-mover apps for each category. Further, we compared and developed patterns of app innovation and strategies applied in sustaining customer usage across different categories of apps. By doing this, we got findings about first mover advantages and sustaining strategies across different categories of apps. We then conducted expert interviews.

E. Finding validation and literature reconsideration

A group of four experts were recruited for this study because of their experience in the development and management of app software on smartphones and their expertise in app research. The characteristics of these four experts are shown in Table 3.5-1. The purpose of this stage is to validate findings of app innovations.

With the validated findings of first-mover advantages, the study will conduct comparison analysis with past studies of first

mover advantages and provide diverse views of the first movers in the industry of app software in the mobile world.

TABLE II. PARTICIPANTS OF EXPERT INTERVIEWS.

Expert ID	Title	Description
A	Industry consultant	With more than twelve years experiences in app software development and management.
B	Professor	With ten years experiences in e-business and innovation research.
C	CEO of an software investment company	Four years of experience in investing and nurturing app developers.
D	CEO of a Software company	Three years of managing app development and business running.

IV. Preliminary findings

A. Preliminary findings on first-mover advantages of game apps.

Our preliminary findings, based on the prices and updates of different game apps showed on a line char, are as follows. First, price changes have a strong influence on ranking. We divide every app's historical ranking trend into three periods: period before apps make their way into top 300, period when apps rank among top 300, and when dropping out of top 300. By doing so, we find that the rank and the price of an app move in opposite directions. Second, the release of an app's sequel version have an influence on ranking. We analyze only three apps (Zombierville USA, Zombie Farm, and Cartoon Wars) that have sequel versions, and find that after the release of their sequel versions, their rank dropped and one of them even dropped out of top 300. Third, we find out several strategies to maintain the competitiveness of apps. This study is a research-in-progress and analyses of additional genres are still being worked on. The above reported results on game apps provide a base for understanding the factors in first-mover advantages of app development.

This study is research-in-progress and analyses of other genres are still underway. The above results establish a foundation for understanding the factors of first-mover advantages.

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Shari Shang is an associate professor of Management Information Systems at the National Chengchi University in Taiwan. Her professional expertise includes business innovation, business process management, enterprise systems (CRM and ERP), and strategic technology management. She received her Ph.D. in Information Systems from the University of Melbourne in Australia. Her research has been published in *Information Systems Journal*, *International Journal of Technology Management, Behaviour & Information Technology*, *Service Industries Journal*, and *Total Quality Management & Business Excellence*. Before undertaking her doctoral study, Dr. Shang worked as a Consulting Manager, MIS Manager, Business Analyst, and EDP specialist in global companies such as IBM, KPMG, and AICPA, in both Taiwan and the United States.



Jason Liang is currently a Master of Science in Management of Information System student at the National Chengchi University. Jason's research interests include first-mover advantages and Mobile & Pervasive Commerce. He also have 2 years of experience in development of mobile web apps.