

# A Study of Factors Affecting Mobile Application Download

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## 모바일 애플리케이션 다운로드에 영향을 미치는 요인에 관한 연구

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**Abstract** Mobile applications are significantly impacting people's smart phone using behavior and mobile industry value chain. By examining sources of data on mobile applications use, this study presents evidence about what factors would affect the amount of apps download, which may be useful to guide app designers and publishers to develop more persuasive new apps and marketing strategies. The results indicated app ranking had effect on download amount of apps in both Android app market and Apple app store, while prices of apps had no impact on the amount of download. App type, developer experience, and locality had effect on the amount of download only for paid apps in Apple app store.

**Key Words** : Smart Phone, Mobile Application, Smart Phone Application, App Store, Download

**요약** 스마트폰 시장이 성장하면서 모바일 애플리케이션 시장은 잠재력 있는 새로운 시장으로 평가받고 있다. 애플스토어 같은 애플리케이션 시장에서 많은 구매자들이 모바일 애플리케이션을 다운로드 받고 있지만, 아직 소비자의 애플리케이션 다운로드에 대한 주요 연구는 없는 실정이다. 그러므로 이 연구는 스마트폰용 모바일 애플리케이션 다운로드에 영향을 미치는 요소에 대해서 연구를 하자고 한다. 앱 순위는 앱 다운로드에 유의한 영향을 미치는 것으로 나타났다. 가격은 유의적인 영향을 발견할 수 없었다. 앱 유형, 개발자 경험, 지역성은 애플 앱스토어에서만 유료 앱 다운로드에 유의적인 영향을 미치는 것으로 나타났다. 이 연구가 모바일 애플리케이션 비즈니스 구축 및 모바일 애플리케이션 시장 활성화 전략 기여를 할 수 있을 것으로 기대된다.

**주제어** : 스마트폰, 모바일 애플리케이션, 스마트폰 애플리케이션, 앱스토어, 다운로드

## 1. Introduction

The number of smart phone users is increasing rapidly all over the world. According to a recently

published report, 91% of people on earth have a mobile phone, and 56% of people own a smart phone[11]. The 2013 reports of Gartner Inc. indicated that worldwide smartphone sales to end users reached 250.2 million

\*이 연구는 한국외국어대학교 교내학술연구비의 지원에 의하여 이루어진 것임

Received 10 May 2014, Revised 9 June 2014

Accepted 20 July 2014

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ISSN: 1738-1916

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units in the third quarter of 2013, which accounted for 55% of overall mobile phones sales (worldwide 455.6 million units) in the third quarter of 2013. Especially, Asia/Pacific contributes a 77.3% increase in the smartphone segment[12].

With the development of wireless networks, users are spending an increasing amount of time on their smart phones. According to AdMob's 2010 report, smartphone users spend about 80 minutes per day on mobile applications, and 50% of mobile phone users use mobile as their primary Internet source[13]. In U.S., people now spend more than half of time online with smartphones and tablets (52%) rather than desktop (48%)[14]. In Korea, this ratio is even above and beyond. Meanwhile, the amount of downloads for smartphone applications from app stores have also increased. In April 2012, according to Appshopper.com, there were over 787,000 apps available for the IOS platform and 50 percent of mobile phone users used the downloaded applications[8]. Over 80% of time on mobile was spent inside apps[11].

Mobile apps now are being used to perform a variety of tasks to serve people's daily life, such as social network communication, games playing, music listening, working assistant, and living guide. More popular using of mobile applications and services support our needs for information, communication or leisure. Until now, apps can be downloaded from a variety of mobile operating platforms to a target device, such as the Google Play, Apple App Store, BlackBerry App World, Windows Phone Store, Samsung Apps Store, Nokia Store, etc. Some apps are free to download, while others need to be paid directly, or make in-app purchase to access special contents or features in an app.

The issue of how to gain the economic value of mobile application has been a hot potato for all of the app designers and publishers for a long time. The economic value of mobile application discussed here means whether the usefulness and user satisfaction of

mobile apps can bring a larger number of download, which may bring more profit for app designers and publishers. Existing literature has identified several influential factors of app download, such as customer review, ranking, price, however, the result (price) was conflicting, and other factors are not clear[3, 4, 7]. The goal of this paper is to gain better understanding of influential factors which may affect mobile apps download through empirically analyzing both free and paid mobile apps on two different platforms—Android platform and IOS platform. The results of this study may provide useful guidelines to app designers about how to increase revenue from app design and marketing.

## 2. Literature Review and Hypotheses Development

How do you measure the success of a mobile app? Counting downloads is a sufficient way to evaluate the success of an app. Download amounts of apps are a good representative of apps' popularity in the marketplace, which may be affected by the following factors.

### 2.1 Ranking

"Ranking" is defined as a relationship between a set of items that follow a special order to distinguish which one is "ranked higher than", "ranked lower than", and "ranked equal to" the others and to make the priorities clear. The psychological hint for "Ranking" can be considered as "order" or "Comparison". Mobile applications ranking list has evolved a highly development today, and the concept of "comparison" here means mobile application users evaluate the functions and abilities that the apps have and compare with other apps.

The ranking list gives users more reasonable suggestions and optimal selections that may reduce the

uncertainty of apps selection. Moreover, ranking list can also be used to reduce users' search cost. By visiting online stores, such as iTunes store and Google play, information on the Internet reduces search costs[5]. For instance, in some online music stores, the accurate ranking of music reduces search costs relative to visiting physical stores and competitors' websites. Online music distributors also give some of their profits as commission to music source providers who can supply their ranking mechanisms to list the digital contents on ranking slots[10]. From music distributor's perspective, the download amounts of music are largely decided by the ranking strategy, which may maximize the value of the ranking service and its profits.

In view of this point, mobile app's download amounts may be decided by its ranking on online app stores that may also affect the received value of the app developers. Ranking is an important factor that can predict apps' popularity, as reflected in the demand for download amounts. Therefore,

Hypothesis 1: The higher the ranking in the app store, the higher the download amounts of apps.

## 2.2 Applications Type

As mobile device technology progresses and evolves, the capabilities of mobile apps continue to grow and expand quickly. From games and "time-wasters" to fully integrated business apps, a variety of different types of apps support our daily using. Generally, mobile applications can be classified into five main categories by following user's using habits, such as "time wasters", "core utilities", "episodic utilities", "composite apps", and "notification-driven apps" [15].

"Time wasters" means apps that can be used in a short time when you are waiting in line and most of them are games. A few of time wasters are both game and utility, such as Facebook. "Core utilities" means some kinds of basic functions that often be used on users' smart phone home screen, such as phone,

message, contact, clock, calendar, etc. "Episodic utilities" means some apps are typically used in different situations or different environments, such as using map navigation to find your way, using renting apps to rent a car, or using chatting apps to chat with friends. These kinds of apps are extremely wide spread to our daily life. "Composite apps" are those apps that cooperate with other apps to perform input and output functions. In other words, apps that knit together meaningful input/output to/from multiple other apps in a coordinated way, such as "Siri" in the Apple IOS system. The last type of apps are "Notification-driven apps", which are some kinds of apps using notification for communication apps like email, texting, update notification, etc[15].

This study categorized apps into two general categories, game apps and non-game apps. In app stores, many of the top ranking popular apps are game apps[6]. Therefore,

Hypothesis 2: Download amounts of game apps are higher than non-game apps.

## 2.3 Price

What kind of pricing strategy should be developed is a critical problem for app publishers and designers. As is known to all, two kinds of apps are categorized based on their price. One is free apps and the other is paid apps.

Free apps or freemium mean giving away free version of apps while charging for a more advanced version with increased functionality. The motivation of app publishers to publish free version is to set up a changing cost, which means users will love the free version so much that they will be more than willing to pony up for an even better one - the paid version.

Paid apps contain three different types: in-app purchase, in-app advertising, and paid for app itself. In-app purchase means the ability of a mobile device to facilitate the sale of products or services within a specific application[16]. In-app purchase is also defined

as purchasing made from within a mobile application and users typically want to achieve some special contents or features in an app to answer for their satisfaction or needs.

In-app advertising refers to an advertising that appears within an application. It is an integrated interest connection, which means app developer and advertising network have an interest relationship. Advertising network pays app developer and put their advertising code into the developer's application. Depending on the collected information from app during users using app, advertising network can provide target ads.

The last pricing type is pricing directly for app itself. With the rapid growth of app amounts, people increasingly prefer free, ad-supported apps for their mobile devices, yet many app developers still are not sure how to deal with the free vs. paid issue. Therefore, paying for an app and download amounts diminishing seem to be unavoidable. Many researchers and publishers have made a lot of efforts to find the best pricing strategy. However, users seem to be accustomed to using a free app but not a paid one.

Figuring out how much to charge for apps will directly affect the download amounts of apps, which has been proved by development of app market. To price an app is all about to figure out the right balance between what it costs to design, produce and maintain the apps, and how much users are willing to pay for it. Therefore, it is important to do a cost analysis to understand the price of executing apps after exceeding the free quotas[9]. Therefore,

Hypothesis 3: Prices of apps have a negative effect on download amounts of apps

## 2.4 Developer experience

App developers develop "applications" before publish them on an online app store. After testing all functions and contents of an app, it will be released to the online app markets. When a developer publishes an app, the

app goes live and can be accessed by any mobile device users. An experienced developer can add great value in terms of understanding the market and users' needs. However, most of the app developers are SMEs or even private individuals. They have only developed a few apps and the download amounts are small. A lot of app developers don't know what should be done before designing and publishing an application. Most of the mobile application users don't know exactly which app developers are more famous and experienced. From users' perspective, user's uncertainty for developer's experience may also affect the download amount of apps. Users can get developer's information from online app stores' descriptions, such as developer's basic information, other applications developed by the same developer, or even visit developer's website for more detailed information.

According to some expertise, app developers and publisher should know a lot of things, such as how to design an attractive interface and icon, how to write the marketing language well, how to manage pricing strategy and promotion strategy, how to get the external reviews, etc.[17]. From this perspective, developer's app developing experience may conspicuously affect users' purchase intention and intention to use, which affect download amounts. Therefore,

Hypothesis 4: Experience of developer has a positive effect on the download amounts of apps.

## 2.5 Locality

Mobile applications are an international business, but plenty of apps are targeted at one country or region only. Local apps are welcomed by local users because of their advantages tailored for daily life. Local app developers and publishers always know exactly about local user's needs and local cultural preference, from native customs and traditions, local collective cognition, to language difference and app interface aesthetic difference. For instance, developers from South Korea

and China have to deal with different local markets and different app design problems. Moreover, local users always prefer to trust local publisher's app products, such as locating service applications, bus route map, subway and railway route map, etc. These kinds of locating service need more accurate local information and it's hard for exotic apps to keep updating[2]. Therefore, local developers have natural advantages to develop and publish localized mobile applications that may bring more competitive advantages than exotic apps. Therefore,

Hypothesis 5: Download amounts of local apps are higher than exotic apps.

### 3. Data Collection and Methodology

We collected data of the top 150 Paid/Free applications in Android app market and top 150 Paid/Free applications in Apple app store in South Korea. App stores and some other companies (e.g., appfigures.com, xyo.net, et. al.) release detailed information about applications like country rank, category, monetization type, monthly download numbers and so on. Ranking of each app, download amounts of each app, and prices of paid apps were gathered. App type was measured using a dummy variable (0 for game apps and 1 for non-game apps).

Experience of developer was measured by total number of apps developed by the same developer in an app store. Locality was measured by a dummy variable equal to 1 when more than 50% of all downloads of an app were generated in South Korea and 0 otherwise.

Regression analysis was employed to analyze the following linear regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon$$

Y: Amount of download

X<sub>1</sub>: Ranking

X<sub>2</sub>: Type of applications

<Table 1> : Operational definition of variables

Variable	Operational Definition	Literature
Ranking	App ranking in app store	Carare(2012)[3], Jung et al. (2012)[4]
Type	Type of apps(0: game; 1: non- game app)	Ghose and Han (2012)[1]
Price	Price of paid apps	Jung et al. (2012)[4], Harman et al.(2012)[7]
Developer experience	Total number of apps developed by the same developer in app store	Self developed
Locality	Locality where most of downloads are generated	Self developed
Download	Number of download of apps	Carare(2012)[3], Jung et al. (2012)[4]

X<sub>3</sub>: Prices of paid applications

X<sub>4</sub>: Developer experience

X<sub>5</sub>: Application locality

Y is the amount of download, as a dependent. X<sub>i</sub> represents a set of independent variables. In details, X<sub>1</sub> represents ranking. X<sub>2</sub> is a dummy variable representing application type. X<sub>3</sub> represents prices of paid apps. X<sub>4</sub> represents developer experience, and X<sub>5</sub> is a dummy variable representing the locality of application. β<sub>i</sub> is the coefficient capturing the effect of each variable and ε means the error term. Prices of free apps are zero, thus price of applications (X<sub>3</sub>) is not included in the regression model for free apps.

### 4. Results and Discussion

According to the collected data (totally 600 observations), table 1 shows the descriptive statistics of the dependent variable download amounts. As seen in table 2, iPhone users and Android users both prefer to download free applications. A two-way ANOVA indicated download amounts in Apple and Android app store were significantly different (F=64.52, P=0.00), and

download amounts of free apps and paid apps were also significantly different ( $F=185.90, P=0.00$ ). Users enjoy using free apps both in Apple and Android app stores.

〈Table 2〉 : Descriptive Statistics of Download

	Mean	SD
Android+Free	728213.33	706713.55
Android+Paid	2508.67	12259.24
Apple+Free	189120.00	407250.26
Apple+Paid	6480.00	17371.51

Since the different patterns of free/paid apps in different markets were evidenced, regression tests were run for four datasets separately. Correlation coefficients of independent variables in the four markets were between  $-0.34$  and  $0.40$ (Table 3, 4, 5, 6), Variance Inflation Factor(VIF) were not greater than 1.31, and condition indexes were not greater than 6.24, which suggest there was no multicollinearity among independent variables in the regression model. The dependent variable download amount was transformed in logarithm in regression analysis.

〈Table 3〉 : Descriptive Statistics and Correlations of Independent Variables (Android Free Apps)

Variables	Mean	SD	1	2	3	4
Ranking	75.50	43.45	1			
Type	0.55	0.50	-0.16	1		
Experience	28.49	35.95	-0.02	0.06	1	
Locality	0.59	0.49	0.15	0.04	-0.27	1

〈Table 4〉 : Descriptive Statistics and Correlations of Independent Variables (Android Paid Apps)

Variables	Mean	SD	1	2	3	4	5
Ranking	75.50	43.45	1				
Type	0.54	0.50	0.31	1			
Price	3.04	2.59	0.07	0.16	1		
Experience	31.41	93.44	-0.01	-0.02	0.26	1	
Locality	0.37	0.48	0.09	0.40	0.18	-0.11	1

〈Table 5〉 : Descriptive Statistics and Correlations of Independent Variables (Apple Free Apps)

Variables	Mean	SD	1	2	3	4
Ranking	75.50	43.45	1			
Type	0.29	0.45	0.30	1		
Experience	61.58	102.68	0.04	-0.20	1	
Locality	0.70	0.46	-0.07	-0.00	-0.33	1

〈Table 6〉 : Descriptive Statistics and Correlations of Independent Variables (Apple Paid Apps)

Variables	Mean	SD	1	2	3	4	5
Ranking	75.50	43.45	1				
Type	0.54	0.50	0.14	1			
Price	3.04	2.59	-0.07	0.05	1		
Experience	31.41	93.44	-0.13	-0.34	-0.05	1	
Locality	0.37	0.48	0.01	0.16	0.10	-0.15	1

Result of regression analysis suggested the four regression models explained at least 0.76 of the variance in dependent variable download amount. As seen in table 7, ranking had a negative effect on the amount of download, thus H1 was supported. The higher the ranking of apps in the app store, the more will be downloaded. Carar(2012)[3] also found the effects of bestseller status of mobile apps on willingness to pay decline steeply with rank at the top ranks from an economic perspective. Download amount of paid game apps in Apple app store was significantly higher than paid non-game apps, while in other three markets the differences were not significant. Thus H2 was partially supported. iPhone users like to download and use more game apps than non-game apps. Similar results have been found in existing researches. Ghose and Han(2012)[1] also found compared to lifestyle apps, gaming apps have a positive impact on app demand while multimedia and education apps have a negative impact on demand. Surprisingly, price of paid apps had no effect on download amount of apps in the four models, thus H3 was not supported. Price is not a determinant factor of app purchase. This result was consistent to prior researches. Harman et al.(2012)[7] also found there was no correlation between price and downloads of 32,108 non-zero priced apps available in the Blackberry app store. Characteristics of developer, such as experience and locality, had a significant effect only in Apple paid app market, while no evidence was found in the other three markets. If the app is a local app developed by a more experienced developer, the download amounts increase, thus H4 and H5 were

partially supported. In Apple app store, user’s brand perception and trust toward developers may be higher than Android app market because of the Apple’s tighten inspection system[4]. Most of the developers have their own brand and representative apps, which have been accepted and widely downloaded by local users.

〈Table 7〉 : Result of Regression Analysis

Variables	Android		Apple	
	Free	Paid	Free	Paid
Intercept	6.18*** (0.028)	3.67*** (0.04)	5.58*** (0.04)	4.05*** (0.04)
Ranking	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
Type	0.02 (0.02)	-0.04 (0.04)	-0.03 (0.03)	-0.07** (0.03)
Price	-	0.00 (0.01)	-	-0.01 (0.01)
Experience	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	0.00*** (0.00)
Locality	0.01 (0.02)	-0.02 (0.04)	0.03 (0.03)	0.12*** (0.04)
R square	0.86	0.84	0.79	0.76

\*Denotes significant at 0.10,  
 \*\*denotes significant at 0.05, and  
 \*\*\*denotes significant at 0.01.

In summary, ranking is the most important factor to determine download amount of mobile apps in all of the four markets, while price of apps doesn’t matter at all. Besides, more experienced local publisher, and the type of apps can also affect the download amount of paid apps in Apple app store.

## 5. Conclusion

This paper aims to identify factors that may affect mobile applications’ download amounts and measure there effect on download. Several conclusions can be made from the data analysis and results.

Firstly, the results show that among five independent variables (ranking, type, price, developer experience, and application locality), only ranking can significantly affect download amounts of mobile apps in

both Android paid/free app market and Apple paid/free app store. It means app ranking is an important determinant that directly affects users’ download intention as well as developer’s developing and publishing strategies. As we have mentioned before, mobile applications ranking lists show a comparative psychological influence which may let users evaluate the functions and features that apps have and compare with other apps to reduce uncertainty in app selection and searching cost. Although app store’s ranking algorithm is not made public to all, developers need to develop strategies to make their products rank higher on the ranking list. As user ratings and app use are also considered in the new ranking algorithm, for app marketers, delivering a positive app experience earning high app ratings from loyal users has never been more critical.

Secondly, the results show that prices have no effect on download amounts of apps in both Android app market and Apple app store. It means most of the users have low price-sensitivity for those popular apps which ranked top 150 on app ranking list. Popular apps’ pricing strategy has no effects on download amount of mobile apps when they are ranked on the top list and users have the intention to download or use the apps. Developers who’s app is top ranked may pay more attention to app itself, such as simple and friendly interface with rich functionality, flexible scalability, and security to increase user engagement rather than a lower price strategy.

Finally, download amount of paid game apps in Apple app store is significantly higher than non-game apps, and developer’s experience and locality have a significant effect on download only in Apple paid app store, while no evidence is found in other markets.

Download amount do not necessarily reflect the actual number of people using an app. For long-term success, developers need people who download app to become long-term users of the app. The industry is beginning to identify engagement metrics that can have

general relevance for understanding user behaviors. Future research may be conducted to study factors affect users engagement of mobile applications.

## ACKNOWLEDGMENTS

This work was supported by Hankuk University of Foreign Studies Research Fund.

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