The mobile apps industry: A case study

Thomas L. Rakestraw
Youngstown State University

Rangamohan V. Eunni
Youngstown State University

Rammohan R. Kasuganti
Youngstown State University

ABSTRACT

From its origins with the advent of Apple's iPhone in 2007, to an industry that could potentially be worth as much as $100 billion by 2015, the mobile apps industry has experienced nearly unprecedented growth. The unique aspects of the industry are discussed in terms of how they have encouraged the widespread popularity of smartphones and other mobile devices and have transformed electronic gaming, internet retailing, and social networking. As major competitors in this arena, Apple and Google have endeavored to distinguish themselves in terms of their relationships with app developers, numbers and uniqueness of apps available, as well as the marketplaces in which the apps are sold. While these battles are waged, others (Blackberry RIM, Facebook, and Amazon) have continued to find their loyal users and niches in the market. Forecasts unanimously paint a very bright future for the industry, but potential stumbling blocks remain in the form of, monetization difficulties, accusations of exploiting children, and security and privacy issues.

Keywords: Industry Analysis, Porter's Five Forces, High Velocity Industries

EVOLUTION OF THE INDUSTRY

Since the advent of the iPhone in early 2007, users could experience the functionality of personal computers on pocket-sized devices. These so-called "smartphones" and their associated mobile software "applications" or "apps" are becoming increasingly ubiquitous in our daily life. According to Mobilewalla.com, a website dedicated to cataloging and rating apps, the one millionth app was made available to users in December, 2011. Even with many of these apps being duplicates, or slight variations created for different devices (e.g., an app created for the iPhone and the iPad would be counted twice), that is an incredible explosion of interest for such a new industry. The growth in mobile apps has shown no signs of slowing, with as many as 15,000 new apps being released each week (Frierman, 2011).

The proliferation of apps being developed can only be expected to continue as smartphone usage grows globally. In a 2011 study conducted jointly by Google and Ipsos MediaCT Germany, data were obtained via random telephone interviews from amongst the general populations of the United States, United Kingdom, Germany, France, and Japan. The highest reported smartphone ownership was found in the United Kingdom (45% of those interviewed) and the United States (38% of those interviewed). Even more telling is the 50% increase in ownership that occurred in the United Kingdom between the first phase of the research conducted in January and February of 2011 and the latter phase in September and October of that year (The Mobile Movement, 2011). There is clearly a shift in usage from computers to mobile devices.

In 2010, smartphones outsold personal computers, which caused tech analysts to shift their attention to the handheld platform. During the fourth quarter of 2010, 100.9 million smartphones were shipped worldwide, whereas only 53.9 million units had been shipped in the corresponding quarter of 2009. According to Flurry, a company that collects mobile-software data and provides consulting services to software developers, in 2011, smartphone and tablet shipments exceeded the shipments of desktop and notebook computers combined. Software developers are increasingly realizing that in the near future smartphones could replace many core functions of personal computers, such as e-mailing, instant messaging, web browsing, and even gaming (Smartphone Mobile Applications To Overtake Standard Websites in Near Future, 2012). Further, in comparing publically available data pertaining to Internet usage with their own client data concerning mobile app usage, Flurry concluded that users are spending more time on mobile apps than on the Internet, as indicated in Table 1 (Appendix)(Newark-French, 2011).

Evidence also suggests that these devices are becoming more and more important in people's lives. In another study conducted by Google in partnership with Ipsos OTX MediaCT, 5,013 adults in the United States who identified themselves as using a smartphone to access the Internet were interviewed in the last quarter of 2010. Eighty-nine percent of those interviewed reported using their smartphones throughout the day and 68% reported having used an app in the previous week. Seventy-nine percent of respondents reported using their smartphones to help with shopping, and 22% reported using apps on their smartphones to make purchases (The Mobile Movement, 2011).

The continued importance of smartphones and mobile apps was highlighted in President Obama's order that all major federal agencies make at least two public services available on mobile phones by May 2013. The intention of the president's order was to encourage innovation and stimulate employment in the field of mobile communications. Others have expressed hope that this initiative would lead to the U.S. government making information available to outside

developers that would facilitate the creation of applications to take full advantage of available government data. It is also anticipated that the increased demand created by those availing themselves of these governmental services would create pressure on the government to free up bandwidth for use by mobile carriers. In sum, President Obama's efforts will greatly add to the groundswell behind the burgeoning field of mobile apps (Melvin, 2012).

BASICS OF THE MOBILE APPS INDUSTRY

Although the mobile apps industry began with Apple's introduction of the iPhone, its phenomenal growth is due to the entry of several competitors into the marketplace, notably Motorola, LG, and Samsung. This competition has given rise to an entirely new product space known as smartphones. Smartphones have far greater functionality than normal mobile phones due to their ability to run mobile apps. These applications confer on smartphones the capabilities to send and receive e-mail, play music, movies, and video games, and even communicate remotely with computers from virtually anywhere in the world (Coustan & Strickland, n.d.).

Smartphones contain many of the same components as personal computers. Every smartphone has a processor, random access memory stick(s), USB ports, display adapters, and internal storage devices. Users may even customize and upgrade their devices to suit their individual needs. For example, a user who wishes to use the smartphone for gaming can purchase a device with a multi-core processor and additional storage to hold large games. Most smartphones are also equipped with a touchscreen obviating the need for a physical key board. USB peripherals such as audio headphones and data transfer cables are also available for smartphones (Coustan & Strickland, n.d.).

The core software found in a smartphone is called the operating system. The operating system contains all the drivers necessary to carry out instructions between the software and hardware of the device. The operating system can be visualized as a software stack consisting of several layers. First, the kernel manages the drivers that manipulate a smartphone's hardware, such as its built-in camera or USB ports. Middleware contains software libraries which link to mobile applications. The application execution environment contains all the application programming interfaces (APIs) for developers to program new mobile applications for the operating system. Finally, the application suite contains core applications which are packaged with the operating system by default. These applications include phone call software, text messaging, menu screens, calendars, and more. A mobile app is software that a user can install on a smartphone to perform a particular task. For example, Android has a GPS app which allows the user to obtain travel directions in real time, or even track the locations of family members from anywhere in the country (Coustan & Strickland, n.d.).

IMPACT ON MOBILE GAMING

Before the dawn of smartphones, mobile gaming for most users occurred on handheld devices such as a Nintendo DS or Sony PSP. Now that smartphones have become commonplace and literally hundreds of low priced games with high-quality graphics are available, mobile gaming has become very different. Apple's iOS and Google's open-source Android operating systems are capable of running some of the most innovative games in the market. As a result Nintendo's and Sony's handheld devices are quickly losing ground to smartphones (iOS and Android Take Over Mobile Gaming Industry, 2011). In 2009, the Nintendo DS accounted for

70% of revenue generated by portable gaming software in the United States, with the iOS and Android at 19% and the Sony PSP at 11%. In 2010, the Nintendo DS dropped to 57% of the revenues while iOS and Android picked up 34%. By 2011, the Nintendo DS fell to 36% while iOS and Android claimed 58% of the revenues from portable gaming software. In 2009, the iOS and Android revenues from mobile gaming stood at $500 million. By 2010, these revenues spiked to $800 million, and continued to climb in 2011 when they hit $1.9 billion, demonstrating the speed with which mobile apps are revolutionizing the use of digital media and tools (iOS and Android Take Over Mobile Gaming Industry, 2011).

IMPACT ON TRADITIONAL WEBSITES

Many now believe that apps will eventually supplant standard Internet websites in the way that DVRs have replaced videotaping and cell phones replaced land line phones. Advances in technology have enabled web developers to not only program for standard web browsing but for mobile browsing as well. This trend of mobile apps taking the place of traditional websites is likely to accelerate for a number of reasons. First, a mobile application can be accessed from virtually anywhere without the need for a wireless hotspot or expensive and physically large piece of hardware. Additionally, many companies and other website owners have created mobile versions of their websites to provide faster loading times, and have optimized user interfaces and other features to add to the functionality of mobile browsers. Not surprisingly, as of 2011 the number of users accessing websites from their mobile phones exceeded those who did so from personal computers (Smartphone Mobile Applications To Overtake Standard Websites in Near Future, 2012).

NATIVE APPS VS. MOBILE WEB APPS

There are two main types of mobile applications: native and mobile Web. Native applications integrate directly with the mobile device's operating system and can interact with its hardware much like the software on a personal computer. Native applications are also capable of taking advantage of local APIs in order to maximize functionality while preserving efficiency. Mobile Web applications are apps that run directly from an online interface such as a website. These applications typically cannot manipulate a device's hardware and are limited to the web application's APIs rather than the programming packages found on the phone (Industry Innovations: A Mobile Applications Interview with Bob Evans, 2011). A mobile website is a series of web pages created for the sole purpose of being viewed on a mobile device's web browser. These pages are often created using HTML, but some operating systems such as iOS or Android are equipped with a webkit. These webkits enable web page rendering that extends functionality far beyond that of a typical mobile Web application; they allow hardware manipulation, user interface scaling, and more (Industry Innovations: A Mobile Applications Interview with Bob Evans, 2011).

Some applications are hybrids that combine the interface and coding components of a web-based interface with the functionality derived from native applications. This allows developers to update the application remotely while still affording a large amount of programming functionality. It also extends the number of platforms which can run the application, as their web-based nature ensures the application must not necessarily be platform-specific (Industry Innovations: A Mobile Applications Interview with Bob Evans, 2011).

Currently, the two dominant operating systems - Google's Linux-based open-source Android Operating System and Apple's iPhone Operating System (iOS) - both support their own marketplaces where users can purchase mobile applications. Some apps are packaged with the operating system by default, but most apps must be downloaded manually from an app marketplace (Coustan & Strickland, n.d.).

THE MARKETPLACE: APPLE VS. GOOGLE

A mobile application marketplace is software which allows the user to download or distribute mobile apps for their smartphone. Free applications may be found in these marketplaces alongside those offered for sale. In most cases, apps are programmed by third party developers such as companies hoping to advertise or enhance their existing products, or by freelance programmers who sell their apps for revenue. Both the leading operating systems, Apple and Android, each have a corresponding dedicated marketplace, as indicated in Tables 2(a) and 2(b) (Appendix). However, third party marketplaces also exist which may offer the same apps, often at different price and/or apps that are unique to that site (Coustan & Strickland, n.d.).

Two types of independent app stores exist for developers to publish their apps: a) full-catalog stores, which sell applications for multiple operating systems and are typically associated with higher priced apps, and b) platform specialists, which are niche marketplaces that concentrate on only one operating system. These marketplaces tend to be more user-friendly and focus on a community-driven, socially-structured interface which give customers the opportunity to compare prices between multiple, similar applications to find the best in price and quality. Full-catalog stores tend to distribute apps at higher prices on an average than those found in platform specialist stores. The prices users are willing to pay for apps appear to depend upon the marketplace. For example, Handango, a full-catalog app store, has an average app price of $9.10. On the other hand, the Amazon App Store, which is a specialist Android marketplace, has an average app price of only $2.52 (Mikalajunaite, 2011).

Restrictive policies of Apple concerning app development in the initial phase have had a demonstrable effect on the market for iOS apps. In mid-2010, a survey revealed that 54% of all mobile app developers prefer to develop apps for the Android operating system while only 40% prefer to do so for Apple's iOS. Later that year, Google and Apple made several announcements regarding the future of their mobile operating systems, and Google was the clear winner. A subsequent survey revealed that 58.6% of these developers now preferred Android while the support for the iOS dropped to 34.9% (Cameron, 2010). In response to these findings, Apple eased some of the restrictions placed on iOS developers and publishers with a view to make their platform somewhat more open. Apple also released additional documentation to the public regarding the process by which applications are accepted for sale in the iOS app store. However, these changes apparently had little impact on the confidence mobile developers placed in the company's operating system. Significantly, 62% of the developers surveyed revealed their preference to develop for Android-powered devices as compared to only 58% for the iPad before its launch. With Google reaping a higher level of support from mobile developers across the board, Apple may face difficulty in gaining new apps to distribute in their mobile app store (Cameron, 2010).

Google, however, is not without concerns of its own. Amazon's new application marketplace decentralizes users' acquisitions of mobile apps. Users visiting multiple app stores

to compare prices and find exclusive apps may become an unwieldy experience and detract from the level of convenience that Android has worked so hard to attain. However, on the upside, Amazon's entrance into the Android market may bring in additional users, and ultimately bode well for the future of this operating system (What Developers Should Know About Amazon's Android App Store, 2010).

THE AMAZON MARKETPLACE

Online retail giant Amazon has developed a specialized marketplace to distribute mobile applications for the Android platform and serve as the main interface for Amazon's Kindle Fire which runs a restricted version of the Android OS. This marketplace was created to provide a more organized, intuitive, and user-friendly alternative to the standard Android Market and is available for all Android users (What Developers Should Know About Amazon's Android App Store, 2010).

Like other mobile application marketplaces, Amazon splits revenue by paying developers 70% of the purchase price per sale, while retaining 30% of the purchase price for Amazon. However, Amazon requires an annual fee of $99 for publisher participation in this marketplace compared to Android's one-time $20 fee. In addition, Amazon reserves the right to modify an application's code and even add its own DRM (Digital Rights Management, a system to prevent piracy in digital goods such as music and software) to the binary. In contrast to the largely unrestricted Android Market, Amazon also has a set of rules to which all publishers must adhere. For instance, applications on the Amazon marketplace cannot be sold at a lower price in competing marketplaces such as the Android Market. Amazon also reserves the right to modify the prices of apps without prior approval of the original publishers. Finally, developers must deliver any updates to the apps to the Amazon market before doing so in other markets. For example, it is illegal to distribute an app update to the Android Market before it is uploaded to Amazon's marketplace (What Developers Should Know About Amazon's Android App Store, 2010).

THE FACEBOOK MARKETPLACE

Facebook working in tandem with one of its major partners, Zynga, has a huge stake in the future of the mobile apps industry. The success of Zynga's online gaming apps has benefited both the companies immensely. Nineteen percent of Facebook's 2011 revenue and 15% of its 2012 first quarter revenue was tied to Zynga, most of which came from the fees the company received for processing users' purchases in Zynga's gaming apps. However, there seems to be a consensus that the future of both these companies is dependent upon their ability to extend that success to mobile applications. The growth of online social games has slowed as the growth of mobile games for iOS and Android devices has exploded (The Most Important Friendship: Facebook and Zynga, n.d.).

The need for Facebook to transfer its success to mobile devices may be the greatest in global markets into which it hopes to expand. From February to March of 2012, Facebook added 56 million users, most of who were based in Asia. They seem to have been particularly successful in gaining mobile users in countries such as Japan. Their efforts there involved creating a mobile site that worked on Japanese phones and building relationships with local developers. According to Google data, Japan's use of smartphones had tripled in less than a year.

Similarly, Facebook has added 2.5 million users in the first six months of 2012, accelerating the growth that was stimulated by the introduction of the iPhone there in 2010 (Wagstaff, 2012).

Facebook's expansion plans are particularly challenging in India. Many Indians have mobile phones and mobile usage is growing faster than web usage. Furthermore, as China is closed to them as a market, India represents the largest population of potential new users that is available. However, much cellphone service in India is provided over less than 3G quality (slower) networks and the users' equipment may be antiquated. Facebook has penetrated the market to the point that 60 percent of the Internet population in India has used the service (representing 51 million users), but given the technological limitations it is extremely difficult for Facebook to reproduce the "large screen experience" on basic phones (What Developers Should Know About Amazon's Android App Store, 2010).

Facebook CEO Mark Zuckerberg has stated that improving Facebook's mobile application, integrating it with other online apps, and creating a "transformative" advertising experience were top priorities for 2012. Numerous third parties have pointed out that being able to monetize its presence with mobile users will be essential to its future success. In a public meeting with investors in May 2012, Zuckerberg and COO Sheryl Sandberg pointed out that the key to Facebook's success on mobile devices would be social ads that make use of information concerning the "likes" of users' friends and that the collection of additional information such as users' locations would be key to targeted advertising efforts (Barr, 2012).

One means by which Facebook hopes to improve its mobile presence is its new App Center. This will be a central location at which users will be able to access all apps (initially, 600) that have been reviewed and cleared by Facebook as having met their quality standards. Rather than happening upon apps randomly, users will have apps recommended to them by the App Center based upon their expressed interests or those of their friends. Links in the App Center will send users to the appropriate Apple or Google marketplace from where the apps could be downloaded (Barr, 2012).

THE BLACKBERRY ANDROID MARKETPLACE

In early 2011, Research In Motion (RIM) announced its new PlayBook tablet computer that has the capability to run Android applications using an 'app player'. This device can run BlackBerry Java apps as well; creating a very powerful piece of hardware that is capable of running apps from multiple platforms. All these applications are available through RIM's BlackBerry App World, which is the company's dedicated marketplace for Android and BlackBerry apps (RIM's New Playbook Will Be Able to Run Android Mobile Applications, 2011).

However, Android applications which are run on the PlayBook cannot be obtained anywhere else other than the BlackBerry App World. This implies that apps from other marketplaces, such as the Android Market and other third-party marketplaces such as the Amazon App Store are not compatible with this device. For Android developers, this means their apps must be compiled using specific rules, certificates, programming packages and permissions designed to run on RIM's PlayBook. This adds a new layer of complexity for developers which could potentially detract them from programming for the PlayBook. It also means that fewer apps will be available for PlayBook users than for native Android users. In 2011, for example, the Android Market had over 250,000 apps whereas the BlackBerry App World had only 20,000 apps (RIM's New Playbook Will Be Able to Run Android Mobile Applications, 2011).

RIM had also announced the release of a SDK, which would enable application programming for the PlayBook's operating system, Tablet OS. This will allow low-level customization of the tablet, including its user interface and other functionality that expands outside the scope of standard applications. Additionally, *Ideaworks Labs* and *Unity Technologies* are also capable of running on PlayBook. Ideaworks is a C and C++ SDK for mobile platforms, which runs on iOS, Android, Symbian, webOS, and Windows Mobile. Unity Technologies offers a host of tools used for creating 3D games for iOS and Android, which may add appeal for potential game developers (RIM's New Playbook Will Be Able to Run Android Mobile Applications, 2011).

NICHE MARKETPLACES

Recently, a number of new third-party marketplaces have entered the mobile apps industry. Since many of these marketplaces are developed by companies far smaller than Google or Apple, they have been forced to target niche app user segments rather than engage in full scale competition with the bigger players. Since 2009, the number of niche app stores has doubled annually, while the number of general app stores has decreased. The number of general app stores entering the market peaked toward the end of 2010, and declined rapidly through 2011. These data clearly suggest that niche marketplaces are the preferred solution for smaller companies to penetrate the mobile apps industry (Gair, 2011).

Niche marketplaces provide users with applications targeting their specific needs, thus reducing much of the confusion created by the ever-increasing number of developers and apps. These marketplaces could also benefit developers by reducing the number of apps they compete with for attention in full catalog stores. In general, there are three categories of niche mobile app marketplaces. 1) Platform-oriented marketplaces offer applications for a specific operating system, such as AndroidPIT for Android or Crackberry for RIM devices; 2) Target group-oriented marketplaces that provide apps for a particular segment of app users, such as businesses or adults; and 3) "Carve out" marketplaces, which are niche stores within a full catalog store, such as "@work" by Apple (Gair, 2011).

CONSUMER PREFERENCES IN MOBILE APPS

By the year 2010, the mobile apps industry became increasingly saturated as new competitors entered the market flooding it with numerous varieties of utilitarian as well as lifestyle apps. A survey conducted by Nielsen in 2010 revealed the types of apps that were in greatest demand by users. A breakdown of the various categories of applications used within a span of 30 days as emerging from the survey is presented in Table 3 (Appendix) (The State of Mobile Apps, 2010). In addition, a chart of app popularity by users of specific operating systems is depicted in Table 4 (Appendix). The survey revealed that games, including both free and paid, were the most downloaded application category. Facebook, Google Maps, and the Weather Channel were the most popular apps across all platforms. In social networking, Facebook was by far the most popular app, with MySpace trailing behind in part due to its continuing popularity with teenagers. LinkedIn also attracted a large number of users in the age group of 25 to 44 (The State of Mobile Apps, 2010). The news and weather application category was dominated by The Weather Channel, which was downloaded by 58% of the users surveyed. Amazon and eBay led the shopping category with 57% and 41% respectively. Finally, the music category was fiercely

competitive with iTunes, Pandora, Sirius-XM, and Yahoo! Music all competing for the #1 position (The State of Mobile Apps, 2010).

Data collected by Flurry in May 2011 revealed that games and social networking apps, led by Facebook, continued to be the most popular app categories among users, as indicated in Table 5 (Appendix). Flurry also discovered that users not only accessed game and social networking apps more frequently but also for longer periods of time per session. That many users were accessing Facebook in order to play games available on that platform points to the overwhelming dominance of this category of smartphone apps (Newark-French, 2011).

In 2010, the most acknowledged choice for app publishers was the iPhone's iOS operating system. However, other operating systems like Android, iPad, Windows Mobile and Symbian also enjoyed large spikes in usage as the devices associated with them became more popular and developers attempted to diversify their products accordingly. A breakdown of the major mobile operating systems and their utilization by app developers in 2010 is presented in Table 6 (Appendix) (State of the app industry 2010 (report), 2010).

In 2011, the emerging operating systems, especially Android and Microsoft's Windows Phone 7, were expected to gain in usage. Microsoft has attempted to stimulate developer interest in its platform by offering incentives to programmers to create pre-release applications. Microsoft has also invested considerable resources in marketing its new product, especially by encouraging favorable reports by technology reviewers. A breakdown of the projected app developer support for 2011 is shown in Table 7 (Appendix)(State of the app industry 2010 (report), 2010):

Finally, a chart showing publishers' expectations of revenue increases for the mobile app industry between 2010 and 2011 is presented in Table 8 (Appendix). Clearly, most publishers were highly optimistic about the industry; with 31% believing revenues would more than double, and 17% predicting revenues would increase by at least 50 (State of the app industry 2010 (report), 2010).

DEVELOPERS AS COMPLEMENTORS TO THE INDUSTRY

In order for companies like Google and Apple to effectively compete in the mobile application industry, they must attract innovative developers to create software for their operating systems and devices. Without the support of developers, the inflow of new apps will wane, leading to the customers shifting to more popular systems. Therefore, innovative business models must be put in place by these platform owners to remain attractive to developers and thereby sustain their competitive advantage (Power, n.d.).

A successful business model requires platform owners to offer as much cooperation to third party app developers and publishers as possible. This involves providing support to the developers as well as creating a developer-friendly environment. Developers expect full and efficient documentation on using a particular operating system, and an active community to enhance further development. The faster and easier it is for them to create an application, the more likely would it be developed for the operating system in question. This would also allow developers to allocate resources to the features and appearance of their applications rather than dissipating them in dealing with cumbersome coding and unclear documentation (Power, n.d.). An obvious way for companies like Google and Apple to cultivate a developer ecosystem is to offer them APIs (Application Programming Interfaces) which are libraries of code that reduce the work involved in creating an application. These APIs greatly enhance programming

efficiency, reduce the chance of bugs, and greatly simplify an otherwise difficult task of programming for a mobile interface (Power, n.d.).

In early 2012, the *Application Developers Alliance* was formally launched at the Consumer Electronics Show in Las Vegas, Nevada. This organization was created to bolster the capabilities of mobile app developers by providing more educational opportunities to prospective developers, give developers access to cloud hosting services, and enable government lobbying possibilities. Currently, this alliance is aimed specifically toward the iOS, Android, and RIM/BlackBerry platforms (Essany, 2012). The ultimate goal of the organization is to develop a solid industry association for the mobile app sector. The core features of the organization include an online database for developers and publishers to collaborate and communicate, a plethora of development tools and application testing facilities, access to free or low-cost technological documentation, structured training and certification programs, and even discounted hosting opportunities via cloud services (Essany, 2012).

REVENUE GENERATION FROM APPS

There are various ways developers earn money from the apps. One common practice is to release an app for free, and generate revenues by placing advertisements throughout the app's user interface. When a user clicks an ad, revenue is instantly generated for the app's publisher. The advantage of this approach is that ad placement is easy to set up, and allows the app access to a wider audience because it does not cost the user any money. However, the amount of revenue generated per click is typically very low. Moreover, users may refrain from using an app if the advertisements are too intrusive (Holbrook, 2011).

Developers may also sell their apps for a predetermined price in an online marketplace. In such cases, the platform owner, Apple or Google, charge a 30% royalty fee for each app sold while the remainder goes to the developer. No fees are however charged by the platform owner for the free apps. Some marketplaces also charge developers a one-time fee to establish a publisher account. Android's publisher accounts, for example, currently cost a one-time fee of $20. This revenue generation method is straightforward and requires minimal effort to set up. However, with so many apps available in the marketplace, competition is intense. Acquiring enough customers to create a significant revenue flow could be difficult if the app is not original, useful, or marketed creatively (Holbrook, 2011).

A more common business model to generate revenues from apps involves distributing an app in two forms: one a "for sale" version with no ads and full functionality, and a second version made available free of cost but with sponsored ads and limited functionality. This dual format allows potential customers to try the app risk-free while providing an incentive to eventually purchase the full version if a user finds that it delivers value for the money. However, in order to succeed in this model, developers must strike a balance in the number of features offered in the trial app. If too many features are offered free, the incentive for customers to purchase the full version may be reduced. On the other hand, if too few features are offered, customers may overlook the app's full potential (Holbrook, 2011).

Apps can also be used by businesses to complement or advertise their existing products. A high quality app can potentially speak for the quality of the entire business which in turn could attract new customers. Alternatively, an app can improve the way existing customers use a product. Insurance companies, banks, video game studios, and a plethora of other businesses actively are pursuing this business model with great success. However, if the app does not

integrate itself seamlessly with the business' agenda, it could have limited effectiveness (Holbrook, 2011).

Finally, app revenues could also be generated by creating an online store within the app itself. Many video games use this "freemium" model to generate revenue. For example, *Zenonia* by Gamevil is a free-to-play game that generates revenue by selling optional weapons, armor, and other virtual goods for real money. Other ways to employ this method include the creation of an e-store. *Fandango* uses this method with great success by selling movie tickets directly from an app that is ostensibly a source of information (movie reviews) and entertainment (movie trailers). When a ticket is purchased, a barcode appears on the smartphone's interface which is scanned by the staff in movie theaters. The advantage of using this revenue generation method is that customers believe that since the app is free, the additional payment is not directly linked to the app and therefore entails a lower risk of downloading and using it. However, from a technical standpoint, this method is also one of the most difficult to implement because it is not directly supported by Google's or Apple's application development kit (Holbrook, 2011).

One effective way to increase revenue flows for app developers is to remain flexible in varying their business models. Each application must be analyzed and compared to the target market in order to determine the optimal marketplace for its distribution as well as the price structure. For example, some application marketplaces may be more suitable for distributing free apps, while others might be better for selling high-priced, high-quality apps. Through a careful analysis of customer trends, app developers and publishers can maximize their revenues (Mikalajunaite, 2011).

ROLE OF NETWORK PROVIDERS

A network provider is a host that allocates resources for developers to create new applications. There are two major methods by which a network provider can monetize assets. First, these providers can add value by granting app developers access to their APIs. The second method involves making investments in the network capabilities that have the most potential to create value. In the end, no one business model will work for every developer or every application. The best business model is determined by the network provider's business goals, competition, compensation policies and a host of other factors. Sometimes, a mix of different business models might be necessary in order to maximize revenue (Alcatel-Lucent, 2010).

Network providers may choose the optimal business model by analyzing a variety of factors. They must determine their primary source of revenue, whether it is from the end user or another party, and who would own the relationship with this revenue source. The number of developers to be supported, as well as how they would be supported are other crucial factors in identifying the most effective business model. The nature of the interaction between the network provider and the application developers and how the development ecosystem is fostered (such as with monetary incentives) are other important decisions pertinent to maximizing revenue (Alcatel-Lucent, 2010).

Traditionally, network providers prefer a 'pay-per-dip' business model. However, small developers may find it difficult to generate revenue with this method due to the low profit margins imposed by fierce marketplace regulations as well as the greater financial risk involved. In order to deal with these issues, network providers must work with developers to reduce development costs, maximize the efficiency of processes, and grant developers greater control. For example, network providers may consider requiring only a minimal upfront investment from

developers, adopting a revenue sharing ratio more favorable to independent developers, instituting transparent approval processes, and allowing developers freedom to set their own prices, branding methods, and means of interaction with their customers (Alcatel-Lucent, 2010).

To illustrate, Alcatel-Lucent supports network service providers through three main initiatives. These initiatives were launched to aid in the creation of new business models that bridge the gap between network providers and application developers. First, Alcatel-Lucent is equipped with an Application Exposure Suite which allows developers to gain access to the network provider's APIs securely and efficiently. This initiative is compounded through Alcatel-Lucent's Open API Service, which provides managed access to a web portal where developers can access the most up-to-date version of the APIs, as well as receive important documentation surrounding these programming libraries. Lastly, Alcatel-Lucent provides a vast portfolio of professional services, such as "business model consulting, the integration of multivendor systems and management of complex networks and service-layer operations", support for developers to transition between open business models and third party development, and other applications and content (Alcatel-Lucent, 2010).

SECURITY AND PRIVACY ISSUES

Both Google and Apple, the mobile industry's top players, were frequently challenged by issues of privacy and security arising from some third-party app developers who sought to exploit their operating systems for illicit gains. Although these market leaders worked hard to combat such misuse, the problem is far from permanent resolution. For instance, Path, a social networking app, was one such application that infringed upon a user's personal information. When a user downloaded Path, the application would send the entire contacts list, including names, e-mail addresses, and phone numbers from the user's mobile device to the company's database. Infringement of privacy is a serious violation of Apple's terms of service, and Path's chief executive officer was summoned for interrogation and reprimand by Apple's top executives. Soon, Apple found that Path was among numerous applications that could mine users' address book from the iPhone. Understandably, such incidents sparked controversy and frustration amongst iPhone enthusiasts (Satariano & MacMillan, 2012).

When Apple's App Store was established in 2008, Steve Jobs' view of the relationship with developers was very different from that of Microsoft. While Microsoft allowed developers unrestricted freedom to create and distribute programs, Apple took a contrasting approach. Every app developed for the iPhone was to be submitted to Apple's servers and a team of analysts would parse through its code to ensure that it meets the company's quality standards, and is free of bugs, malicious codes or scams. However, with the increasing popularity of the iPhone and iOS, and the exponential pace of app development, Apple could no longer sanitize and approve the apps in a timely manner. Developers grew frustrated when their applications had to wait in line for months before being allowed into the App Store, and eventually, Apple had to lower the severity of its vetting policies (Satariano & MacMillan, 2012).

Adverse publicity in media and the resulting public outrage following the revelation of privacy violations by Path even invited the attention of the U.S. Congress. Senator Charles Schumer called up on the Federal Trade Commission to investigate both Apple and Google over claims that apps running on their mobile operating systems were violating user privacy. Senator Schumer voiced the general sentiment that personal information being accessed by the mobile apps goes "beyond what a reasonable user understands himself to be consenting to when he

allows an app to access data on the phone for purposes of the app's functionality." Representatives Henry Waxman (D-California) and G. K. Butterfield (D-North Carolina) publicized letters they had sent to CEO Tim Cook of Apple and 33 other companies with iOS apps published on Apple's iTunes store, soliciting information on their privacy policies (Lowensohn, 2012; New York Senator Asks FTC to Investigate Google, Apple, 2012).

In February 2012, California's attorney general, Kamala Harris, made Apple, Google, Microsoft, Amazon, Hewlett-Packard, and Research in Motion sign an undertaking promising to improve privacy protections in apps made available on their operating systems. Under this agreement, the companies would henceforth require developers to provide app users information concerning their privacy policies and disclose what user data the apps would access and share *before* the apps could be downloaded. The state of California already had in place a stringent legal framework to protect Internet users - the *Online Privacy Protection Act*, which applied to websites and online services. With this agreement, the Act ostensibly extended the protection to mobile apps too. Penalties for infringing the provisions of this act could be quite severe - fines up to $500,000 per use of the app in violation. Even though Google was a signatory to the agreement, the company spokesperson claimed that "from the beginning, Android has had an industry-leading permissions system which informs consumers what data an app can access and requires user approval before installation" (Mills, 2012).

The Federal Trade Commission (FTC) has been particularly concerned with protecting children's privacy. In a widely discussed report of its findings, the FTC concluded that a vast majority of the apps meant for children that they had examined on both the Apple and Google marketplace sites displayed no privacy policies at all. In fairness to the developers, the report qualified that this is not to say that such policies did not exist, but rather that they were not readily accessible on the store's promotions page or on the "landing page" that was accessed after a particular app was selected for downloading. A major role of the FTC is enforcement of the Children's Online Privacy Protection Act ("COPPA") and the FTC's *Implementing Rule*. The summary result of these efforts is to "require operators of online services (including mobile apps), direct to children under age 13 to provide notice and obtain parental consent before collecting items of personal information from children." The FTC settled its first case against a mobile app developer in 2012 and proceeded to issue a *Notice of Proposed Rulemaking* to amend the COPPA Rule. In so many words, the FTC enjoined all those involved in the developing, selling, and managing of apps targeting children to provide privacy-related information to parents. They further emphasized the need to disclose what information would be collected, how it would be used and who would have access to it. Through its words and actions, the FTC has made it clear that they intend to stay involved in the rapidly growing mobile apps industry to ensure that the same public safeguards are in place as they do for other media (Poss & Hasty, 2012).

Many of the privacy issues arising from the apps created for Apple's iOS revolve around the app developers' ability to access the unique device identifiers (UDIDs) that were made available to them by the operating system. The UDID for a specific phone is a string of numbers, which is meant to be anonymous. However, some believe that they have been used to identify individuals by combining the UDID with other information available on their phones. In response to numerous lawsuits and the media scrutiny that followed, Apple had announced that it would begin phasing out UDIDs and followed it up relatively quickly with rejection of apps that continued to use them. These actions have placed Apple squarely in between the public's calls for privacy and developers' desires to effectively monetize their apps. By tracking the UDIDs

advertisers could profile a user across multiple apps and thereby direct ads relevant to them more accurately. MoPub, an ad server, has estimated that preventing access to the UDIDs could lead to a 24% decrease in revenue for app developers and believes the onus is on Apple to create an alternative means of identifying users (Aimonetti, 2012; Cooper, 2012; Vascellaro, 2012).

Another common ploy in the mobile industry involves the manipulation of advertisement revenue. Some companies enter into agreements with app developers to generate app downloads through effective marketing procedures. In reality, however, some of these developers operate a series of computers called 'bots' which are designed to download applications thousands of times on command. Thus while an application may show that it was downloaded several times, these downloads were artificially generated using fake accounts. An alternative to using bots involves paying workers in other countries such as China small amounts to download the applications manually. In response to this scam, Apple announced a new policy that would ban any developer who engages in such scam practices. This resulted in a 24% decrease in the number of downloads in Apple's App Store from January to February of 2012 (Satariano & MacMillan, 2012).

Some companies also attempt to manipulate the leaderboards in mobile app marketplaces by offering incentives for users to rate, review, or download additional apps in order to inflate the popularity of a specific app. Other developers seek to piggyback on the truly successful apps by christening their apps with a slight variation in the names of games such as *Angry Birds* and *Temple Run* in order to attract more customers. Apple has worked vigorously to remove such applications from its marketplace, but the process is laborious and is frequently difficult for a company to sustain. According to a former Apple executive, thousands of new apps are submitted to Apple every month, and each one is reviewed for only about 15 minutes. In other words, a lot many malicious apps could potentially conceal their true intent and slip through the company's review process undetected (Satariano & MacMillan, 2012).

In early 2012, Apple invested $50 million in a project called *Chomp*, a search engine to help smartphone and table-top users find new apps and thereby reduce reliance on the marketplace's leaderboard system. The search engine would also have the intelligence to craft new algorithms in order to determine which apps suit a user's needs better. Normally, Apple's default algorithm based the leaderboard rankings solely on the number of times an app was downloaded. However, with Chomp, new criteria such as the frequency of an app's usage could be factored into the recommendations. This would allow the leaderboard to evaluate and signpost the usefulness and popularity of the apps more accurately (Satariano & MacMillan, 2012).

In early 2011, a team of programmers released a Trojan disguised as an official Android clean-up app. This malicious file, called the *DroidTeam Trojan*, was distributed in the Android Market through the use of a vulnerability found in its operating system. Google quickly released a security patch to kill the Trojan, but the file continued to thrive on the Android Market by disguising itself as a number of popular gaming and other apps. Google successfully pulled all such apps from the Marketplace with alacrity and thereby halted the spread of this malware. Learning from this experience, Google soon thereafter released an update to co-exist within the Android Marketplace called the Android Market Security Tool (Google Working Hard to Keep Android Safe From Viruses and Malware, 2011). Capitalizing on the release of this tool, the Trojan programmers created a false version of the application which further spread the malicious file to additional handsets. This time around, the file was distributed over third-party Android marketplaces wherein Google had virtually no power to stop the infection from spreading. The new Trojan was capable of extracting phone numbers and other contact details from the infected

Android phones and uploading them to a database controlled by the hackers. Using this database, the hackers could send remote text messages from the infected devices to perhaps extract information from other unsuspecting phones in the contacts list, and thereby further spread this malware (Google Working Hard to Keep Android Safe From Viruses and Malware, 2011).

MOBILE APP INDUSTRY TRENDS

Changes occur so rapidly in the mobile app industry that a totally new trend makes its presence every year. For instance, in 2010 smartphones and mobile apps were the trendiest products in the industry, while in 2011 tablet computers took the lead with a sharp increase in consumer demand. These changes in demand have led to corresponding increases in the supply of apps available in the app marketplaces. By analyzing previous trends, one may forecast the products which would be in high demand in future (Viswanathan, 2011).

In 2010, the leading app categories were mobile gaming and social networking. However, in 2012, a growth area is expected to be business apps with practical utility. App developers must cater to users by creating apps to handle things such as time management and multitasking. One difficulty associated with the development of business apps involves the selection of the right platform to suit the business customers' needs. Developers must determine the most popular platforms used by businesses and executives in order to maximize profits. Toward the end of 2011, the number of business apps downloaded had risen significantly, but in terms of the overall market there appears to be even greater potential for growth (Viswanathan, 2011).

Consumers have also begun using their mobile devices for online shopping as well as making normal purchases. Therefore, another trending app category for 2012 might be the mobile wallet, wherein the mobile device serves as a virtual form of credit or debit card and online banking. Several banks have already begun to offer mobile apps to address this need. Such digital wallet apps are expected to become more common in 2012 (Viswanathan, 2011).

The recent dramatic increase in demand for cloud computing will continue as more industries shift toward cloud-based services. This will in turn create the need for cloud sync providers and cloud based apps. More apps that organize data through the cloud, both private and public, are expected to be created as developers gravitate toward web-based applications, as these are much more efficient for cloud-based software (Viswanathan, 2011).

Another significant trend for app development in 2012 will be the usage of location-based monitoring systems. This will allow app publishers to offer targeted advertising to consumers based on their GPS location. Targeted ads will be much more efficient and cost-effective, which will also increase the app revenues (Viswanathan, 2011).

In addition to the sale of apps to users, another profitable aspect of the mobile app industry expected to see growth in 2012 is the offering of marketing services to app developers. Because of the ever-growing supply of apps in all the major app marketplaces, it has become extremely difficult for app publishers to differentiate their products from the competition. It is difficult for developers to pitch the superiority of their products due to the over-saturation and lack of structure in the marketplace. Mobile marketing firms are very uncommon in the industry, which leaves room for a great opportunity to offer these services to developers (Viswanathan, 2011).

INDUSTRY FORECASTS

Mobile industry analysts predict that by 2012, the industry would be worth $17.5 billion. The number of app downloads is projected to grow at a rate of 92% per year, which translates into a jump from 7 billion downloads in 2009 to nearly 50 billion in 2012. These figures imply an enormous opportunity for app developers as the industry grows exponentially (Floriceanu, 2010). In addition, studies forecasted that by 2012, off-deck applications (i.e., apps which are not approved by the phone carriers) will account for nearly 50% of all revenues in the mobile application industry. Conversely, on-deck applications (apps which must be approved by phone carriers before distribution is allowed), which accounted for 60% of all revenues in the industry in 2009, were projected to make up only 23% of revenues by 2012 (Floriceanu, 2010).

Intense competition in app development has led to a steep hike in failure rate among mobile app companies. In the iPhone App Store, the top 10% of the apps in popularity account for 80% of all the apps downloaded. In response to this trend, many app developers are now resorting to third party app development to boost their revenues. In the United States, third party app development is in greatest demand with up to 98% of application project revenues stemming from concept development, design, and coding. Analysts predict that this number will drop to around 70% by 2015. On the other hand, app maintenance, analytics, and distribution and extension services which generated only 2% of the industry revenue in 2010 will increase to nearly 30% by 2015 (Perez, 2011). Currently, third party app developers are thriving in the United States and Western Europe. However, emerging markets, such as China and India, have shown great promise in the mobile app industry (Perez, 2011).

It is anticipated that the average price of mobile apps will decrease by about 29%. In 2009, the number of mobile app stores increased from 8 to 38, and these will continue to increase through 2012 and beyond. The methods used to generate revenue from mobile apps are also changing. In 2009, advertising accounted for only 12% of the app revenues; this is expected to double by the end of 2012 (Floriceanu, 2010).

App revenues in Europe are estimated to surge from $1.5 billion in 2009 to nearly $8.5 billion by 2012. In North America, the revenues are predicted to rise from $2.1 billion in 2009 to $6.7 billion in 2012. Although Asia leads in the number of mobile apps downloaded globally, North America still generates the highest revenues, accounting for 50% of the entire mobile app industry revenues in 2009 (Floriceanu, 2010; What Developers Should Know About Amazon's Android App Store, 2010). Revenue from apps is predicted to increase by 92%, from $7.3 billion in 2011 to $14.1 billion in 2012. The market for mobile apps is forecasted to increase @ 50% compounded annually, resulting in downloads across all platforms of 182.7 billion and revenues of $36.7 billion by 2015. These numbers reflect not only apps which have a one-time purchase price but also those with additional fees for "in-app" premium content, and subscription-based pricing models. In other words, the projections aggregate direct purchases, in-app purchases, and advertising (Racoma, 2011). Another forecast estimates that the mobile app industry, including app development, management, distribution, and extension processes, will grow to $100 billion by 2015. As of 2011, 66% of the applications were being developed by third party vendors. Analysts predict that this number will grow over the next several years as the industry matures and more programmers gain familiarity with working on platforms like Android and iOS (Perez, 2011).

ABI Research, a market intelligence company focusing on global technology trends, forecasts that revenue from mobile apps will reach an estimated $46 billion in 2016. That

projection includes income from downloading apps, in-app purchases, subscriptions, and advertising and represents nearly a five-fold increase over the $8.5 billion generated in 2011. In 2012, income from in-app purchases was projected to surpass that from app downloads, but ABI does not expect this trend to continue. They report that the majority of in-app purchases are made by a relatively small percentage of players of mobile game apps. The percentage of such users is not expected to grow; so any increase in in-app income will have to come from an as yet unseen source. However, HIS iSuppli, another market research firm, reported that in-app purchases were 39% of total revenue from apps in 2011 and they expect that to increase to 64% by 2015. Another limitation on growth of in-app revenue is Google's relatively stringent restrictions on in-app purchase options for apps created for the Android operating system. As the number of free apps available for download increases, the ability of developers to offer apps for sale decreases. It therefore becomes increasingly important for them to find other sources of revenue (Mobile App Revenue Set to Soar to $46 Billion in 2016, 2012).

LOOKING AHEAD

In response to the growing competition in the mobile industry, Google and Apple have announced several expansions to their existing products, and also expanded their product lines in 2012. During the vacation season in 2011, the sale of physical devices and app downloads rose to an all-time high. The number of app downloads exceeded one billion, demonstrating a clear boom in the industry. This milestone called to attention the future of the big players in the mobile industry – Google and Apple (Mathew, 2012).

Apple believes that smartphones will be soon replaced by super phones, which are more intelligent and responsive than their earlier counterparts. Mobile apps are expected to become even more impressive with the introduction of these super phones, and competition is expected to continue to intensify throughout the industry. Moreover, mobile commerce is expected to garner a lot of attention from both businesses as well as consumers. In an attempt to dominate the mobile commerce sector, Google introduced the Google Wallet in the summer of 2011, which is an Android app that allows customers to make purchases either in-store or online using their phones. It is expected to be met competition from the Windows Mobile, which could take a significant chunk of the market share. Post Nokia acquisition, Microsoft now has access to the resources necessary to carve out a significant position in the mobile industry (Mathew, 2012).

With the launch of the *Mobile Application Developer's Association*, an alliance created to aid in the development of apps for iOS, Android, and RIM platforms, the app developers will also gain in strength as important stakeholders of the mobile app industry. The core functions of this alliance include a collaboration network, a plethora of platform-specific tools and testing modules, cloud hosting services, discounted and free certification and training programs, and more (Mathew, 2012). The future of the mobile app industry is indeed exciting and potent with possibilities.
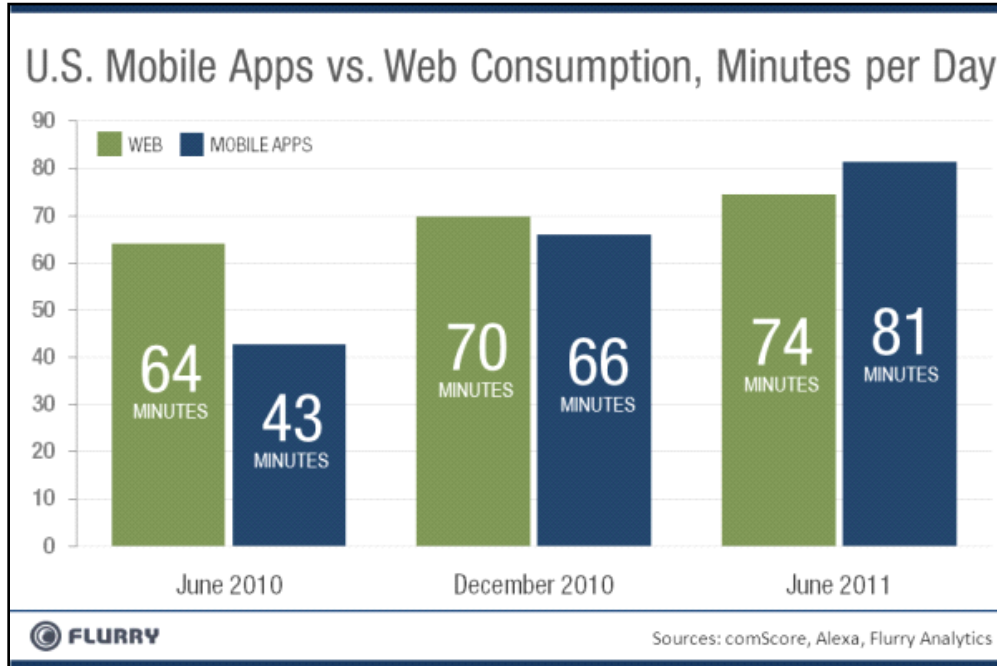
APPENDIX

Table 1

Table 2(a)
Apple's iOS App Store
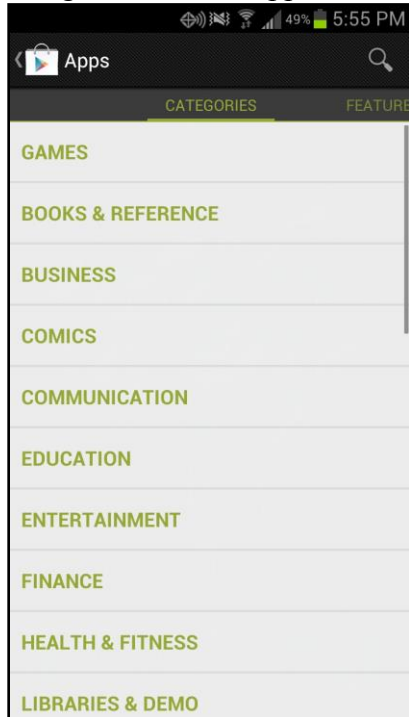

Table 2(b)

Google's Android App Store
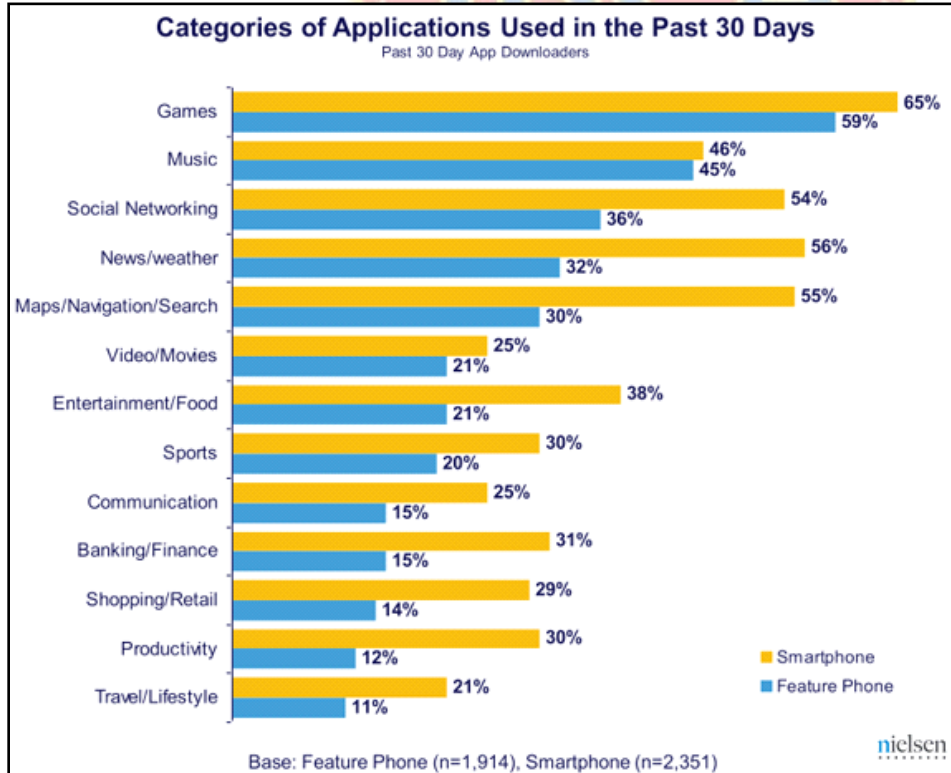

Table 3
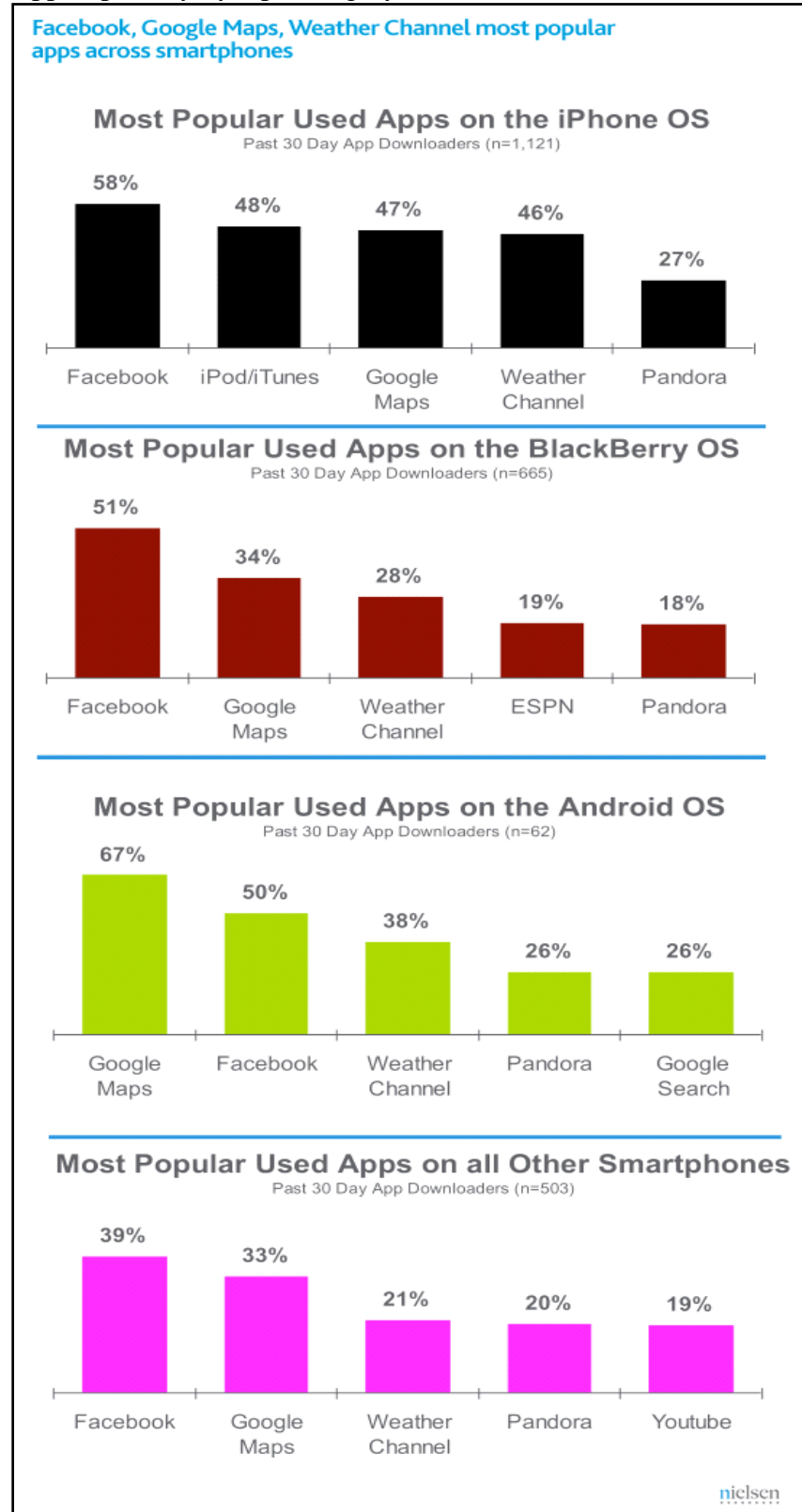Categories of Apps Used in a 30-Day Span

Categories of Applications Used in the Past 30 Days
Past 30 Day App Downloaders

Category	Smartphone	Feature Phone
Games	65%	59%
Music	46%	45%
Social Networking	54%	36%
News/weather	56%	32%
Maps/Navigation/Search	55%	30%
Video/Movies	25%	21%
Entertainment/Food	38%	21%
Sports	30%	20%
Communication	25%	15%
Banking/Finance	31%	15%
Shopping/Retail	29%	14%
Productivity	30%	12%
Travel/Lifestyle	21%	11%

Base: Feature Phone (n=1,914), Smartphone (n=2,351)

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Table 4

App Popularity by Operating Systems

Facebook, Google Maps, Weather Channel most popular apps across smartphones

Most Popular Used Apps on the iPhone OS
Past 30 Day App Downloaders (n=1,121)

Facebook	iPod/iTunes	Google Maps	Weather Channel	Pandora
58%	48%	47%	46%	27%

Most Popular Used Apps on the BlackBerry OS
Past 30 Day App Downloaders (n=665)

Facebook	Google Maps	Weather Channel	ESPN	Pandora
51%	34%	28%	19%	18%

Most Popular Used Apps on the Android OS
Past 30 Day App Downloaders (n=62)

Google Maps	Facebook	Weather Channel	Pandora	Google Search
67%	50%	38%	26%	26%

Most Popular Used Apps on all Other Smartphones
Past 30 Day App Downloaders (n=503)

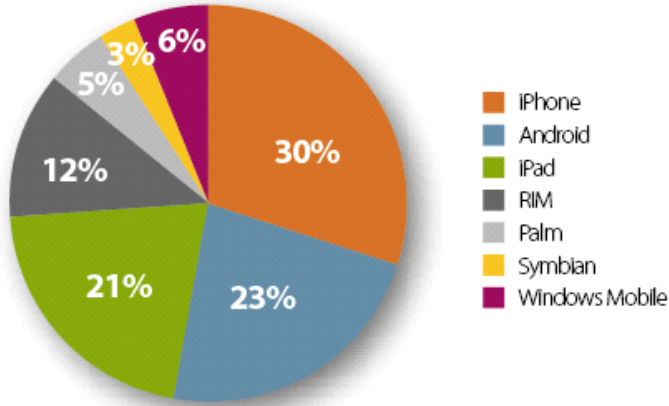| Facebook	Google Maps	Weather Channel	Pandora	Youtube
39%	33%	21%	20%	19%

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Table 5
Mobile App Consumption Time By Category

Table 6
Popularity of Mobile App Platforms with Publishers in 2010

Mobile App Platforms For Which Publishers Are Developing in 2010

CHART A

- iPhone — 30%
- Android — 23%
- iPad — 21%
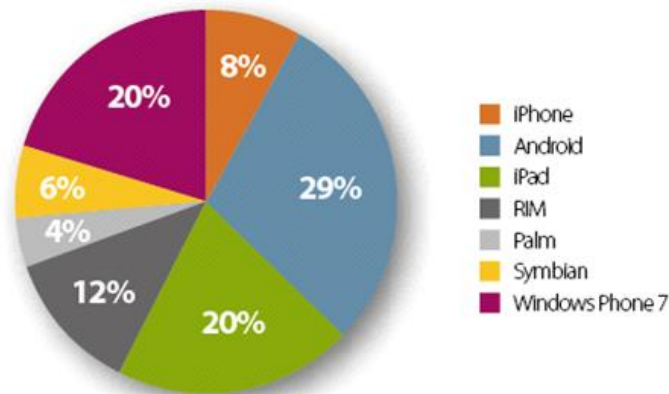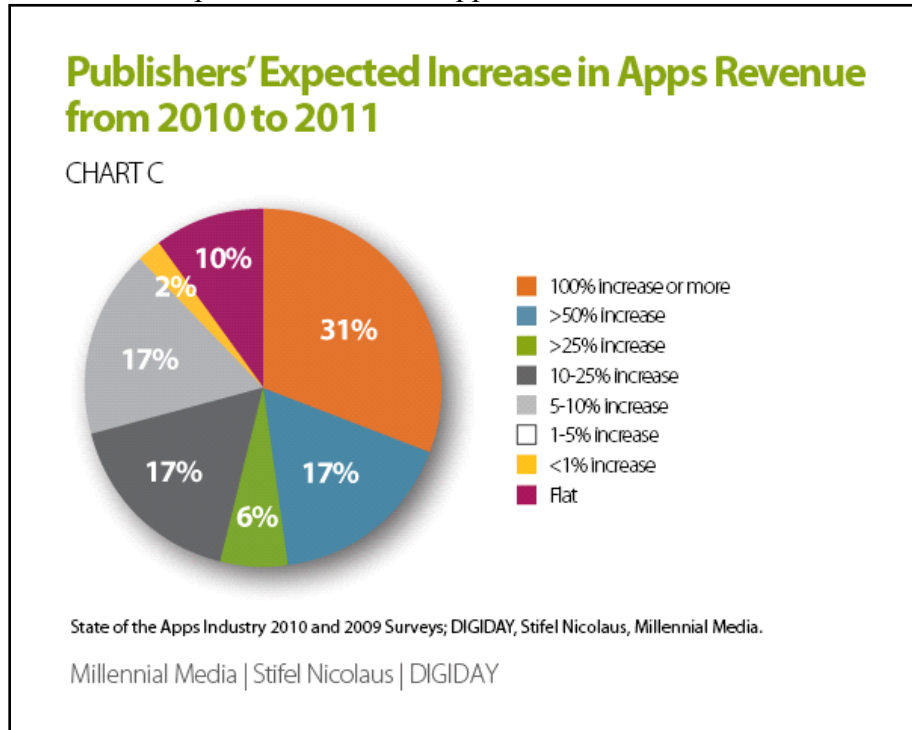- RIM — 12%
- Palm — 5%
- Symbian — 3%
- Windows Mobile — 6%

State of the Apps Industry 2010 and 2009 Surveys; DIGIDAY, Stifel Nicolaus, Millennial Media.

Millennial Media | Stifel Nicolaus | DIGIDAY

Table 7
Popularity of Mobile App Platforms with Publishers in 2011

New App Platforms Publishers Plan to Support in 2011

CHART B

- iPhone — 8%
- Android — 29%
- iPad — 20%
- RIM — 12%
- Palm — 4%
- Symbian — 6%
- Windows Phone 7 — 20%

State of the Apps Industry 2010 and 2009 Surveys; DIGIDAY, Stifel Nicolaus, Millennial Media.

Millennial Media | Stifel Nicolaus | DIGIDAY

Table 8
Publishers' Expected Increase in Apps Revenue from 2010 to 2011

Publishers' Expected Increase in Apps Revenue from 2010 to 2011

CHART C

- 100% increase or more — 31%
- >50% increase — 17%
- >25% increase — 6%
- 10-25% increase — 17%
- 5-10% increase — 17%
- 1-5% increase
- <1% increase — 2%
- Flat — 10%

State of the Apps Industry 2010 and 2009 Surveys; DIGIDAY, Stifel Nicolaus, Millennial Media.

Millennial Media | Stifel Nicolaus | DIGIDAY

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