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The App Economy

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THE APP ECONOMY

English - Or. English

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FOREWORD

This report on the "app" economy was prepared by Deborah Alcocer Delano and Taylor Reynolds of the Working Party on the Information Economy (WPIE) over the course of 2012, and in the context of the OECD's work on digital content. The Committee for Information, Computer and Communications Policy declassified the report by written procedure on 4 September 2013.

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TABLE OF CONTENTS

FOREWORD 2
THE APP ECONOMY EXECUTIVE SUMMARY 4
The app ecosystem 5
Policy issues 5
Competition 5
Consumers 7
Education and awareness 7
APP TRENDS AND MARKET DEVELOPMENTS 8
Growth of apps 8
Demographics 13
Apps by category 16
Public sector information apps 17
UNDERSTANDING THE APP ECO-SYSTEM 18
Platforms and App stores 18
New platform entrants 20
Developers 22
Paid downloads 22
In-app advertising 23
In-app purchases 24
Freemium (free-to-premium) 24
Promotion of non-digital goods 24
Resale of user data from apps 25
Developer decisions 25
Consumers 26
Device manufacturers 26
Network operators 27
EMERGING POLICY ISSUES 27
Competition 27
Market dominance and the importance of network effects 27
App submissions 30
Consumer lock-in 34
Consumer protection and privacy 37
Permissions 37
Lack of transparency in app rankings 44
In-app purchases 46
Dispute resolution and redress 48
Skills development 49
Users 49
Developers 49
App education: Businesses and governments 50

THE WAY FORWARD 50
ANNEX: ANDROID PERMISSIONS BY CATEGORY 51

Boxes

Box 1. HTML5: Browsers, apps and operating systems.....11
Box 2. Platform transaction fees.....20
Box 3. Costs of creating apps for diverse platforms.....26
Box 4. Apple vs. Google's Voice Service.....33
Box 5. Competitive effects of Twitter's vertical integration.....34
Box 6. Reporting on how smartphone data is used: Clueful app.....41
Box 7. About Apple's iOS6.....42
Box 8. Government’s setting privacy guidance for app developers 44
Box 9. In-app purchases targeting children 47

THE APP ECONOMY
EXECUTIVE SUMMARY

Apps are one of the main new sources of innovation in the economy and remain an area of spectacular growth during this economic downturn. Mobile apps enable significant efficiency gains by improving the way people communicate, access information and obtain services.

Apps extend the rich communication potential of the Internet beyond the traditional desktop computer and enable users to benefit from a myriad of information services practically anywhere or anytime they want. Economies rely on information to function effectively and the app economy represents a leap forward towards the goal of an informed and efficient knowledge-based society.

The app economy is extremely dynamic and evolving, and policy makers are keen to maximise its innovative potential and benefit for all sectors of the economy and society. Policy makers need to understand the mechanisms of the app economy in order to support innovation and ensure the maximum benefits possible for users.

The app ecosystem

The rapid growth of mobile computing is the result of the recent growth of wireless broadband, new portable devices and a burgeoning of innovative and appealing services on open networks. The current wave of app development is relatively new and the players and platforms are still evolving. Apps represent an increasingly important channel for governments and companies to deliver content, information and services to users.

The growth of available apps has been phenomenal by historical standards. There are roughly 827 000 apps available for download for Apple's mobile operating system (iOS),[1] followed closely by an estimated 670 000 for Google's operating system (Android).[2] Other platforms have been slow to gain market share, despite significant efforts to boost adoption and attract developers.

The average Android smartphone user in the OECD has 26 apps on their smartphone. The Japanese, on average, have the most apps on their phones (41) while users in Switzerland, France and Sweden have over 30 on average. The majority of apps on smartphones in the OECD are free apps (average 15) and the remainder are paid apps (average 11).

There are various business models for app development. Developers of paid apps receive the revenues from the sale of their apps in app stores, minus a transaction fee of typically 30%. The developers of free apps do not receive payments for each download of the app. Instead, they usually rely on a variety of other revenue models that commonly include in-app advertising or in-app purchases. But there are other revenue options such as freemium business models (offering a free basic version and a paid version with more functionality), the promotion of non-digital goods, and the resale of user data collected by apps.

Policy issues

Competition

Various measures of competition indicate that the market for mobile platforms is highly concentrated, but these measures must be interpreted with caution since the market is still developing and market shares have risen and fallen dramatically over a short period of time.

The mobile market is also poised to benefit from the introduction of two new mobile platforms: Firefox OS and Ubuntu. The entry of these new platforms could be significant because both are open source and Firefox OS is fully based on open web standards such as HTML5 that could allow apps to be written once and used across platforms. If new platform entrants can instigate a shift of resources towards open web standardisation and development, or hybrid HTML5/native solutions, then the number of available apps could increase across all platforms and strengthen competition as a whole. At the beginning of 2013, Android and iOS still maintain commanding positions in terms of market share and available apps. But the significant competitive potential on the horizon warrants regulatory restraint related to market power or dominance in the platform segment of the mobile market.

There are also promising signs for intra-platform competition in relationship to independent app stores. Unaffiliated app stores are expanding the number of apps they offer without having to pay transaction fees to platform providers on each app they sell. This is an important avenue to introduce price competition of apps within open platforms.

High market concentration levels could become more problematic in cases where significant consumer lock-in emerges. App users commonly have significant investments in hardware, apps, accessories and digital content within one ecosystem that cannot be used in another. Switching platforms typically means purchasing a new handset or device and this can represent a significant cost barrier for users. But there are other investments that may be linked to a specific platform. Individuals in OECD member countries have an average of USD 26 worth of paid apps on their devices that may not be compatible with other platforms. Any use of proprietary plugs and chargers also raises barriers for users wishing to switch platforms.

Investments in digital content locked to a given platform can also be a significant economic disincentive to switching platforms. If switching costs related to investments in digital content on a platform were to become too high, it could signal the need for intervention by competition authorities. Platform providers may therefore have an incentive to work towards the portability of digital content between platforms with rights holders and other concerned parties.

App stores are the primary distribution channels for apps, so closed app submissions processes and non-transparent app ranking methodologies are important areas of concern. If platform operators with closed systems reject apps on their platforms, they should communicate the reasons to developers in a clear and timely way that allows them to make modifications to the app and resubmit it for future consideration. Platforms should provide tools which empower end-users to rate and review apps, making sure that their ranking process is clear, transparent and useful to the consumer.

Attention should be drawn to any platforms that gain dominance through encouraging innovation and then use that position to block or restrict services that could be a threat to their dominance. Discrimination of this nature should be examined closely by competition authorities. Likewise, when a platform starts integrating functionality that was previously developed by outside providers in a way that can shut out existing or new developers, this should be cause for careful review.

The risk of over-enforcement or under-enforcement is an issue that competition authorities need to consider. Governments should encourage a self-regulatory approach from platforms and major stakeholders that addresses issues that are of governmental and consumer concern, and enables them to establish their own industry standards and benchmark best practices. At the same time, policy makers can take steps to minimise the risks associated with self-regulatory schemes. The government's role in the app economy should be one of an enabler, but one that also requires clear rules and transparency, and on-going monitoring of competitive dynamics.

Consumers

One of the key policy items emerging in the app economy is the need to provide users with meaningful information and control over how apps are using personal data on the device. The two largest platform providers (Google and Apple) have made important steps in this direction; Google via the transparency it allows to see what permissions apps are requesting, and Apple for allowing users to turn off certain access on an app-by-app basis. Policy makers should promote the integration of both types of protections on platforms as a start, but additional measures may be necessary to achieve a sufficient level of transparency.

The way apps are ranked and displayed within app stores influences which apps are eventually purchased (licensed) or downloaded. The ranking of apps in app stores is indeed the result of a complex system which involves various factors, but the methodologies need to be more transparent for the benefit of users and developers. App rankings should provide relevant and objective information concerning the way apps are being ranked, in order to provide a reliable measure to guide consumer purchases. It is increasingly important that rankings and end-user participation in reviews reflect the actual products and services offered, particularly if governments favour a self-regulatory approach to app ecosystems.

Certain apps allow users to make purchases within the app (so-called “in-app” purchases). One of the most lucrative uses of in-app purchases is allowing users to buy points or upgrades within gaming apps. These games are often popular, but they have also raised concerns when users have made substantial and un-intended in-app purchases. In some cases children can do so without the consent of their parents; in other cases, it affects users in general, who either are not aware of this type of business model, or lack education in the purchase of digital content products. All stakeholders share the responsibility to minimise un-intended purchases. There have been calls from within the industry for a consistent labelling scheme for games targeting young children. More can also be done to educate all users about the tools that are available to protect them against these purchases. Finally, developers share responsibility to prevent un-intended purchases through the way they design and promote their apps.

Education and awareness

The app development market is characterised by many small firms and individuals producing apps. One of the key areas where policy could focus is teaching basic app use and development skills as part of the computer curriculum of secondary and tertiary education systems. Students in these age groups are often considered to be strong users of information and communication technologies but it is still important that they learn the skills necessary to operate information devices, at a minimum, and potentially how to use or build tools for sharing information with apps and other online tools. Policy could also focus on ways to address the large number of unfilled jobs for highly-skilled ICT specialists.

APP TRENDS AND MARKET DEVELOPMENTS

The term "app" has recently entered the global lexicon and is short for the word "application". An app is a standardised piece of software that runs on a computing platform. The term app originally referred only to applications for mobile devices and tablets but now also includes software for a wide range of devices including desktop computers, as Apple now uses the term "app" to refer to desktop software in its Mac App Store.[3]

One of the key differences between an app and a traditional piece of software is that apps are delivered over an Internet connection. Apps are also distributed via centralised portals rather than through traditional retail channels, with portal operators taking a percentage of the sale as a commission.

App stores are emerging in any market segment where software can be delivered online. They may be tied to a desktop operating system (e.g. Windows Store, Apple App Store), a mobile platform (Google Play, iTunes, BlackBerry World, Windows Store), a browser (Firefox Marketplace, Chrome web store), a television platform (e.g. Samsung Apps, Iliad's Freebox), social networks (Facebook) or other platforms. Some app stores/markets such as Getjar, Handango and Opera offer apps across platforms and operating systems.

The scope of app ecosystems is broad so this paper examines only the narrow subset of apps for mobile and portable devices. All the emerging app ecosystems are important for policy makers but the mobile device segment is particularly important because it has seen the most significant growth over the previous four years. For this paper, the term "app" will refer to applications delivered over the Internet to mobile or portable devices. This narrow interpretation will permit a more detailed analysis of one important app market, but the findings for this particular market may or may not be applicable to other market segments. Future research could examine other specific app markets in detail.

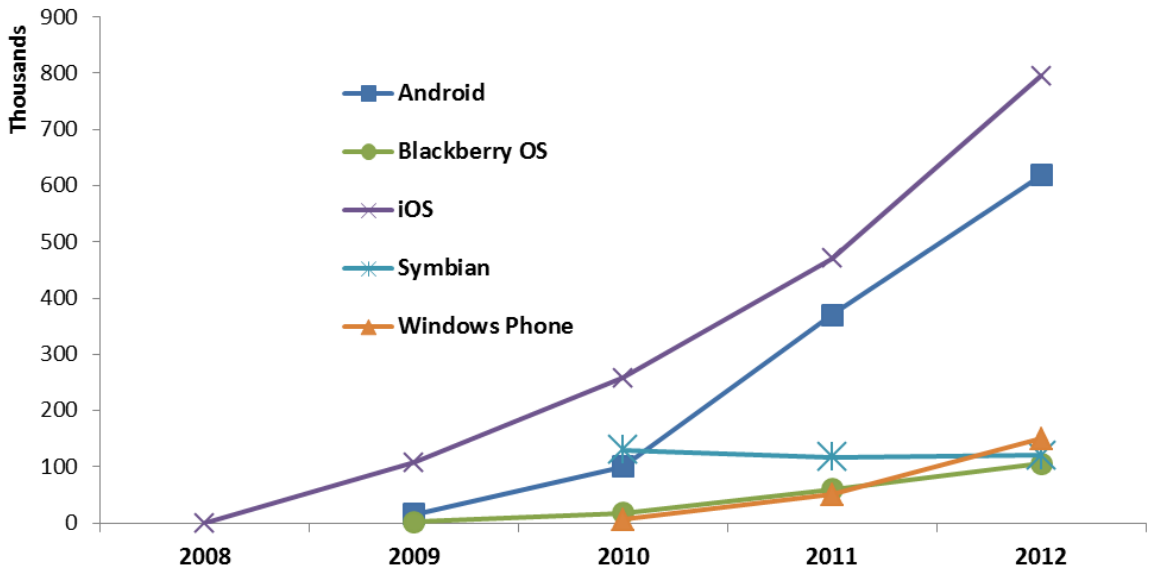
Growth of apps

While the growth of apps running on smartphones is a relatively recent phenomenon, software with similar functionality has been available on other platforms for some time. Some of the predecessors to the modern app included widget platforms such as Konfabulator and browser plug-ins, which have contributed to what apps are today.

The growth of apps has been rapid (Figure 1). When Apple's iTunes App Store and Google's Android Market first launched in 2008, smartphone users could choose from about 60 000 apps. As of March 2013, there were more than 827 000 apps in the Apple App store[4] and about 670 000 apps in the Android Market,[5] Blackberry had over 40 000**,** Windows Mobile had over 35 000 and Symbian had 25 000 applications which consumers could access from a variety of mobile devices, including smartphones and tablets.

Figure 1. Growth of apps available for download

By platform, 2008-2012

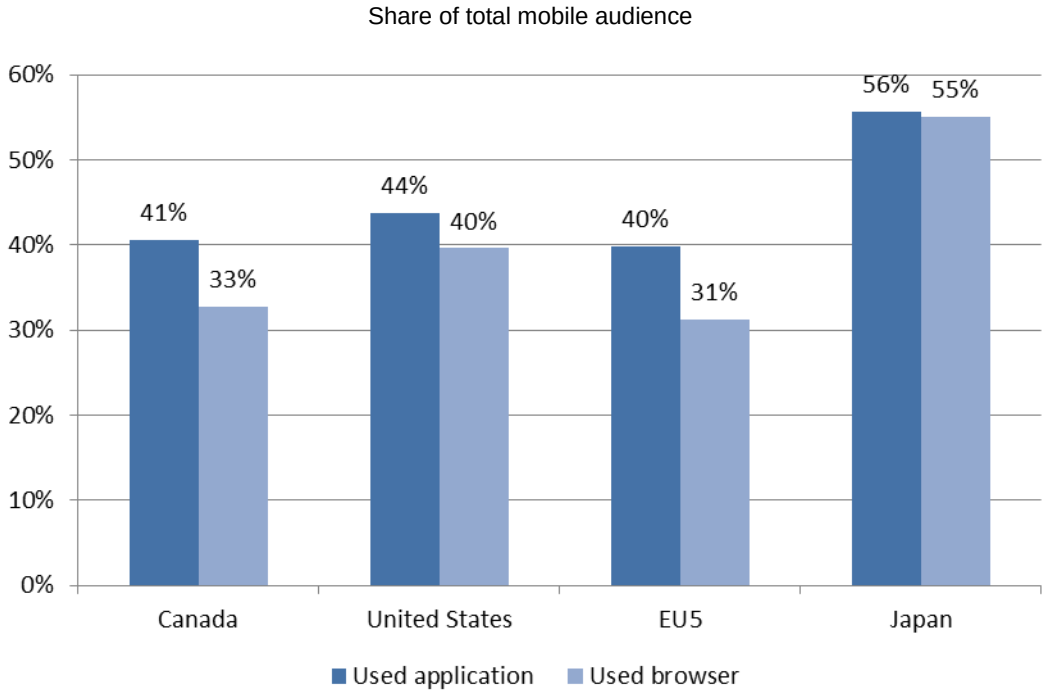


Source: Statista.com, 148apps.biz, appbrain.com, and company profiles (2013).

Some estimates put the total number of available apps across all app stores in 2012 at 2 million.[6] Other research groups have focused on the total number of apps downloaded. Berg Insight estimates that in 2010 there were roughly 10 billion app downloads but predict that by 2015, the market will reach a total of almost 100 billion downloads.[7]

This rapid app adoption has led to changes in the way that people access information and content on mobile phones and portable devices such as tablets. Currently, the trend is shifting away from accessing information via mobile web browsers and instead to dedicated apps as the entry-point to their services (Figure 2), although this trend could reverse as browser-based apps are already a competitive alternative to OS-based apps, and with a broader adoption of HTML5.

Figure 2. Information access methods via a mobile device



Note: EU5 (UK, DE, FR, ES, IT)
Source: ComScore, MobiLens March 2011.

It is common for mobile websites to suggest that users download dedicated apps instead of accessing the content via a web browser when users visit their site. Some sites are even requiring mobile users to enter via a dedicated app (e.g. Speedtest.net) and will no longer offer access via a mobile browser. This is, however, an incipient trend and there are debates about whether the app-as-a-standalone-program will dominate in the future or if websites will offer a more "app-like" web experience using tools such as HTML5 (Box 1).

Box 1. HTML5: Browsers, apps and operating systems

HTML5 is an update of the HTML standard that dictates how content is displayed on the web. It will affect three key areas of the app ecosystem: 1) mobile browsers, 2) mobile apps, and 3) mobile operating systems.

- **Mobile Browsers**: HTML5 is the next iteration of HTML, the web mark-up language that tells browsers how to display web pages. HTML5 is a significant evolution of the standard by introducing richer functionality that allows websites in a browser to mimic functionality of stand-alone apps. For example, HTML5 has tags for showing video on a web page or allowing users to drag and drop elements within the browser window. Most browsers can already take advantage of HTML5 content. Strategy Analytics estimates there were 336 million HTML5 capable smartphones sold in 2011 and predict the number of HTML5-compatible phones sold in 2013 will reach 1 billion.[8] One of the key benefits for app developers using HTML5 in a browser is that they are not tied to an app store that may require a share of app revenues. Despite advancements in the HTML standard, native apps (built specifically for one platform) often can make better use of specific hardware features of phones to deliver content and often run faster than HTML5 content because they are tailored to a specific device or operating system.[9]

- **Mobile apps**: HTML5 can also be used as the core of standalone apps that can be written once and work across different mobile operating systems. The HTML5 can be viewed directly via a browser or "wrapped" into an app that is specific to a mobile operating system so that the app that can take full advantage of the hardware potential of devices.[10] These new hybrid solutions are emerging from companies such as PhoneGap and Marmalade. With the open-source PhoneGap, developers can write applications using HTML5, JavaScript and CSS and then compile native apps using PhoneGap to take advantage of APIs for accelerometers, the camera, compass, etc.[11]

- **Mobile operating systems**: HTML5 content is available across platforms via HTML5 compliant browsers but the emergence of new browser-based operating systems such as Chrome OS and Firefox OS that run apps could further promote the use of the standard. In particular, Firefox OS from the Mozilla Corporation will only run HTML5 apps.

One of the reasons that apps have generated so much interest from advertisers and developers alike is because they are arguably the first powerful software platform that people carry with them nearly all the time. A "Think with Google survey" found that 71% of smartphone users in OECD countries say they don't leave their house without their smartphone. The same study found that 38% of smartphone users notice advertising while using an app, making it an attractive platform for advertisers.[12]

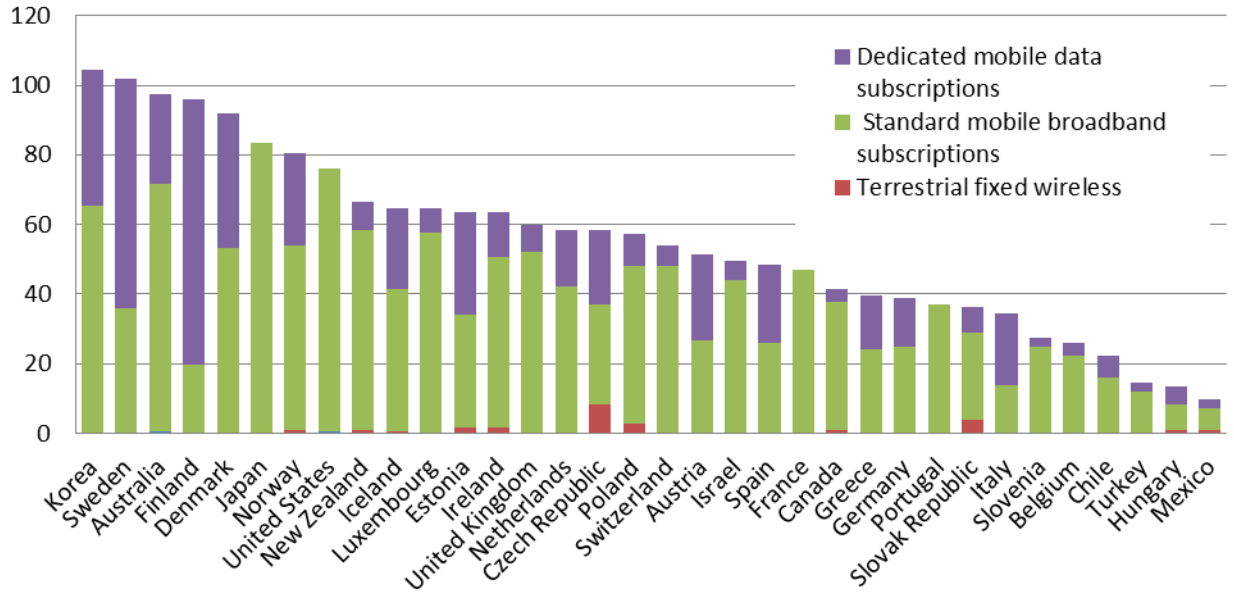
As indicated above, an app-like experience has been available on other platforms before. But the dramatic increase in app adoption today is the result of a conflux of affordable and powerful mobile devices such as smartphones and tablets paired with affordable mobile broadband connectivity. Apple and Google essentially created open, powerful platforms for developers to build applications for mobile devices on a scale that was not possible before.

Since 2005, the number of mobile phone subscriptions worldwide (voice and/or data) has doubled, with particularly strong growth in non-OECD countries where the number has tripled. In 2010, more than one out of five Internet users in Iceland, Luxembourg, Norway, Spain and Sweden reported using a mobile phone with an Internet connection, while in Korea it is one out of three Internet users. The shift to accessing the Internet via a mobile device has been a key trend since 2008, and the evolution of smartphones has changed the surfing behaviour of individuals.[13]

Adoption of basic mobile cellular subscriptions has been rapid in both developed and developing countries alike. These subscriptions increasingly offer mobile broadband connectivity although significant adoption gaps remain between income levels.

Wireless broadband subscriptions in OECD countries have risen quickly over the previous three years and now Korea and Sweden have become the first OECD countries to surpass the threshold of one mobile broadband subscription per inhabitant (Figure 3). These subscriptions are the primary network foundation supporting the growth of mobile apps and smartphone platforms.

Figure 3. OECD wireless broadband subscriptions per 100 inhabitants, June 2012



Note: Standard mobile broadband subscriptions may include dedicated mobile data subscriptions when breakdowns are not available.
Note for Israel: The statistical data for Israel are supplied by and under the responsibility of the relevant Israel authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.
Source: OECD Broadband statistics, http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm, January 2013

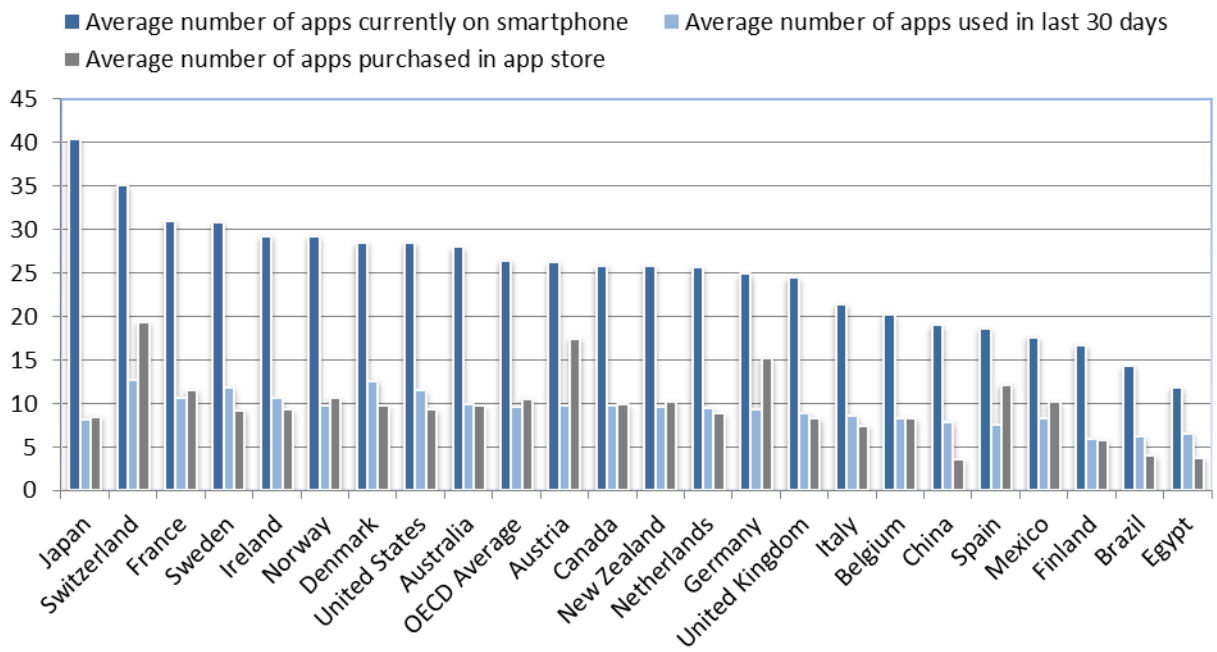
Technical advances in storage capacity also mean that current smartphones and tablets have sufficient space for a large number of apps and digital content. The number of apps on a smartphone will vary from user to user depending on the needs of the individual and the amount of space dedicated to storing other digital content. Cloud computing will also have an impact on apps as the cloud can store and make available more content than devices themselves could hold. Apple's iCloud and Microsoft's SkyDrive are examples of mobile cloud services where the data and applications can reside in the cloud.

Google data of Android app users in OECD countries shows that the average Android smartphone user in the OECD has 26 apps on their smartphone. The Japanese, on average, have the most apps on their phones (41) while users in Switzerland, France and Sweden have an average of over 30 (see Figure 4).

The apps that stay on the phone may not all be used frequently. Google data shows that only 37% of all apps on a phone in OECD countries are used within a 30-day period. The Swiss use the most apps in a given month at nearly 13 compared with the OECD average of 10.

Figure 4. Average number of apps currently on smartphone and those used in the last 30 days

2012



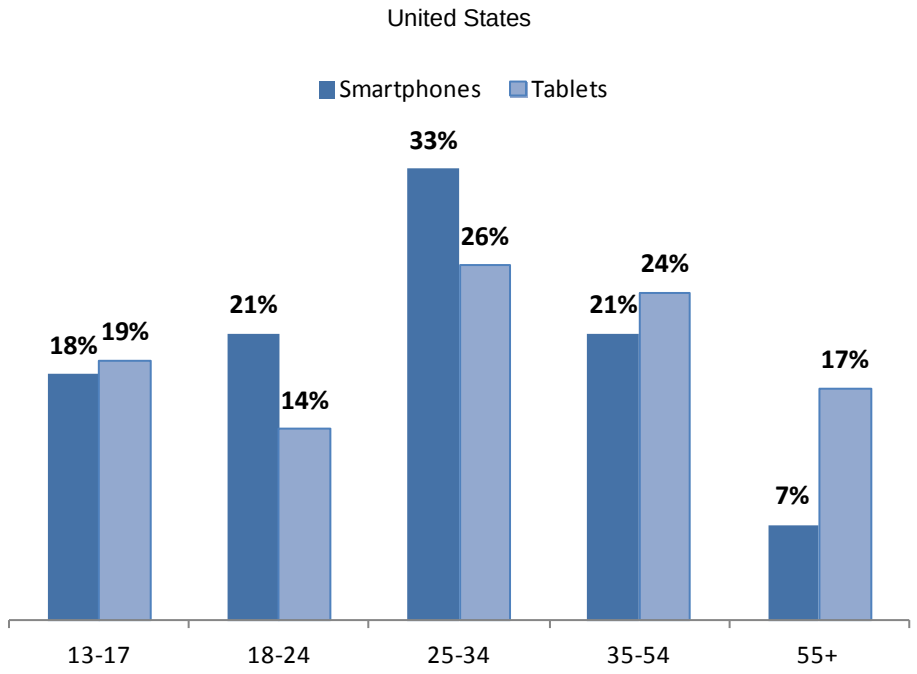
Note: OECD average reflects the average of the OECD countries within the sample, not the full membership.
Source: Think with Google, mobile planet (2012). www.thinkwithgoogle.com/mobileplanet/en/downloads/ ,

The Google data also show the average number of apps that have been purchased/licensed on devices across countries. On average, users in OECD countries have paid for 11 of the apps on their device and the remaining apps are free downloads. Users in Switzerland, Austria, Germany and Spain have a relatively high number of paid apps on their devices.

Demographics

Smartphone and tablet adoption is increasing throughout the world but the rates vary across age groups. The highest adoption levels are in the 25-34 age group, followed by the 35-54 age bracket. A study by Flurry Analytics found that the average age of smartphone users is 30, and the average age for tablet users is slightly older at 34 (Figure 5). In terms of demographics, the 55+ age group has the lowest rate of smartphone adoption (7%) but a much higher rate of adoption for tablets (17%).

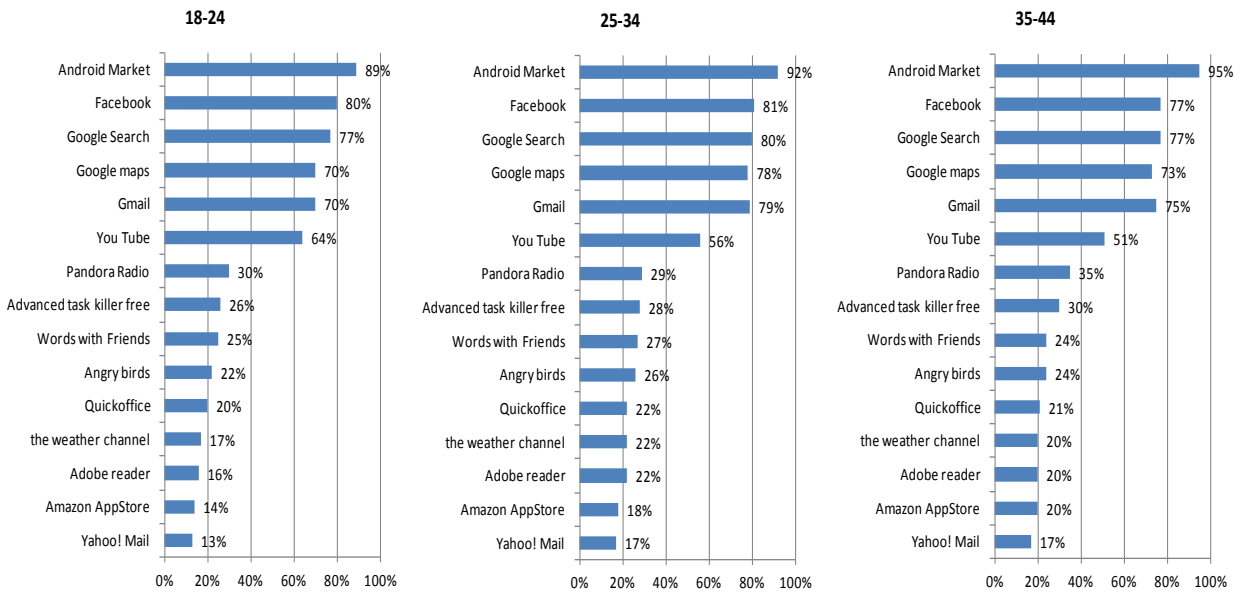
Figure 5. Age distribution, smartphone versus tablets



Source: Flurry analytics, September 2012.

The breakdown of apps on a smartphone or tablet also varies across age groups. Facebook and YouTube are more likely to be in a phone of a younger user but Pandora radio (a music streaming app) is more commonly used by people aged 35-44 in the United States (Figure 6).

Figure 6. Mobile Application Reach by Age in the US

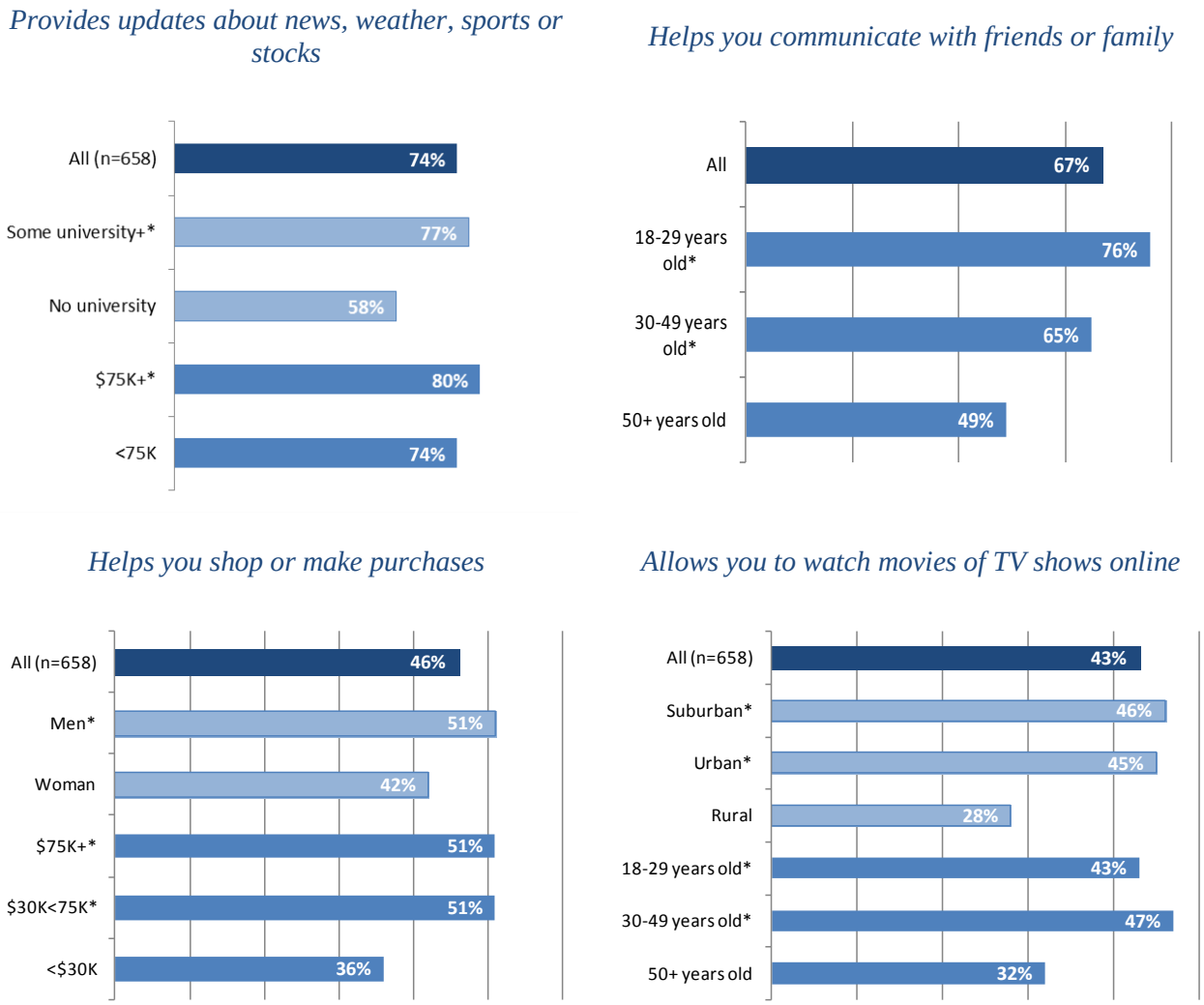


Source: Nielsen Smartphone Analytics, Device Metering Data, September 2011.

Other demographic factors influence the types of apps installed by users (Figure 7). For example, apps providing updates about news, weather, sports or stocks are more commonly installed on the phones of Americans with a college education or those who have incomes over USD 75 000 per year. Gender also plays a role as men are significantly more likely than women to install apps that help users shop or make purchases.

Figure 7. Which demographic groups in the United States are most likely to download each type of app?

% of app downloaders who have downloaded an app that…



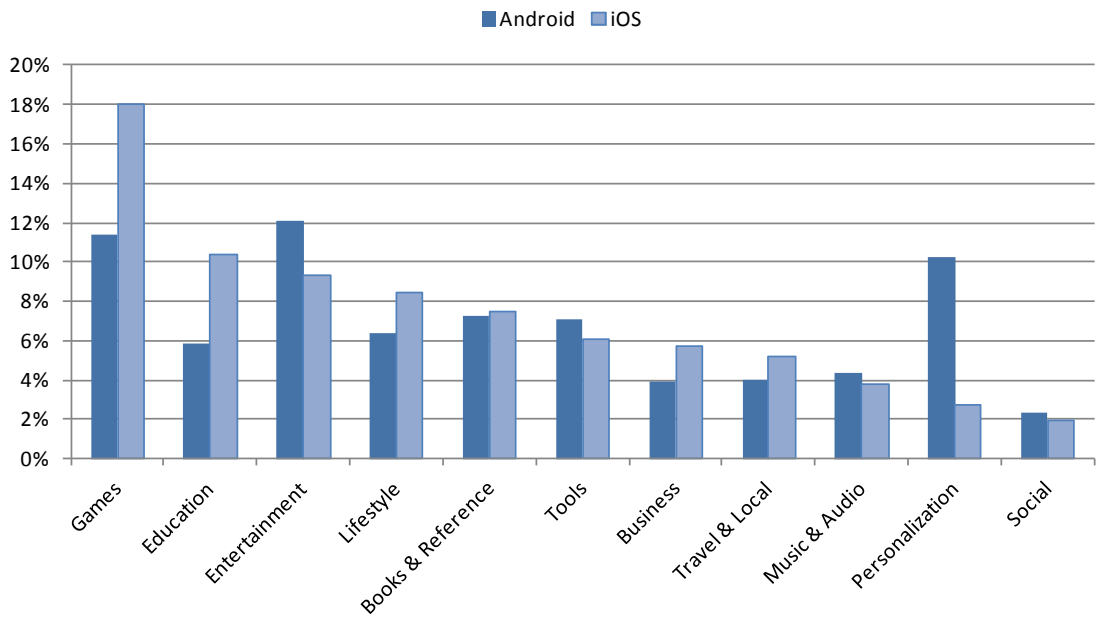
Note: Tracking survey. N=658 app downloaders, margin error is plus or minus 4.5 percentage points. Interviews conducted in English and Spanish. An asterix (*) indicates a significant difference at the 95% confidence level.
Source: Pew Research Center's Internet & American Life Project, 25 July-26 August 2011.

Social apps such as Facebook and apps from Google such as Gmail are the most popular smartphone apps among Android owners aged 18 years and older in the United States according to Nielsen research on smartphone usage.[14] Facebook's app is the most popular app among Android owners aged 18-24 and 25-34 years old. Google's YouTube app gets heavy usage from Android smartphone owners aged 18-24, highlighting how media apps with a social dimension (*e.g.* Words with Friends) are preferred by that age group.

Apps by category

The most popular app categories for both Android and iOS are provided in Figure 8. Games and entertainment are the most popular type of apps the Android and Apple app stores. For Android, the personalisation apps rank in third place, as opposed to the education category for iOS.[15]

Figure 8. Share of apps by category



Notes: Games: include for Android: Arcade & Action and Brain & Puzzle & Casual categories. For Personalisation category: used Productivity category in iOS.

Source: OECD estimates adapted from Appbrain.com (October 2012). 148apps.biz (October 2012).

In a recent survey, Nielsen reports that 64% of app downloaders had used a game app in the previous 30 days, followed by weather apps (60%), social networking (56%), maps/navigation/search (51%), music (44%) and news (39%). The survey also indicated less popular app categories such as health apps, were only used by just 13% of downloaders and education apps (11%) in the month prior to the survey.

The games category is the largest app category in both Apple's App Store and Google Play, and the category also generates the most downloads. It is important to highlight, however, that the social networking category only represents 2% of total available apps on either platform but social apps such as Facebook, Skype, Twitter, Instagram, Whatsapp, Viber, Kakao Talk, Line and WeChat may remain longer in the user's smartphone, as opposed to apps under the gaming category which may see their popularity dissipate and then are eventually removed from the devices.[16]

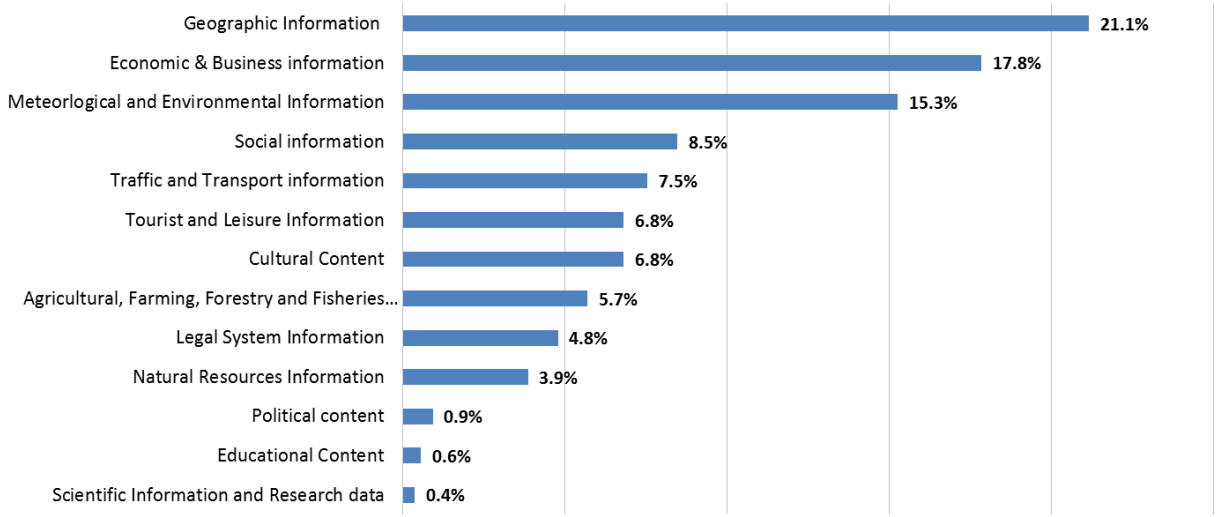
The overall trends show that the number of available apps is growing quickly along with the number of smartphones and tablets. Apps growth is strong across the economy and across all demographics but there are variances based on age, gender, education and country.

Public sector information apps

The evolution of apps has opened a new channel where users can access public sector information (PSI). Some of the most popular apps are partially or wholly based on available PSI. For example, some of the most popular apps are related to weather that make use of public meteorological data from national governments.

One way to identify apps using PSI is to match categories from the OECD's Recommendation for Enhanced Access and More Effective Use of Public Sector Information[17] with organisational categories within an app store. A sample of 545 selected apps from the Android Market that rely on public sector information can help illustrate which data are most commonly used and where developers are focusing their work. Apps using public geographic information accounted for 21% of all PSI-related apps in the sample (Figure 9). Apps using economic and business information were just behind at 18% while meteorological and environmental data accounted for 15% of PSI-related apps in the sample. Other key categories were social information, traffic and tourism.

Figure 9. Apps using Public Sector Information



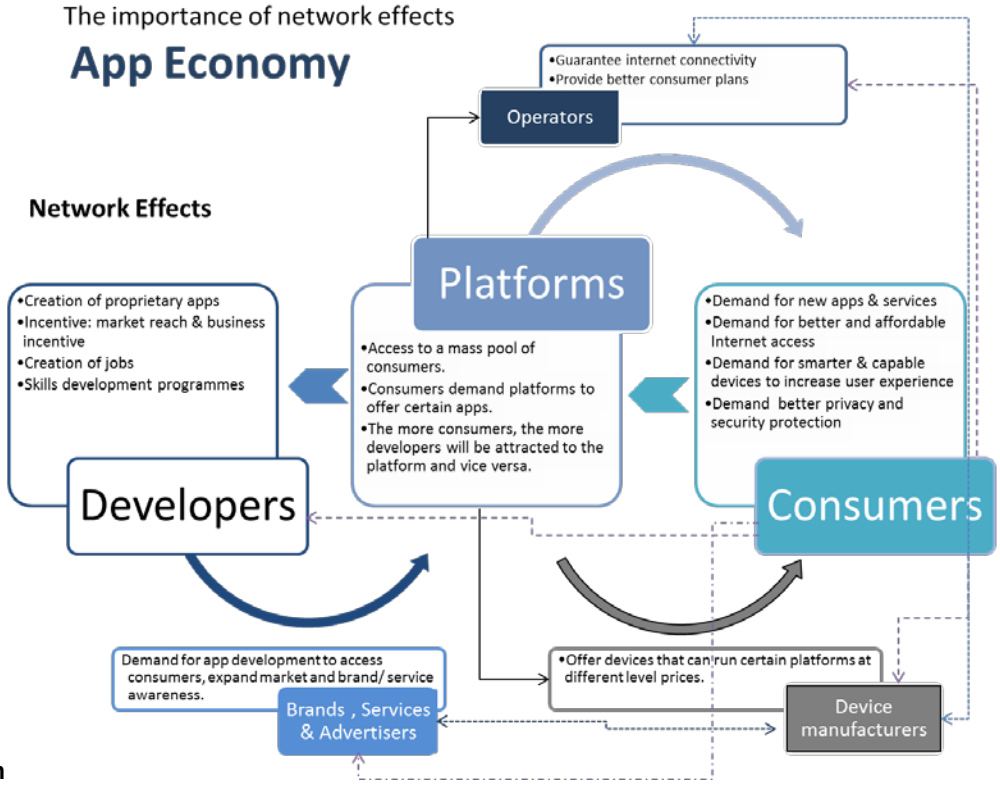
Note: A total of 544 apps were considered.
Source: OECD based on data from Android Market (September, 2012). OECD (2008) Recommendation for Enhanced access and more effective use of Public Sector Information.

The apps using PSI fall into both categories, paid and free. The average price paid for an app under the Geographic Information category is EUR 3.75, making it the most expensive category, followed by Social Information (EUR 2.75), and then Economic and Meteorological Information (both around EUR 2.50). The category where the average price was the lowest was "Legal System information" with an average price of EUR 1.35.

UNDERSTANDING THE APP ECO-SYSTEM

A breakdown of the value chain for apps can help policy makers understand the app ecosystem and the key transactions behind the app economy, the economic drivers, and potential bottlenecks or areas of competitive concern. Figure 10 provides a graphical representation of the basic value chain for apps and includes platforms, developers, consumers, operators and device manufacturers. Each step in the value chain is explained below. The ecosystem for apps includes various players, and depending on the country stakeholders can play a larger or lesser role, depending on the conditions of the market.

Figure 10. The App Economy



ecosystem

The entities that occupy different parts of the value chain can vary from country to country. When i-mode launched in the Japanese market in 1999, the telecommunication provider NTT DoCoMo controlled the platform on the phones and took a percentage of all revenues it billed for developers and content providers. When the iPhone reached the market in 2007, it was Apple as the hardware manufacturer that introduced the new platform for app distribution and managed the revenue sharing model with developers. The introduction of Android-based phones in 2008 resulted in Google taking a key role in the platform part of the value chain.

Platforms and App stores

Apps exist within a software platform (operating system) and there are several popular platforms supporting apps on mobile and portable devices (Figure 11). The largest platforms by market share of installed phones are Android (Google), Symbian (Nokia), iOS (Apple), BlackBerry (RIM), Bada (Samsung), Windows Phone (Microsoft) and Windows Mobile (Microsoft). There are other key players that do not supply mobile operating systems but still provide a platform for apps on mobile devices. One

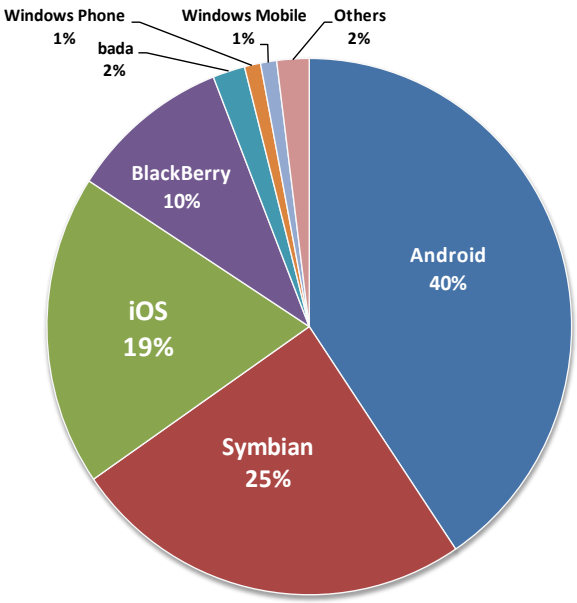
key example is Facebook which runs web apps in the context of Facebook, or Samsung which supports apps on its SmartTV platform.

Platform providers have a goal of attracting more users, developers and, in some cases, more handset manufacturers to the platform. The value of the platform increases along with the number of apps available, the number of users, and the variety of handset options for users. All the segments are interrelated as developers want to build for platforms with the most users and users are interested in platforms that have the most apps and attractive hardware options.

Android and Symbian have the largest current overall market shares but Symbian's market share is declining rapidly as iOS and Android surge. The competition for the largest market share in the near future will likely be between Android and iOS (Figure 11) but the situation is very fluid and could change rapidly.

Figure 11. Market share of operating systems

2012



Source: Based on IDC (2012), TomiAhonen Consulting Estimates August 15, 2012 from vendor data and other sources.

A central element in the app ecosystem is the **"app store"** – an online marketplace where users can download purchased or free apps to their devices. App stores are available across an increasingly broad range of platforms including mobile and desktop app stores (e.g. Apple, Google, Windows), social media sites (e.g. Facebook) and government-specific portals (e.g. Apps.gov). The attractiveness of an app store for users and developers may vary by its submission processes, the levels of certification/quality control it enforces over published apps, the flexibility given in pricing mechanisms as well as the promotion and revenue-generating capacity it provides to developers.

The app store itself marks a drastic change in the way software is sold and delivered. Rather than packing software and selling via retail channels, app stores make apps available for online download. In this way, the Internet has made the delivery of software much more economically and environmentally

attractive since it does away with packaged physical software. Apps still have a presence in retail channels but typically via gift cards that can be purchased with a pre-determined amount of credit on them for use online. Developers may still choose to make apps available from their own websites but the app stores are currently the most popular channels for distribution.

Platform operators collect revenues through a variety of channels. These include licensing the operating system to mobile manufacturers, monetising search services offered on the platform and increasingly via transaction fees associated with app downloads and in-app payments via app stores. The transactions fee model for app stores is explained in Box 2.

Box 2. Platform transaction fees

As a general rule for platforms, the price set for apps and services determines the amount of payment a developer receives. Platforms earn revenue by charging a transaction fee based on the sales price. A transaction fee is charged on the sales price and apportioned to the distribution partner for operating fees. The remainder (the sales price minus the transaction fee) is remitted to the developer.

The transaction fee is equivalent to **30%** of the application price. This percentage is the same for Android's Play Store, Apple's App Store and Amazon's AppStore.

With Android, developers are responsible for determining whether the app or service is taxable letting the payment processor know the appropriate rate for each taxing jurisdiction where the products are sold. It is the developer's responsibility to remit taxes to the appropriate authority.

In many cases, developers choose to make their products available for free on the platform. In these cases, the developers are not charged a transaction free but that also means that they will not be able to collect future charges from users for copies of the apps or services if they were originally downloaded for free.

Source: Developer distribution agreement, Android (2012).

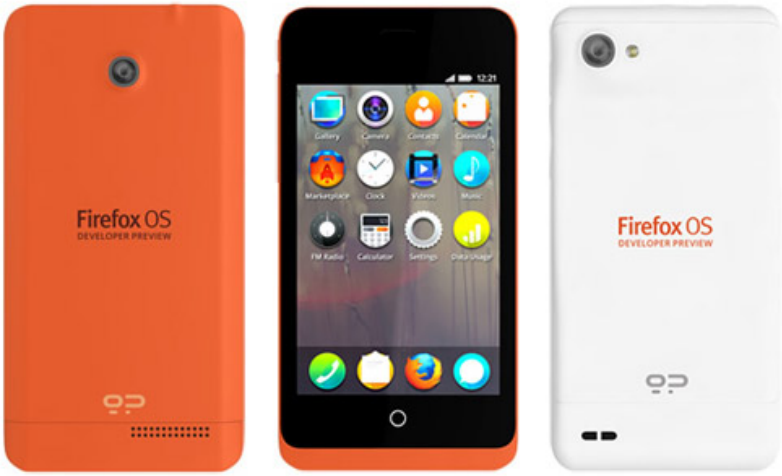
Google provides Android to handset manufacturers for free but monetises search services via advertisements and earns revenue from its Play Store for apps (and other digital content). Apple does not license its iOS operating system to other hardware manufacturers but earns revenue from advertisements tied to the platform and revenue from its app store. Finally, Microsoft licenses its mobile operating system to hardware manufacturers for a fee but also earns revenues from advertising and its app store.

New platform entrants

The mobile platform market is very dynamic and the market players at the top tend to shift often. This is likely due to the short replacement cycle for mobile phones where an average user in some OECD countries changes phones more than once every two years.[18] This rapid return to the market for updated mobile phones has created openings in the past for new platform providers to emerge and rapidly gain market share. Two significant new platform entrants, Ubuntu and Firefox, are positioning themselves to challenge the current platform leaders and take advantage of quick upgrade cycles (Figure 12).

Figure 12. New operating systems from Ubuntu and Firefox

Ubuntu OS



Firefox OS

Ubuntu for phones and tablets

Ubuntu is a free and open-source operating system for desktop computers based on the Debian Linux distribution and currently has 20 million users.[19] In 2013, Ubuntu announced the development of two new operating systems – one for smartphones and another for tablets. The operating system will run HTML5 or native Ubuntu apps and will be available for free for installation on phones. The operating system uses the same drivers as Android, meaning is compatible with some existing hardware. Ubuntu seems to be positioning their offerings as mobile operating systems that can also be used as a desktop computer. Mobile phones with dual core processors can be used as a mobile phone when unplugged but can also operate like a PC when they are plugged into a keyboard, mouse and monitor. This dual functionality could have significant impact on computing, particularly in developing countries.

Firefox OS

In February 2013, Mozilla previewed the first commercial version of a new mobile operating system, Firefox OS. The new operating system is built entirely upon open web standards such as HTML5 and CSS where every feature on the phone is developed as an HTML5 application.[20] One key difference

between other platforms and the Firefox OS is that Firefox OS will only run HTML5 applications and does not have "native" apps. The entire user interface of the OS is a web app that is capable of launching other web apps. Any modifications that are made to the user interface and any applications that are created to run on Firefox OS are web pages, albeit with enhanced access to the mobile device's hardware and services.[21] Mozilla makes the OS available for free and apps can be hosted and downloaded from any site on the Internet.

All other major operating systems support HTML5 but offer enhanced functionality to their own native apps via platform-specific APIs. With Firefox OS, HTML5 is the only app type that is supported. Developers may spend more time on HTML5 apps if Firefox OS gains market share, moving the market closer to the ultimate goal of writing an app once and using it everywhere.

Developers

Developers create the apps that underpin the entire app ecosystem. Platform providers court developers because there must be a critical mass of appealing apps for a platform to thrive. At the same time, developers want to build for platforms with the largest potential market as a way to maximise their reach and revenues.

Developers must take several items into account when making decisions about how to allocate scarce development resources. They consider the tools available for building apps on the platform and the potential of the platform for future growth. They must consider their clients (namely users) and select the platforms that best address their audience. Developers are also faced with questions about how they build the apps. For example, if they build their app with open web tools they can reach a larger audience, but the app may have less functionality than it would if it were built for a specific platform.

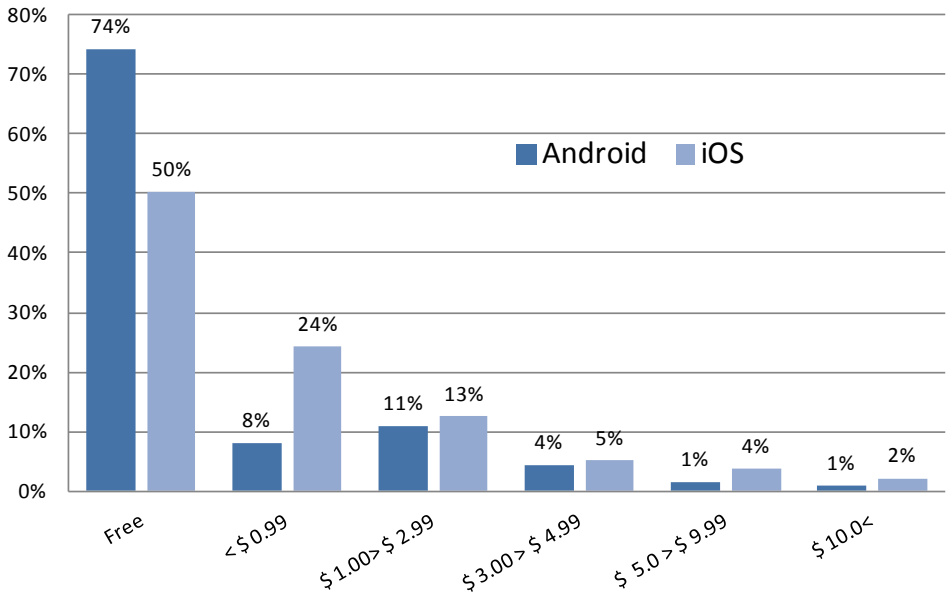
Another important driver for developers is revenue potential. There is a variety of revenue of models emerging in the mobile app economy. These include:

- Paid downloads - charging money for downloads of their apps
- In-app advertising
- In-app purchases (games, digital content)
- Freemium (free-to-premium) (e.g. Dropbox, RememberTheMilk)
- Promotion of non-digital goods (e.g. Nike, Comedy Central, restaurants, grocery stores)
- Resale of data collected via app use

Paid downloads

Developers can charge for their apps on any of the platforms and are paid the revenues from the sale minus a transaction fee that is typically 30% of the purchase price. The majority of apps are made available for free but the most common price point for paid apps is USD 0.99 and below for Apple's iOS and USD 1 to USD 2.99 on Android (see Figure 13).

Figure 13. Percentage of apps available by price per platform



Source: Based on Appbrain.com *Android market stats*. www.appbrain.com/stats/ (September, 2012), 148biz.com *App Store Metrics.* http://148apps.biz/app-store-metrics/?mpage=catcount (September 2012)

Pricing is one the main decisions developers will take into account for this category of apps. Interestingly among the restrictions established by Google Play is that while developers can change the price for an application, even after publishing it, they cannot change the pricing mechanisms for apps that were initially published as free. If the developer would want to begin charging for these apps, they would need to create a new app. Since the majority of apps in both the Android and iOS platforms are made available for free, the developers of these free apps do not receive payments for each download of the app.

In-app advertising

In-app advertising provides developers a way to monetise their apps, often leveraging existing ad networks managed by platform providers. The market for in-app advertising is large and growing. In 2011 the market was reported to be EUR 300 million and represented 16% of total app revenues. Forecasts predict that this in-app advertising market is expected to generate EUR 3.5 billion (29% of total app revenues) by 2015.[22]

The in-app advertising market is growing in importance, but one company (Admob) is the world's largest mobile advertising network and represents 33% of advertisement-based apps in the Android market. The second largest in-app advertising network (AirPush) is significantly smaller and represents 5% of advertisement-based apps and almost 3% of apps installed.[23]

These advertising networks are an important source of revenue for providers of free apps and appear to benefit from scale economies. Therefore, it is important for policy makers to keep an eye on developments and competitive issues related to mobile advertising firms and their market power.

At the same time, recent research by Bresnahan, Yin and Davis finds that nearly half of all free apps (43% for Android, 48% for Apple) do not rely on in-app advertising for revenues and use some other revenue model.[24]

In-app purchases

Another revenue source for developers is allowing users to make purchases within an app (which is commonly free to download). Examples include apps that allow you to unlock additional functionality such as city guide maps, weekly magazine subscriptions, or bonus game levels.[25] Developers receive the revenues from the in-app purchases minus a transaction fee of 30% from the platform operator. In the case of Android, the 30% fee applies to all purchases made through Google's billing platform on apps distributed in the Play Store. Amazon's App store app is not available in the Play Store and must be downloaded directly from Amazon's website because this allows Amazon to handle its own billing and retain the 30% transaction fee it applies to apps on its own platform.

The earnings from in-app purchases can be significant. NaturalMotion, the company behind the popular *CSR Racing* game, announced that it had exceeded USD 12 million in monthly revenue via in-app purchases where players can spend either earned or paid currency they buy in the game.[26] In-app purchases have also led to complaints from consumer groups, particularly when minors inadvertently make large purchases via freely downloaded games.[27]

Freemium (free-to-premium)

Another popular revenue model for developers is the "freemium" approach where users have access to a free version of an app with limited functionality or features but are given an option to upgrade to either a paid app or pay for upgraded functionality. One example is the to-do list "Remember the Milk". Their apps and web version are all available for free to end users but accounts can sync only once per day with a free account. The "pro" account allows unlimited syncing among all user devices. Dropbox also operates a freemium model where all users have access to 2GB of storage in their account – including access via the free mobile apps. Users can, however, pay for more storage space.

Both examples (Remember the Milk and Dropbox) direct users to their respective websites to pay for the upgrades, rather than routing payments via the platform providers as a way to avoid the 30% transaction fee levied by platform providers.

Subscription-based services can fall either into the "in-app purchases" or "freemium" categories and seem to work best when either the content needs regular updating (e.g. newspaper subscriptions) or is required for daily or regular use (e.g. e-mail). Some app providers have found success by convincing users that certain "free" services are worth paying for. An example of a successful marketing campaign using subscription-based models comes from Sparrow: *"Paying $5 for an email app might to some sound ludicrous, but paying $5 per month for the email app you use all day, every day doesn't sound nearly so bad."*[28]

Promotion of non-digital goods

Some apps do not rely on traditional app revenue models but rather promote other non-digital products. The OECD's own Factbook and iEconomy apps fall into this category. The apps are provided for free but serve as a way to promote other products, or in the OECD's case, data and research.

As Bresnahan, Yin and Davis highlight, the linkages between apps and non-mobile products remain very important to developers.[29] These links between apps and "off-line" goods and services can be a powerful way to promote products and services,

One sector that has developed strong ties between physical products and apps is the exercise/fitness market segment. Companies such as Nike, Fitbit and Jawbone sell physical fitness trackers

that interact with mobile apps. The app provides the user interface to data from the device. These apps are typically provided for free, but the revenue comes from the sales of the physical products.

Pay-per-lead apps also fall into the category of promoting non-digital goods. Tourism and phone directory apps are good examples of app revenue models that rely on leads to off-line services for revenues.

Resale of user data from apps

Data collected by apps on a mobile phone has the potential to be sold for a variety of purposes, including providing targeted advertising. The firms selling data may be telecommunication firms (e.g. Verizon: Precision Market Insights),[30] platform providers (e.g. Google's AdMob, Apple's iAd) or app developers themselves.[31]

There is a growing industry in assembling data collected from mobile phones into profiles of cellular mobile and smart phone users. Thurm and Yukari report that Mobclix, an advertising exchange, matches more than 25 advertising networks with some 15 000 apps seeking advertisers.[32] By tracking a phone's location, Mobclix also makes a "best guess" of where a person lives. Mobclix then matches that location with off-line spending and demographic data from Nielsen. This increases the effectiveness of mobile advertising and enhances the value of the information for users by making it locationally relevant.[33]

Developer decisions

App developers must select a revenue model they will employ for the apps they develop. VisionMobile[34] research claims that Apple's iOS provides the highest revenues per app (Figures 14, 15) but many developers are investing heavily in other platforms such as Android because of its rapid market-share growth.

Figure 14. Top revenue models for application developers

By % of respondents

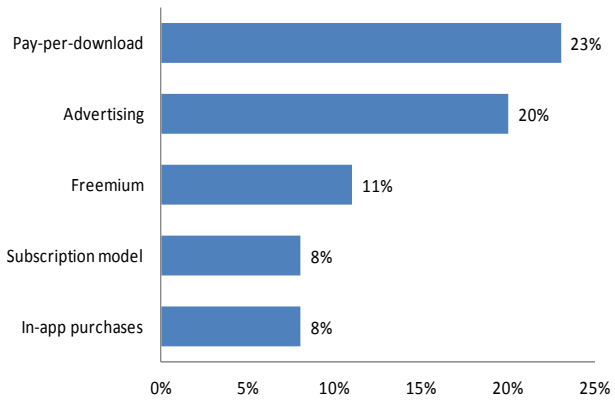
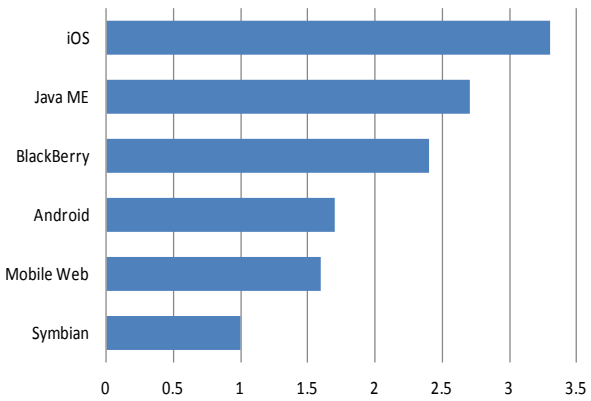


Figure 15. Per-app revenues reported by platform developers

Relative to Symbian



Source: Based on Vision Mobile, Developer Economics Report, June 2011. www.visionmobile.com/product/developer-economics-2012/.

The development of apps and the establishment of the preferred business/revenue-model must not only be lucrative for developers, but must also cover the 30% commission paid to the platform for transactions on both iOS and Android.

Another decision facing developers is whether they want to focus development on a single or small set of devices and languages or whether their apps need to be available to the widest range of devices and languages as possible (see Box 3).

Box 3. Costs of creating apps for diverse platforms

According to Deloitte's Technology, Media & Telecommunications predictions 2012, in the future, the global apps market will likely be characterised by the co-existence of multiple platforms, countries, languages, genres, manufacturers, file sizes and even model-specific application stores.

In order to reach more than 90% of all apps users, a developer may need to create versions for five different operating systems (plus HTML5), five major languages, three different processor speeds, and four different screen sizes. In other words, 360 variants of a single app may need to be created in order to fully cover the global market.

Each variant would count as a distinct app. As the feature and capability gap between high-end and entry-level smartphones is likely to grow, which will likely necessitate multiple versions of the same app optimized for different processor speeds.

Source: Deloitte. *Technology, Media & Telecommunications Predictions* 2012.
www.deloitte.com/assets/DcomAustralia/Local%20Assets/Documents/Industries/TMT/Deloitte_TMT_Predictions_2012.pdf

Consumers

Consumers and end-users drive the demand for new apps and services. Developers target consumers when they build their apps and platform providers attempt to create an eco-system that pulls together the hardware and apps in attractive packages at affordable price points.

Device manufacturers

Device manufacturers are often vertically integrated firms that produce both hardware and software. Apple, Samsung, RIM and Nokia (and to a lesser effect, Google with its Motorola division) are examples of firms that each build hardware but also have a software platform for smartphones. As mentioned earlier, Apple, RIM, Samsung and Nokia do not license their operating systems to run on other hardware. On the other hand, Nokia and Samsung build hardware that also uses other operating systems such as Android or Microsoft's software. Other device manufacturers such as LG and HTC use various operating systems.

Device manufacturers want to partner with platforms that will help boost sales of their devices. Choosing the wrong software platform can lead to a lack of apps to attract buyers and eventually disappointing sales. The relationships between device manufacturers and platform providers can be complicated when the software partner also produces hardware. With the introduction of smartphones, and in particular the iPhone, handset manufacturers were able to re-assert a strong position in the value chain relative to mobile carriers. [35]

Network operators

Network operators also play an important role in the ecosystem because they supply the networks that deliver and support apps. The entire system relies on networks with sufficient, reliable connectivity to function well and hardware manufacturers want to be available on as many networks as possible. Users increasingly rely on apps such as GPS navigation that may require continuous network connectivity to function effectively so platform providers, developers and device manufacturers benefit from the most reliable networks as possible.

Almost all apps request access to network connectivity (see the forthcoming section on app permissions) and this connectivity is viewed as an essential for innovation. Regulatory groups such as the Body of European Regulators of Electronic Communications (BEREC) have expressed concern about networks usage restrictions for certain categories of apps (such as VoIP and P2P) and their effects on the development of the app economy.[36]

It is worth pointing out that in certain countries, mobile devices built for one network operator (e.g. GSM) will not work on the networks of their competitors in the same market (e.g. CDMA-based networks). In other cases, the frequency bands across countries may not be harmonised. This means that hardware manufacturers may need to build different devices for different networks leading to higher switching costs for consumers and higher development costs to service an entire market.

EMERGING POLICY ISSUES

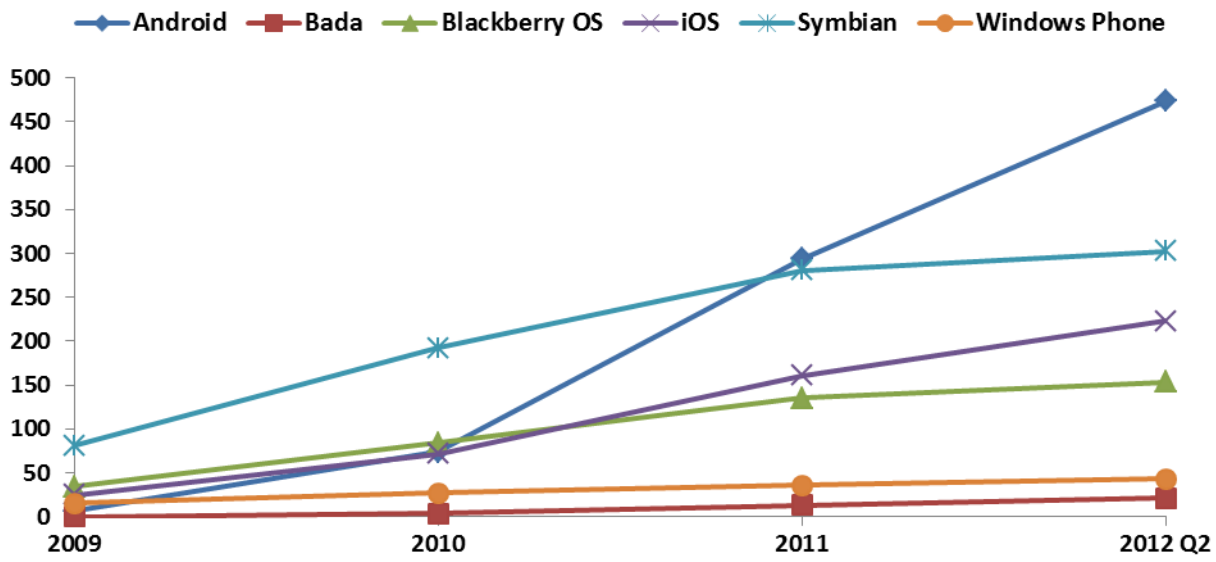
Competition

Market dominance and the importance of network effects

The app ecosystem is still in a rapid growth stage but competition authorities are already looking at potential emerging issues. The app economy is driven by the growth of smartphone and tablet use, and over the course of the past four years there have been drastic changes in market penetration among the major mobile platforms. For example, there has been a rapid decrease in the market share of the Symbian platform but impressive growth of the Android and iOS platforms and this has significantly altered the competitive landscape (Figure 16).

Figure 16. Devices sold per platform

(millions)



Source: Statista.com, 148appsbiz.com, appbrain.com, company profiles and press releases (2012).

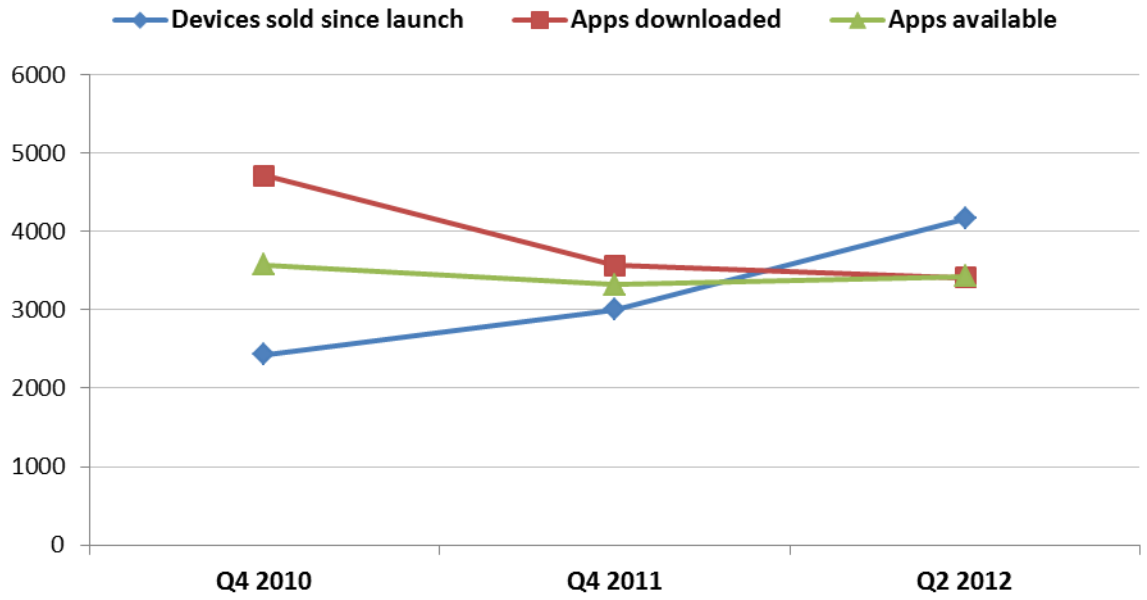
The ability of platforms to grow is partially determined by the number of apps they can offer. In this respect, Apple's iOS is the leader in the market with over 827 000 apps available,[37] followed closely by Android at 670 000.[38] Other platforms have been slow to gain market share, despite significant efforts to boost adoption and attract developers.

There has been debate about the potential market power of app platforms. It is clear that the market is evolving so rapidly that an analysis based solely on traditional measures of concentration risks may risk invoking regulation before the markets have had time to settle and potential market power has solidified.

Traditional measures imply that the mobile platform market, if defined as mobile phones running apps, is highly concentrated. This degree of concentration in the mobile platform market is visible by common measures such as the Hirfindahl-Hirschman Index (HHI, see endnote).[39] The index can be constructed using various measures of market shares, such as the number of apps per platform, the number of downloads from each platform or the number of devices sold per platform.

HHI indices based on different measures of market shares are very high and would typically indicate a very significant degree of concentration on the market for platforms (Figure 17). Interestingly, all the indices tend to oscillate in the same ranges of magnitude, between 3 500 and 4 000. This indicates a very high degree of concentration in the current market for platforms, irrespective of the measurement approach.

Figure 17. HHI concentration index in the app economy

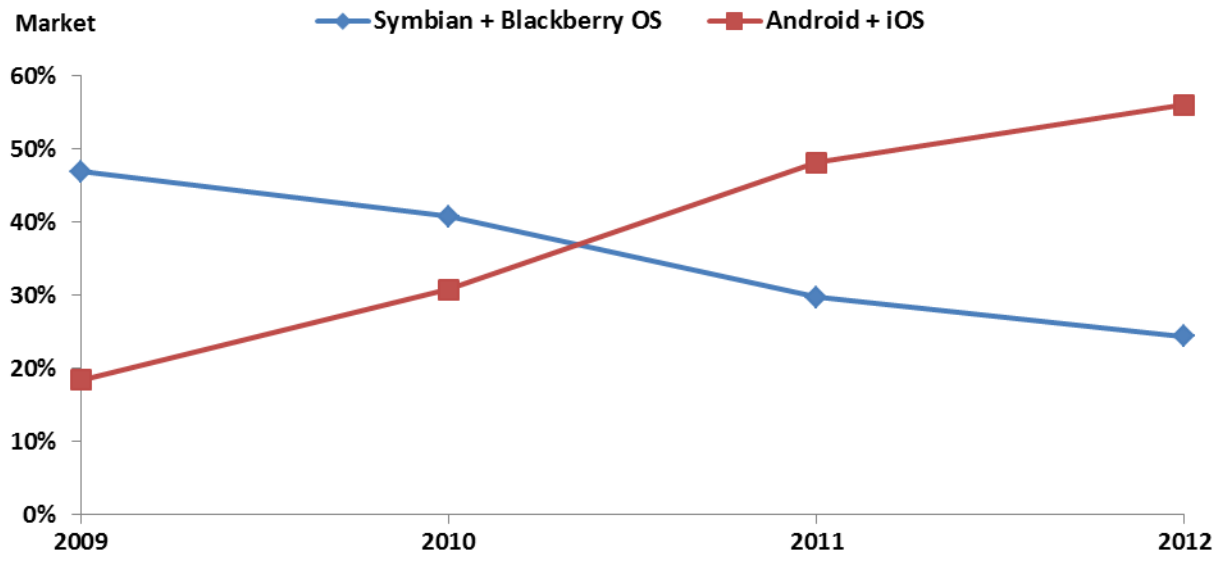


Source: 148appsbiz.com, appbrain.com, and company profiles (2012)

But any interpretation of concentration measures must be done with caution since the market is still developing and market shares have risen and fallen dramatically over a short period of time. In 2009, Symbian and Blackberry OS together accounted for 47% of all operating systems installed on mobile phones, while Android and iOS combined accounted for only 18%. In just two and a half years, the situation had fully reversed (see Figure 18).

Figure 18. The changing fortunes of mobile OS providers

Rapid changes in market share by number of devices sold since launch (2009-2012)



The mobile market is also poised to benefit from the introduction of two new mobile platforms: Firefox OS and Ubuntu. One of the reasons that the entry of these two new platforms could be significant

is that both are open source and Firefox OS is fully based on open web standards such as HTML5. In the past, the introduction of new platforms meant increased fragmentation for developers and fewer resources that could be allocated to one specific platform. But if the entry of Firefox and Ubuntu could instigate a shift of resources towards HTML5 standardisation and development, or hybrid HTML5/native solutions, then the number of available apps could dramatically increase across all platforms and strengthen competition as a whole.

Market penetration and power could also fluctuate with the introduction of a hugely popular app or service linked to one specific platform. The introduction of a "killer app" could further disrupt the market shares of platform operators.[40]

It is not just inter-platform competition that appears to be flourishing. There are also promising signs for intra-platform competition in relation to independent app stores, particularly for Android. Unaffiliated app stores are expanding the number of apps they offer either for free or as paid downloads. Examples include GetJar (150 000 apps),[41] Handango (140 000),[42] Opera Mobile (55 000),[43] and the Amazon AppStore (50 000).[44]

Amazon's AppStore is of particular interest because it offers paid apps that circumvent Google's Play Store and transaction fees completely. Amazon's AppStore app is not available in the Play Store (or it would be subject to the 30% transaction fee) and must be downloaded directly from Amazon. Once the app is installed on a device, users are able to buy apps directly from Amazon, with Amazon retaining a portion of the sale price as its own transaction fee. This is an important avenue to introduce price competition on apps, and promotions such as Amazon's "Paid app for free every day" campaign have helped bring users to the platform.

In many ways, app platforms resemble the divided technical leadership structure introduced by Bresnahan and Greenstein in 1999[45] [46] where there is no single vertically integrated firm with ultimate control over the direction of the platform. Instead, the direction of the platform is determined by the interconnectedness and jostling of firms, each specialising in different aspects of the ecosystem, that fit together to comprise the entire platform. Greenstein explains that competition between platforms determines prices in the market but it is the divided technical leadership within the platform that ultimately steers the development of the platform and determines the allocation of returns.[47] In such cases, any remedies targeting just one technical leader within the ecosystem may not have the desired effect.

At the beginning of 2013, Android and iOS still maintained commanding positions in terms of market share and available apps. But there is significant competitive potential on the horizon that warrants regulatory restraint related to market power or dominance in the platform segment of the mobile market.

App submissions

There are key differences between Google's and Apple's approach to allowing apps on a mobile device. Google's platform is an open system where any apps that developers build can be installed on devices. Apple's platform is considered to be a closed system where all apps that are available in its app store must be approved and accepted by Apple before users are able to install them on their phones. The only way to install non-approved apps on an iOS device is by gaining root access to the phone via a technical workaround, called "jailbreaking", but this can void the user's warranty with Apple and may leave the phone more vulnerable to security risks.

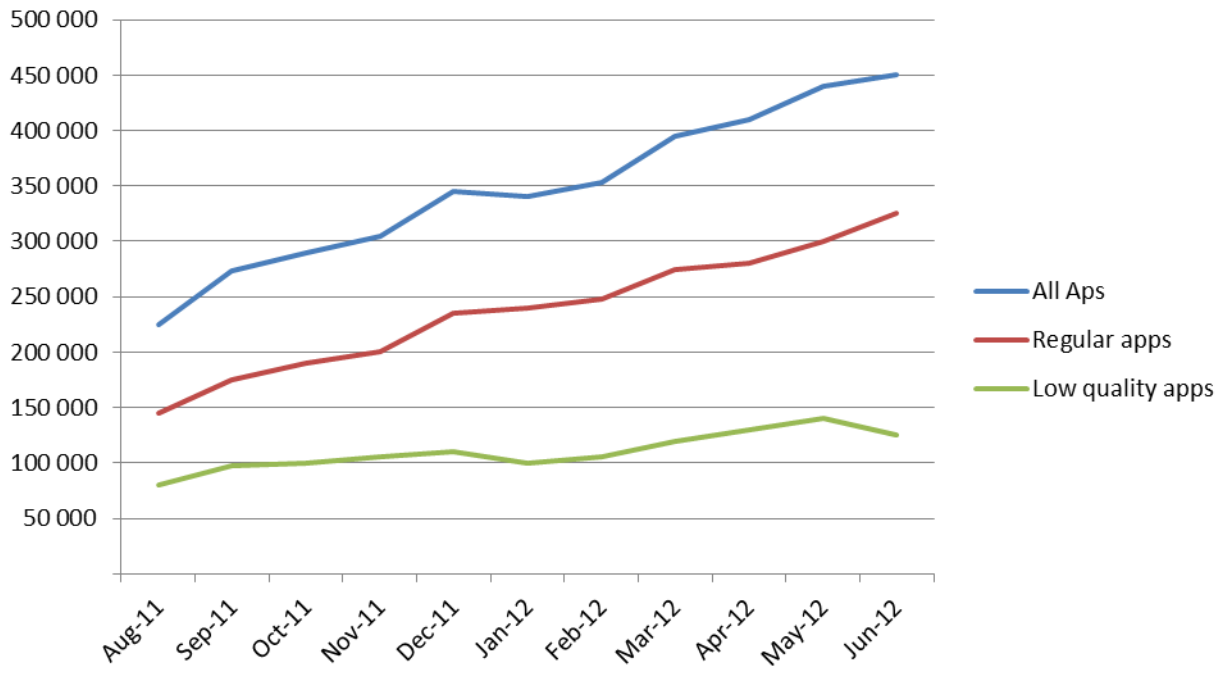
One area where policy makers should apply additional scrutiny to ensure market power is not excessive in less-competitive markets is the app submission process. Developers build an app for a specific platform and then submit it to be placed within the respective app store. The leading app stores

may be similar in terms of the apps they provide but have very different policies for the review and publication of apps from developers.

Android offers developers an automatic submission process which means that apps appear immediately in the store. This system allows developers to build their own apps and distribute them from their own website or from Google's Play Store. This can, however, lead to low-quality and even copyright-infringing apps being reported in the store. AppBrain predicted that as of June 2012, an average of 28% of apps in the Play Store were considered "low quality" (Figure 19). The Android approach favours openness but app downloaders bear more responsibility for ensuring that the apps are safe and secure.

Figure 19. Android apps available on the Android market, June 2012

Total number of apps



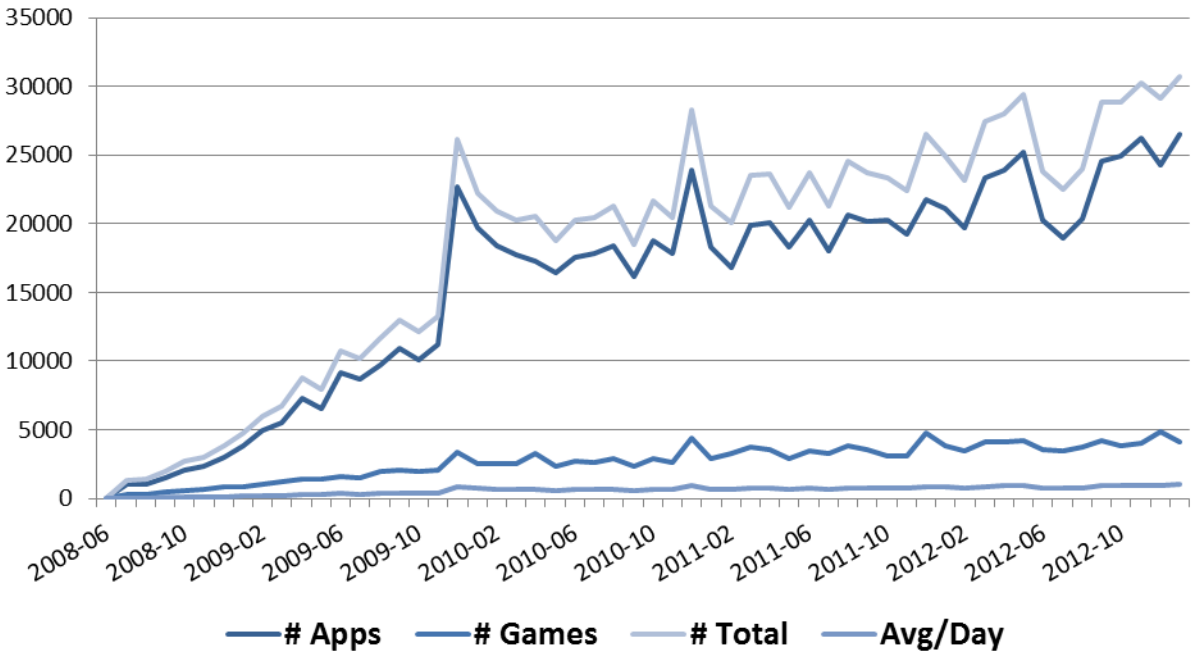
Note: Google occasionally removes apps from the Android market, which can cause the total number of available apps to decrease. AppBrain subdivides apps into regular and low quality ones.
Source: Based on AppBrain (2012). *Android market stats*. www.appbrain.com/stats/.

Apple takes a different approach and imposes strict quality control over the app submission process that can take several weeks for approval. This is beneficial to consumers who know that the apps in the store have a certain level of quality control. It is an effort to address quality and security concerns for apps in the app store and many users appreciate the filtering that Apple does. But the approach has come under criticism because it may not provide sufficient feedback to the developer as to why an app is rejected. Apple also reserves the right to change, suspend, remove or disable access to any app without any notice, as well as to impose limits on the use of or access to certain features or portions of the app services for any case and without notice or liability.[48]

The iOS platform received an average of 990 new app submissions per day in January 2013 to review (Figure 20).[49] To date, out of the total apps seen in the United States app store, 26%[50] of those are considered inactive apps meaning that that are no longer available for download because they have been

removed by Apple or the author. Other platforms such as Nokia's Ovi Store have placed strict approval criteria based on a country-by-country basis, which may delay time-to-market for developers.

Figure 20. iOS app submissions by month



Note: This page tracks the number of applications submitted per month to the iTunes App Store. This is determined by the application release date. While this can be changed by the developer before release, it usually isn't. Note that due to approval delay, the last few weeks may not be properly represented and are not displayed.
Source: Based on 148apps.biz (January 2013). http://148apps.biz/app-store-metrics/?mpage=catcount.

There is uncertainty surrounding the admission and publication process for iOS apps and, in order to provide more information, Apple has published the "App Store Review Guidelines 2012", where the company does advise developers about functionality, metadata, privacy, purchasing and content that may make an app subject for rejection. For example, Apple states that if the app does not do something useful or provide some form of lasting entertainment it may not be accepted. Apple also says that a certain level of skill and quality are demanded from the app and that they will reject apps for any content or behaviour they believe is "over the line", although that line is not defined. Apple informs developers that they have a review board that developers can appeal to if their app is rejected.[51]

Platforms that control the app submission process can sometimes be considered an instrument for anti-competitive behaviour in markets lacking sufficient inter-platform competition if they block certain apps that could compete with their own services. There is a delicate balance to find between ensuring that the apps on the platform are of high quality and free of malicious software, and the promotion of openness in the creation of apps. This balance becomes increasingly important if there are very few platforms represented in the mobile market. Apple has been criticised in the past for rejecting apps that appeared to compete with its own services and this led to letters of inquiry from regulators (see Box 4).

Box 4. Apple vs. Google's Voice Service

Google Voice is an app that adds certain calling features to phones. Google provides users with a distinct phone number and then redirects calls to other numbers of the user's choosing when calls arrive.

On 31 July 2009 the Federal Communications Commission (FCC) sent Apple, Google and AT&T letters of inquiry. The FCC's inquiry focused on potential anticompetitive behaviour relating to an application that Google submitted for approval to Apple's app store. Apple allegedly rejected Google's application and removed related third-party software that used the Google Voice service.

- The FCC wanted to understand the reasoning behind Apple's removal of the third-party software and the alleged rejection of the Google Voice Application.
- The FCC required Apple to disclose specific details as to why it rejected the Google Voice application while allowing other applications with virtually identical features.

The matter was eventually resolved and the Google Voice app is now available on Apple's App Store.

Source: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-1736A1.pdf.

The app submission process should be an area that policy makers follow in cases of limited inter-platform competition since an overly-restrictive process could supress innovation and entrepreneurship in the economy. At a minimum, if an app store rejects an app on their platform, the reasons should be communicated to developers in a clear and timely way that allows them to make modifications to the app and resubmit it for future consideration. Market efficiency could improve if closed platform providers were more transparent in their app approval processes.

Irrespective of whether the platform is open or closed, attention should be drawn towards platforms that gain dominance through encouraging innovation and then later use that position to block or restrict services that could be a threat to their dominance. Discrimination of this nature should attract the attention of competition law authorities.

Competition authorities should also take notice if the platform starts shutting out existing or new developers. This can happen if the platform provider integrates downstream (through acquisition, or redesign) or if they disable access for downstream companies that were previously partners or developers but now could be considered rivals. This should be cause for careful review (see Box 5).

Box 5. Competitive effects of Twitter's vertical integration

Twitter's application programming interface (API) allows outside developers to build apps that can pull in information directly from Twitter to display in their own apps. The availability and openness of proprietary API's has been instrumental for the rapid expansion of apps and the growth of platforms such as Twitter.

Twitter has been pursuing a vertical integration strategy by acquiring and building a portfolio of apps. The company purchased apps such as TweetDeck (2011), Tweetie (2010) and Summize (2008) to later transform them in brand extensions that serve different platforms and services, e.g. search engines.

The result of this integration is that Twitter wants developers to start building apps that use Twitter, rather than Twitter apps. Twitter has been discouraging developers from using their APIs to make apps that compete directly with their platform, by rejecting apps that rely on tweet feeds via its API or by revoking API access. The risk of such an approach for Twitter or other growing platforms is that the uncertainty of future access to the API will stifle investment and innovation.

In August 2012, Twitter restricted the number of individual user tokens for an app that could access their APIs to 100 000. This essentially means that app developers are limited to 100 000 app installs on users' devices without special permission from Twitter to increase the number. Some developers were forced to require all members to re-login to free up unused keys for new users.

Source: CNET News[52], Mashable[53], Twitter[54], Yahoo News[55]

Competition authorities can expect to confront questions about the competitive implications of vertical integration and interoperability/access denials by platform owners. But markets may be able to adapt on their own if there is sufficient inter-platform competition and if it becomes significantly easier to write applications across platforms.

However, the risk of over-enforcement or under-enforcement in this sector is also an issue that competition authorities will need to consider. Over-enforcement creates a danger of destroying legitimate products, discouraging innovation and damaging the reputation of the competition authority. Yet, under-enforcement will also create a risk of diminishing innovation if monopolies become entrenched and are permitted to delay investment and block new entry. Authorities must develop technical expertise and understanding of this new digital economy.[56]

The app economy is in its initial phases of development, despite its rapid growth, and could benefit from the establishment of clear rules. If governments start regulating right away, the risks of discouraging innovation and growth are high. This may be harmful for individual developers and the industry as a whole. Governments should encourage a self-regulatory approach from platforms and major stakeholders, raise issues that are of governmental and consumer concern, enable stakeholders to establish their own industry standards, and benchmark best practices. At the same time, governments should be aware of the competitive risks associated with self-regulatory schemes and consider safeguards that could be implemented to reduce these risks. The government's role in the app economy should be one of an enabler, but one that requires clear ground rules and transparency.

Consumer lock-in

Consumers also benefit from competitive markets when they can "vote with their feet" by quickly switching among services. Anything that hinders switching among platforms can create consumer lock-in and increase the market power of platforms. In the app economy, consumers face platform "stickiness" and lock-in from investments in both hardware and software. Investments on the hardware side are significant, with smartphones ranging between USD 70 and USD 700 or more. The replacement

cycle varies across OECD countries but consumers typically buy new telephones roughly every 2 to 4 years.[57] Hardware is, for the most part, tied to an operating system or platform. Users typically can only switch between mobile platforms by buying a new handset or device.

There are also other, significant investments in accessories built for hardware that can raise the switching costs from one platform to another for end users. Switching platforms often means buying entirely new accessories such as cables and chargers. Much of the industry is moving towards standardised chargers and cables for both economic and ecological reasons. The International Telecommunication Union has a recommendation (ITU-T L.1000) for a "Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices" that is aimed at reducing electronic waste by enabling users to re-use chargers with multiple devices.[58] The ability to reuse existing chargers, cables and accessories also reduces the switching costs that could strengthen the lock of consumers into a given app platform.

Many device manufacturers appear to be shifting towards using standardised connectors such as Micro USB for devices, which would allow accessories to be re-used with other devices, thus reducing switching costs across platforms, Apple, on the other hand, has used a proprietary adapter on its portable devices since its launch and introduced a new range of devices in November 2012 with a connector that will not work with older Apple products or with devices from other manufacturers without an adapter (see Figure 21). Incompatibilities across accessories could become a consideration for switching platforms.

Figure 21. Device connectors and consumer stickiness to platforms

Apple	Apple	Generic	
Lightning to 30pin	Lightning to MicroUSB	Mini USB	Micro USB

Note:
(Left, middle) : Apple's new Lightning connector requires an adapter to interface with the previous 30-pin connector (USD 29, left picture) or to micro USB (USD 19, middle).
(Right): Many mobile hardware manufacturers are choosing to use Micro USB as a standard for charging and connecting devices.
Source: www.apple.com/ipad/accessories/.

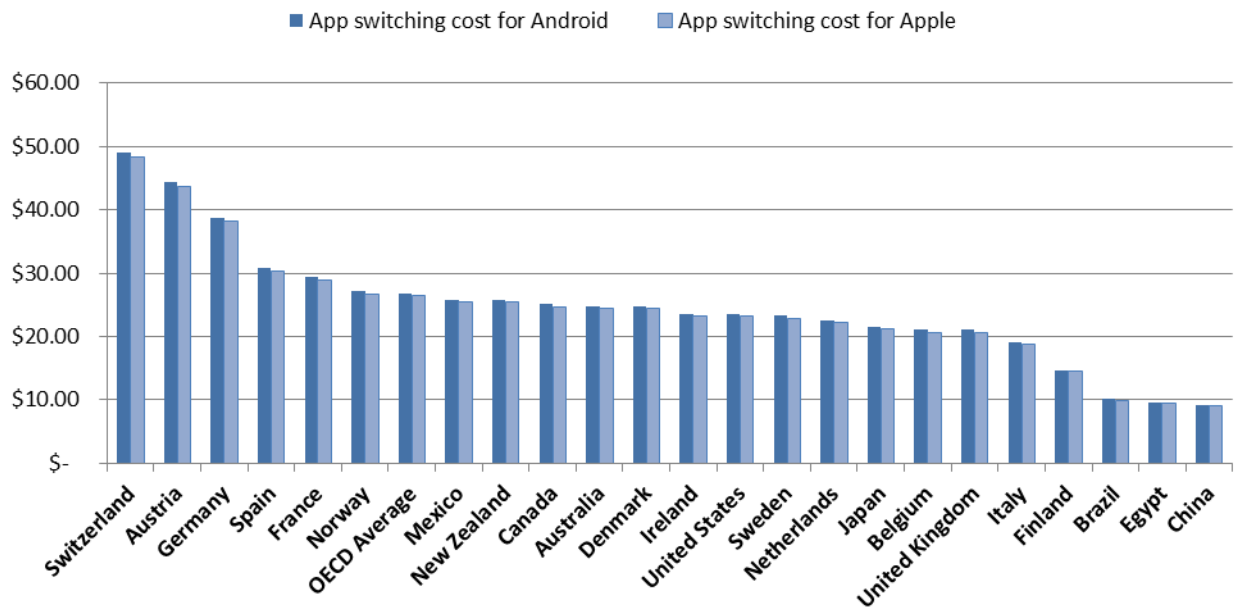
Software can also represent a significant investment for users and while many apps are available for free, there can also be considerable investment in paid software that is tied to a specific platform. As Figure 13 previously showed, most paid apps are at the lower end of the price scale. The estimated average price across paid apps is similar in Android (USD 2.53) and iOS (USD 2.49) using what limited public data is available.

An analysis of the average value of paid apps on Android devices across countries shows that investments in paid apps could lead to consumer stickiness when it comes to switching platforms (Figure 22). Swiss users have an average of nearly USD 50 of paid apps on their phones. The OECD average is

estimated to be roughly USD 26 and these investments would be lost when switching platforms. It is important to highlight though that these sums are a relatively small percentage of the overall purchase price of many smartphones which are replaced regularly.

Figure 22. App switching costs by platform

OECD countries, 2012, USD



Notes: Data on the average number of apps on Apple's iOS platform was not available so the average number of paid Android apps was used with iOS prices to compute the Apple component.
Source: Think with Google survey, Our mobile planet (2012) www.thinkwithgoogle.com/mobileplanet/en/downloads/.

Finally, consumer stickiness to a specific platform will also be highly influenced by the amount of digital content that has been purchased on the platform and locked by digital rights management (DRM). Music purchases are commonly free of DRM restrictions and can played on nearly any device, regardless of platform. Downloaded video content, however, is almost always tied to one platform and cannot be viewed on others. This can significantly raise switching costs if users have invested large amounts in purchased digital content if it will not be available on the new platform. Interestingly, the investment in digital content can be significantly larger than the investment in apps for the platform. According to Goldman Sachs, the explicit switching cost (to replace music, apps, etc.) comes to an average of USD 122 to USD 301 per iOS device.[59]

One key policy area is encouraging the portability of digital content that has been legally purchased among devices of users among members of their household and across platforms. Initiatives such as Ultraviolet (www.uvvu.com) that include digital copies with the purchase of physical disks are a step in the right direction but are limited to the purchase of physical disks and the number of titles are limited. Their slow start and lack of available titles mean that users are still buying content that is locked to a certain operating system or platform.

Platform providers have an incentive to work towards portability for digital content with all relevant parties, including rights holders, because if switching costs between app platforms resulting from

large digital library investments are deemed to be too high, competition authorities may need to intervene to protect platform competition. They could even consider the role of digital rights management in hampering competition in this increasingly important area of the economy.

Interoperability

Promoting interoperability has long been a goal of policy makers because it reduces switching costs in the market. It can also provide a larger addressable market to attract businesses (e.g. developers). At the same time, interoperability may reduce the speed of innovation in the market, particularly if developers must wait for standards to be decided before they can introduce new features.

Interoperability would be maximised in markets where apps were built upon open standards and where users and content owners could move between different service and platform providers. The success of the Internet itself has been inextricably tied to its open, interoperable and global architecture. This has lowered the barriers for innovation and empowered the edges of the network in ways that were not possible before on previous networks.

Policy makers have an incentive to try and replicate the success of the Internet model in other areas, such as mobile ecosystems. Therefore, governments should pay particular attention to developments in the area of apps built using open web standards such as HTML5 since this could make app development across platforms much more cost-efficient and reduce barriers for innovation at the edges of the network. Walled garden approaches and consumer lock-in could have the opposite effect of hampering innovation and competition but could also be sources of more rapid innovation in the market.

Consumer protection and privacy

Consumer benefits and challenges in relation to the purchase of digital content products, including apps, are being considered by the OECD's Committee on Consumer Policy within the context of its review of the OECD's 1999 *Guidelines for Consumer Protection in the Context of Electronic Commerce*. The committee has a background report in this area, on the basis of which policy guidance will be developed.[60] Key consumer challenges identified under the project include: *i*) contract clarity; *ii*) the complexity of the legal landscapes; *iii*) product access and quality; *iv*) unauthorised charges; *v*) misleading or unfair commercial practices; *vii*) privacy; *viii*) digital competence; and *ix)* dispute resolution and redress issues. The following section focuses on some of these challenges.

Permissions

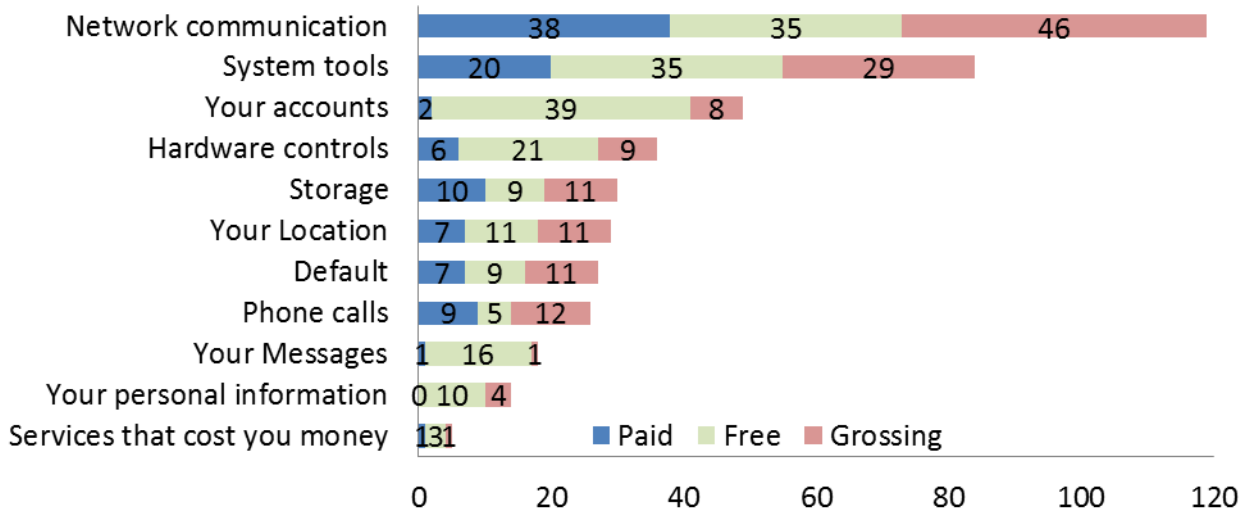
Apps require access to operating system resources in order to function. The type of access to resources that apps need depends on the services that the app provides. For example, navigation apps require access to the GPS functionality of the device in order to provide accurate location information. Apps from news providers require Internet access to update news feeds within the app. However, there are concerns that many apps seem to request more permissions than what is strictly necessary for the app to function. This section examines the permissions requested by 36 top apps from the following three categories (Paid, Free, and Top grossing[61]) in the Google Play Store as a way to understand which permissions apps are requesting and to evaluate if certain applications are requesting more permissions than necessary. The 36 reviewed apps (12 in each category) requested a total of 437 permissions, or an average of just over 12 permissions per app. A list of the permissions is provided in the annex.

Apple does not make information about the permissions requested by apps available to users in a detailed manner. Android, on the other hand, provides a significant amount of detail on the permissions that apps request and this allows researchers to analyse which apps are requesting which permissions. The

following analysis is therefore limited to Android apps but the findings could be generalised across the app ecosystem.

The permission category with the most requests was *Network Communication* with a total of 119 permissions required, representing 27% of the total requests (Figure 23). The category includes specific permissions for full Internet access (28% of apps), access to view the user's network (26%) and Wi-Fi state (16%), and receive data from the Internet (16%). In contrast, the permissions category with the fewest number of requests was *Services that cost you money*, (*e.g.* to be able to directly call phone numbers or send SMS messages), with just 5 permission requests.

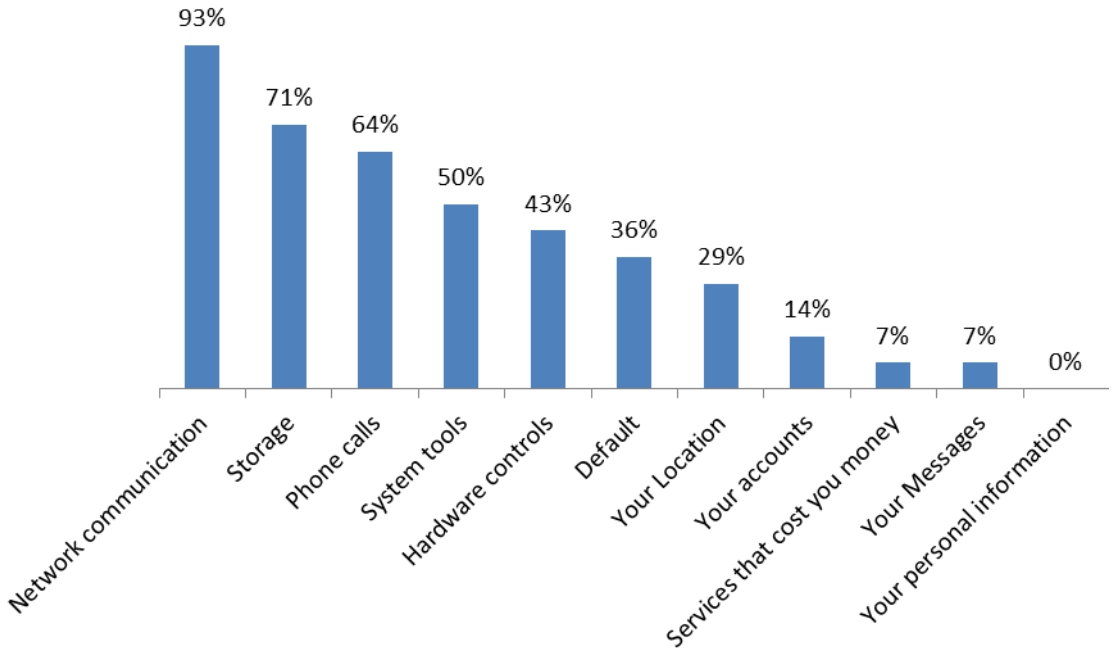
Figure 23. Number of permissions by type requested on Android's top-rated apps



Source: OECD based on data from Android Market (September 2012).

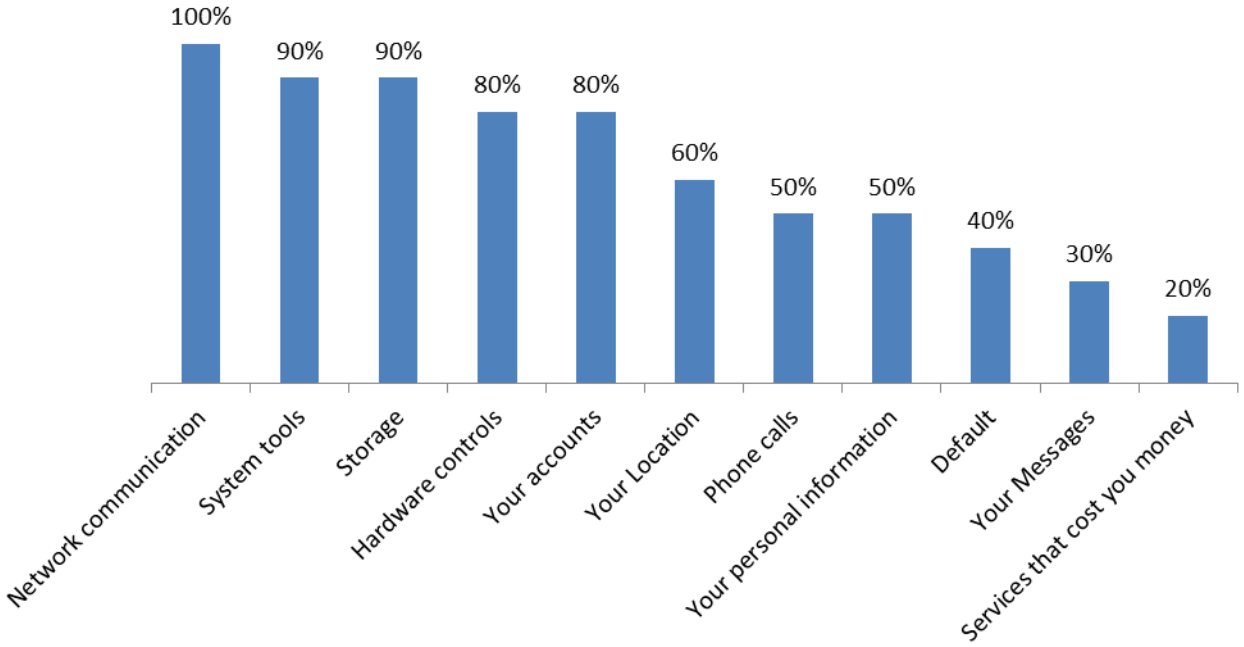
Paid and free apps request very different types of permissions within this sample. Among the top rated *paid* apps, the most permission requests were for network communication, storage, phone calls and system tools (Figure 24). The percentages of apps asking for location information, information on accounts, messages or personal information were all below 20%. Interestingly, none of the top-rated paid apps asked for permissions within the category of personal information.[62] While this may reflect the specific functionality of the apps in the category at that time, it is likely also because the revenue models of these apps rely, at least partially, on payments for the app itself and not on targeted advertising or in-app purchases.

Figure 24. Number of permissions requested by Android's top-rated paid apps



Source: OECD based on data from Play Market (September, 2012).

Figure 25. Number of permissions requested by Android's top-rated free apps



Source: OECD based on data from Android Market (September, 2012).

The types and number of permissions requested by *free* apps are generally different from those requested by *paid* apps in this sample. Figure 25 suggests that top-rated *free* apps are more likely to request permissions in all categories except for one, phone calls. All the apps surveyed in the category of top-rated free apps requested network communication. One of the key differences between paid and free apps is that free apps in the sample are much more likely to ask for permissions to see account information, location information, personal information and messages. Not one of the top paid apps requested the category "personal information", yet half of the free apps did. The differences between permission requests in the free and paid categories may stem from a variety of factors, but they likely reflect that one of the business models where free apps earn revenues from advertising relies on information about the user. The data suggest that there is a trade-off for users of free apps; users provide access to personal information and data in exchange for using free apps.

It is unclear what permissions are actually necessary for apps to work effectively because permission requests can vary significantly for similar apps. For example, Facebook requires a total of 19 requests, as opposed to Google+ which requires a total of 44. In the Arcade and Action category, games such as Bahamut asks for 17 permissions as opposed Minecraft - Pocket Edition which only makes 3 permission requests.

The Android platform has also been studied at the University of Berkeley to see which permissions are requested by Android applications and whether developers follow the principle of "least privilege" – only requesting what is necessary for the app to function – when they build their apps. The static analysis tool and permission map called "Stowaway" for identifying permission use in Android applications was used to evaluate 940 apps in the Android market and determined that about one-third are over privileged.[63] Users seem to increasingly understand that free apps are based on advertising and that these ads are worth more when they are matched with certain information about the user's preferences and tastes. Smartphone data can offer a wealth of accurate information about users related to their location, and their smartphone usage habits. However, there are concerns that consumers are not aware of the data that is being collected by apps and mobile platforms and how it is being used.

The concerns are most pronounced in situations where data is obtained without the user's permission or when the user is unaware of the permissions they have granted. Tools to help users understand how data are collected and transmitted have appeared on Apple's App Store, for example, but then were later removed (Box 6).

Box 6. Reporting on how smartphone data is used: Clueful app

In May 2012, the company Bitdefender launched an app called Clueful on the Apple App Store that evaluated how apps on the iOS platform were collecting data such as personal information, storing it, and then sending it over the Internet. They analysed and built up a database of how data was being treated by over 65 000 apps.

Bitdefender claimed that 42.5% of the analysed apps collect personal data without encrypting it and 41.4% track the user's location without obtaining permission to do so. In addition, 18.6% of the analysed software could access all contact details in the user's address book without the owner's knowledge.

The app was removed from the Apple App Store without explanation in June 2012 but Bitdefender launched a web version that users can visit for access to the compiled database.

Sources: :
Phonearena (2012). www.phonearena.com/news/40-of-iOS-apps-invade-your-privacy-without-permission-reveals-app-before-getting-pulled_id32483.
http://techcrunch.com/2012/08/27/bitdefender-clueful-returns/.

Where the data which is being accessed by the app constitutes personal data, the use of this information may also have implications for the user's privacy. The *OECD Privacy Framework*[64] defines personal data as "any information relating to an identified or identifiable individual (data subject)". Given the highly personal nature of most mobile devices, much of the data which is stored on these devices (e.g. contact information, calendars, pictures etc.) may be considered personal data. The transparency issues described in the previous paragraphs are at odds with several of the core principles of the privacy guidelines, such as the purpose specification principle and the openness principle. These principles imply that individuals should be provided with meaningful information regarding the data being collected as well as how it is being used, or that, at a minimum, the means to obtain such additional information should be readily available.

Google and Apple take different approaches to granting apps permission to certain resources on the platform. Google's Android has a total of 134 permissions (functionality) that an app can request. When a user downloads an Android app, the platform provides the user with a list of the permissions that the app is requesting. The user has an opportunity to either agree to grant the app the requested permissions to access the system resources and information or abort the installation process. With Android, the user has access to information on the permissions requested by the app but must either accept them all or not install the app. Very often, the user will not be provided with any information regarding the use of data retrieved through these permissions. They may therefore not understand why the permissions are being asked for or what will be done with their data once it has been accessed. There is generally little or no information concerning whether data are sold to other third parties (e.g. advertisers), whether they are used for data mining or if they are retained and then deleted by the developer.

Apple does not provide its users with information on the types of permissions that apps request. It does, however, allow users to block access to certain functionalities such as location information, on an app-by-app basis (see Box 7). Before the launch of iOS6, the control that users had over functionality was limited to blocking access to location information. Now, users can set permissions at a more granular level for items such as access to contact information, photos, the calendar or reminders. Now iOS7 notifies users if an app is requesting access to the microphone.

Box 7. About Apple's iOS6

The introduction of Apple's mobile operating system (iOS6) required developers to explicitly ask users for permission before an application could access certain types of information, according to the "Data Privacy" section of Apple's iOS 6 release notes.

Under the requirements, developers must take into account that a user may refuse to grant permission to access personal data, and ensure the app continues working under that scenario.

The rules specify that explicit permission is required before an app can access a user's phone contact list, calendars, reminders and photos. When the app attempts to reach any of these data types, the user will be prompted with an access dialog to grant or deny permissions. Previously, apps needed to obtain explicit consent only for the phone's geo-locational data. iOS7 now requires an app to receive explicit consent from the user in order to access the microphone.

Source: "Data Privacy" section of Apple's iOS 6 release notes. Apple (2012).
http://developer.apple.com/library/ios/#releasenotes/General/RN-iOSSDK-6_0/_index.html.

As apps become an increasingly important source of information and service delivery, it is important that users feel confident to use these apps with respect to the privacy of their personal information. A study on Privacy and Data Management on Mobile Devices done by the Pew Internet and American Life Project found that 54% of app users have decided not to install an app when they

discovered how much personal information they would need to share in order to use it.[65] A total of 57% of app users reported either uninstalling an app over concerns about having to share their personal information, or declined to install an app for similar reasons. They also found that 30% of users have uninstalled an app that was already on their phones because they learned it was collecting personal information that they did not wish to share. Finally, the study also found that users on Android and iOS devices are equally likely to delete or entirely avoid apps due to concerns over their personal information.

It is not enough for platforms or developers to display the kind of permissions required for a certain app; those permissions must be justified in the eye of the consumer and explain why developers need this tool. For example, users may ask why does an app like Sims Free Play require GPS location, the ability to read the phone state and to identify it. Or why would a transportation app, such as iCoyote Europe require permissions to directly call phone numbers, send SMS messages and modify Global System Settings?

These questions must be addressed in order to promote the growth of the app economy, making it not only attractive to developers and advertisers to reach a highly connected market, but also guaranteeing consumer privacy and protection of personal data (see Box 8). If platform providers, developers and other stakeholders fail to take action in the issues highlighted above governments have to step in and regulate, limiting the innovation potential the app market has in delivering products and services everywhere and in any device.

Box 8. Government's setting privacy guidance for app developers

Some OECD governments have recently taken steps to engage with app developers to improve privacy considerations.

Canada

The Office of the Privacy Commissioner of Canada recently launched a guidance document in October 2012 entitled, "Seizing Opportunity: Good Privacy Practices for Developing Mobile Apps". The document provides guidance to developers on items such as turning privacy into a competitive advantage, and how Canadian privacy law applies to app developers. It also includes five key privacy considerations for developing mobile apps:

1. You are accountable for your conduct and your code.
2. Be open and transparent about your privacy practices.
3. Collect and keep only what your app needs to function, and secure it.
4. Obtaining meaningful consent despite the small screen challenge.
5. Timing of user notice and consent is critical.

United States

The National Telecommunications and Information Administration of the United States Department of Commerce convened a series of meetings using a multistakeholder process to look at mobile app transparency in relationship to privacy. The goal of the first process is to develop a code of conduct to provide transparency in how companies providing applications and interactive services for mobile devices handle personal data.

European Union

The EU's Article 29 Working Party has released an opinion on privacy for apps on smart devices. The opinion clarifies the legal framework applicable to the processing of personal data in the development, distribution and usage of apps on smart devices, with a focus on the consent requirement, the principles of purpose limitation and data minimisation, the need to take adequate security measures, the obligation to correctly inform end users, their rights, reasonable retention periods and specifically, fair processing of data collected from and about children.

Sources:
Office of the Privacy Commissioner of Canada. "Seizing Opportunity: Good Privacy Practices for Developing Mobile Apps" (October 2012). www.priv.gc.ca/information/pub/gd_app_201210_e.asp
The United States, Privacy Multistakeholder Process: Mobile Application Transparency.
www.ntia.doc.gov/other-publication/2013/privacy-multistakeholder-process-mobile-application-transparency
Art. 29 Working Party: http://ec.europa.eu/justice/data-protection/article-29/documentation/opinion-recommendation/files/2013/wp202_en.pdf

Lack of transparency in app rankings

Previous antitrust inquiries have highlighted that the ranking within search results can have a significant impact on the success of firms whose services or sites are being ranked.[66] App portals are the main entry point for app downloads and app discovery (learning about new apps) so as the main distribution channels for software, they are receiving additional scrutiny in the way that apps are ranked on their pages. It is increasingly important that rankings and end-user participation in reviews reflect the

actual products and services offered, particularly if governments favour a self-regulatory approach to app ecosystems.

The rankings are important because an FCC study in the United States finds that a consumer's willingness to pay is greater for top-ranking apps than for unranked apps. The study also finds that the effects of having a "bestseller status" for an app declines steeply as the rank falls but that the differences are still significant between ranked and non-ranked apps for the first 50 apps within the top 100 list.[67]

A working paper by Yin, Davis and Muzyrya also finds that there is a significant and positive relationship between having a previous top 300 ranked app in any category (free, paid, gross revenues) and having another top 300-ranked app.[68]

Ranking apps is a complex activity as platforms have multiple timeframes and categories to consider. Furthermore, platforms want to be able to display not just the top apps of all time but also those that are currently rising in popularity and other criteria as a way to signal interesting apps to users. Currently, the ranking processes and methodologies used to rank apps are not transparent on any major platform.

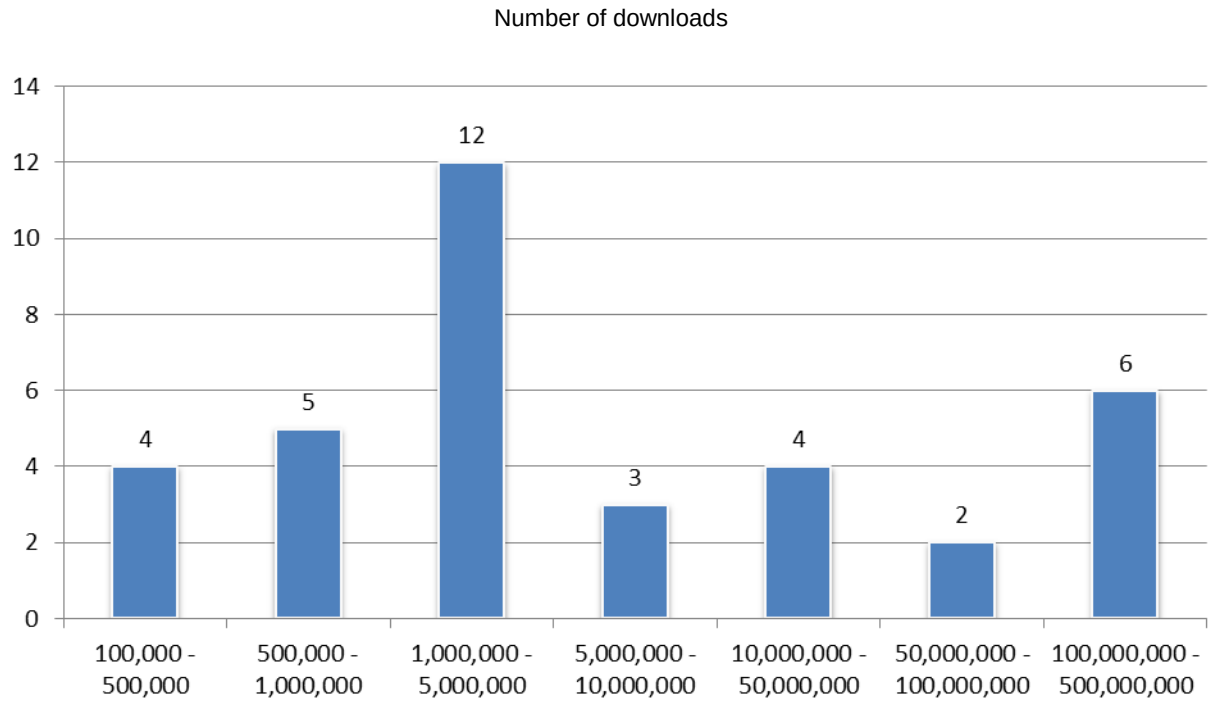
Apple displays the links to the most downloaded apps by category and allows consumers to search for apps by name. The sales rankings for Apple are computed separately for each of the more than 60 country stores, as preferences vary across countries. There is no additional information, however, on the number of apps downloaded in each category, nor is there a published methodology on how the list of the 100 most downloaded apps is calculated. The FCC study highlights that mobile advertisers seem to agree that Apple's rankings are based on unit sales and that Apple uses a 24-hour window to compute download ranks.

Google's Play Store also displays apps in a variety of categories and with various rankings based on groupings such as top paid, top free, top grossing, top new free and top new grossing. There is a limited amount of information available on Google's page that discusses "visibility for your apps" on its developer site. The page states:

"Your app's rating is one of the most important factors influencing its ranking in the various lists and search results in Google Play. It's also one of the key signals that the editorial staff looks for, when curating apps and games for promotion in the store."[69]

No further information is provided regarding how Google selects which apps appear at the top of categories or search lists. An examination of 36 apps showing up in the top rankings of Android Market in September 2012 shows that the number of downloads alone is not a good predictor of an app appearing in the top of categories (Figure 26). In Google Play's top-rated apps, 33% of the apps were installed between 1-5 million times (e.g. Beautiful Widgets), followed by 17% of apps being installed between 100-500 million times (e.g. Google Maps and Facebook). The third position is occupied by apps that have been installed from 5 hundred-thousand to 1 million times.

Figure 26. Top apps in the Android Market



Source: OECD based on data from Android Market (September 2012).

The average rating given to top-rated apps was 4.4, however the number of users rating the app can vary significantly among the apps, from just over 3 900 ratings for iCoyote Europe to over 4.8 million ratings for Facebook. In the Android market, roughly 5% of apps have been ranked as a 4.5+ star by more than 50 000 users. Information on downloads is not available from Apple so a similar type of analysis is not possible for iOS.

App developers use various methods to try and increase the visibility of their rankings on both platforms but Apple does state in its terms of service that if developers attempt to cheat the system (for example, by trying to trick the review process, steal data form users, copy another developer's work, or manipulate the ratings) their apps will be removed from the store and the developer would be expelled from the programme, which is the only accepted method for installing apps on iOS devices.

The lack of transparency as to how apps are being ranked in the major platforms, either by unit sales/downloads, ratings, advertisement bidding or other criteria, may lead to complaints of unfair treatment that will only be exacerbated if platforms become larger and the market consolidates. Policy makers should consider measures that encourage app stores to make the ranking process more transparent voluntarily in order to reduce the need for future regulation in this area.

In-app purchases

An important revenue source for developers is charging users to make purchases from within an app for items such as guide maps and subscriptions to periodicals. One of the most lucrative uses of in-app purchases has been allowing users to buy points or upgrades within gaming apps. While these apps have been welcomed by consumers and some are extremely popular, they have also been the subject of scrutiny in cases where children have been able to download apps and make substantial purchases without the

consent of their parents or when adults do it unknowingly. The in-app purchases model has also raised the attention to the lack of awareness and understanding adult users may have in using these types of apps.

Several app platforms have taken steps to address these issues. Apple, for example, responded to an inquiry by the US Federal Trade Commission about in-app purchases made by children[70] by introducing changes to their operating system that required users to resubmit a password when making in-app purchases after a 15 minute delay from the last authentication if parental settings were not configured on the device.[71]

The Google, Apple and Amazon app platforms now each have a way to enable parental controls. For iOS, the settings are managed in the device while Amazon and Google each have parental settings that can be configured in the respective app store settings. Despite these changes, there are still cases where users make unwanted purchases (Box 9).

Box 9. In-app purchases targeting children

Despite efforts taken to protect parents from unintended in-app purchases by children, there are still cases emerging that highlight insufficient awareness about tools available to parents. These tools are important because children may not fully understand the concept of spending real money within an app for digital items.

App platform providers have adjusted their settings to allow parents to restrict in-app purchases but users must typically configure these manually on their device or within their account.

App developers should also share some responsibility for helping protect users from unintended purchases. For example, some games offer in-app purchases immediately after the app is opened for the first time or after the tutorial has run. Children may be offered to make in-app purchases during the 15 minute period before a password is required.

Some of these purchases can be quite significant. The Wall Street Journal reports that the Tiny Zoo app introduced a pop-up after 60 seconds of use that said, "Looks like you need more Coins to buy Chickity Puff. Purchase 100 000 coins for $99.99." These messages may not be understood by some users playing the games and could lead to unintended purchases.

"Mom, Please Feed My Apps!", Wall Street Journal, 11 June 2012, at: http://online.wsj.com/article/SB10001424052702303753904577452341745766920.html.

Source: "Is regulation required to stop IAP abuse in apps for kids?" The Guardian, 9 July 2012, at: www.guardian.co.uk/technology/appsblog/2012/jul/09/regulation-iap-apps-for-kids.

Both Android and iOS also now clarify in their terms and conditions that the app store and its products are available for individuals aged 13 years or older. If the user is under the age of 18, parental or guardian supervision and approval is required. There also have been calls from within the industry for a consistent labelling scheme for games targeting young children.[72] In general, the tools are improving to ensure that in-app purchases are not used inadvertently by young children but more can be done to educate parents about them.

All stakeholders share responsibility to stop unintended in-app purchases. As children are increasingly using the Internet, parents or guardians need to be involved when children can make purchases with mobiles. They need tools to monitor or limit the activity of children on devices, particularly when payments are possible. Developers and platform operators also have an important role to play by enabling the tools for users that provide clear and easy to understand information on the costs that may be incurred in using apps and create the tools that allow users to avoid unintended purchases.

But the policy issues related to in-app purchases should not be considered simply as a problem for children. Rather, there is a need for meaningful consumer disclosure for app-based transactions for all consumers who may participate in the app economy. Appropriate consideration should therefore be given to assuring adequate protection from fraudulent or deceptive behaviour, so that consumers are able to make informed choices that will support the development of a vibrant and competitive app economy.

Dispute resolution and redress

Consumers who purchase apps may find it difficult to resolve issues related to app purchases. As highlighted in an OECD Committee on Consumer Policy's Digital Content Report,[73] information on the dispute resolution processes provided to consumers purchasing digital products is not always readily available and when it is, it is not always easily accessible. A mystery shopping survey[74] carried out in 2010 in the United Kingdom revealed that 56% of mystery shoppers could not find information on dispute resolution in the terms and conditions, even though such information was in most instances available.

The situation may be particularly complex for consumers purchasing products like "apps" from third party developers on online platforms. The role of the platform provider can be unclear. In some countries, such as Poland and Spain, the law requires the online platform to provide consumers with information (including the identity) on the third party vendor. In other countries, such as Hungary, consumers need to be informed simply that a third party may be supplying a service to consumers.[75]

As regards redress, refund policies for purchases on both major platforms are extremely limited. Apple states that it does not allow returns on electronic software download (apps), subscriptions to the software-up-to-date programme, nor any other Apple developer connection products.[76] Similarly Google Play policies state that all sales are final, and no returns, replacements or refunds are permitted (this sentence does not apply where you have been provided with defective content). If a replacement, return or refund is granted for any transaction, the transaction may be reversed; the user may no longer be able to access the content acquired through the transaction. The rights to withdraw, cancel or return purchases and get a refund are set out in the additional terms for the relevant content type and related policies.

Users are entitled to 15 minutes from the time of download to return any applications purchased from Google Play for a full refund of any applicable fees. In cases though where Google removes an app from a device because it violates the Google Play Developer Distribution Agreement or other policies, the user may not receive a refund of the purchase price. Google states that if this occurs, they would make reasonable efforts to recover the purchase price of the product, in any from the originating developer on your behalf. If Google is unable to recover the full amount of the purchase price, it will divide any recovered amounts between the affected users on a *pro rata* basis.[77]

App store policies regarding consumer redress will need to evolve as app stores become increasingly important distribution channels for digital content. As the market evolves, platforms will need to develop low-cost, easy to use alternative dispute resolution and redress mechanisms which would facilitate claims over payments involving low-value products.[78]

Skills development

Apps are an increasingly important delivery mechanism for information and services but developing apps and using them requires a new set of skills for users, developers and businesses. This is an important area of focus for OECD governments, particularly as there is a strong focus on creating jobs among the general population, and particularly among youth.

Users

Users face a learning curve for apps and there is a set of skills that people must master before they can take advantage of all the benefits of the app economy. The switch from a standard "feature-phone" to a smartphone requires that users configure an account, that they learn how the new operating system functions, and that they have the skills necessary to install and use apps. The platform providers have made the platforms as intuitive as possible but there are still steps that can be difficult for end users.

Policy initiatives can target groups who stand to benefit from the potential of smartphones but who may not have the technological know-how to configure or use one. One such group is increasingly older populations. Operating system providers, handset manufacturers and network operators can also play a part in designing and offering simplified solutions to certain segments of the population who may have special requirements, physical barriers, or otherwise limited abilities.

Developers

On the developer side, the growth in apps has been rapid and the demand for programmers who can design and build apps will continue. Policy makers are keen to develop a talent pool of developers who can build apps for business and social use in the domestic and international market.

Data on apps in Apple's App Store from 148apps.biz show that there are 723 000 active apps in the store and 192 000 active publishers.[79] That implies that, on average, an app publisher in the App Store has created 3.7 apps. This suggests that most apps are developed by firms or individuals with relatively few apps.

Because the app development market is characterised by large numbers of small firms or individuals producing apps, one key policy focus could be teaching basic app use and development skills as part of the computer curriculum of secondary and tertiary education systems. Students in these age groups are often considered to be strong users of information and communication technologies but it is still important that they learn the skills necessary to operate information devices, at a minimum, and potentially how to use or build tools for sharing information with apps and other online tools.

During the current economic crisis it is the youth that also have been the hardest hit by unemployment, and particularly youth without a tertiary education. This implies that an introduction to earlier training could help youth gain skills related to the ICT sector which has remained one of the key growth areas in an otherwise struggling economy.

App education: Businesses and governments

Finally, businesses and governments may not fully understand the potential of apps to improve efficiency and improve communication in their specific areas. In the same way that the Internet began transforming communications for businesses in the 1990's, the growth of mobile and the proliferation of apps is shifting the way people communicate and interact with businesses and governments. Educational campaigns targeting particularly small and medium sized enterprises and talking about the potential and limitations of apps and mobile developments for their operations could be particularly helpful.

THE WAY FORWARD

The app economy will continue to grow rapidly and apps will be increasingly used by businesses, governments and individuals as a way to improve efficiency and information service delivery. This paper provides a broad overview of this emerging mobile app sector and highlights a number of areas where policy makers should place careful focus to ensure that the markets remain competitive, to serve the needs of users and to support continued innovation.

More in-depth analysis is necessary in many of the areas introduced, but not fully explored, in this report. One of the most promising areas for future research is a detailed examination of HTML5 and other open web standards, both in terms of their potential impact in markets but also with regards to bottlenecks and barriers to their adoption.

There is also considerable interest in understanding the economic and social impact of the app economy. This could involve deepening our understanding of the economic value of the app economy, the number of app entrepreneurs, their motivations, the economics behind their business models and the potential for job creation. It could also look at key sectors that are beginning to rely on apps, such as mobile banking.

This report focused on a small segment of the burgeoning app market, essentially platforms for mobile phones and tablets. The app economy is much larger though and encompasses new smart televisions, social networking platforms, browsers and even traditional software for PCs. Many of the findings of this report could be generalised across platforms but there will also be specific issues related to different market segments that deserve a deeper analysis.

Apps will also play a key role in helping governments provide better access and use of public-sector information. This is an area of particular interest for OECD governments and could be an area of future work; analysis could attempt to provide measurement on the benefit of opening up data (PSI) by using apps. There is also need for more study about how apps are improving the efficiency and service delivery in key sectors of the economy. Important sectors for future research include health/wellness/ageing, education, transportation, energy and banking.

Finally, policy makers would benefit from a deeper understanding of how apps can be leveraged by entrepreneurs and small/medium enterprises to stimulate this important growth engine of the economy. As well as the implications of patent and copyright policies on fostering healthy competition among mobile platforms.

ANNEX: ANDROID PERMISSIONS BY CATEGORY

Network communication	Services that cost you	Your Location	Phone calls	System tools	Hardware controls	Storage	Your accounts	Default	Your Messages	Your personal information
Full Internet access	Directly call phone numbers	Fine (GPS) Location	Read phone state and identity	Prevent tablet from sleeping prevent phone from sleeping	Control Vibrator	Modify/delete USB storage contents modify/delete SD card contents	Discover known accounts	View WiMAX state	Read SMS or MMS	Read contact data
View Network State	Send SMS messages	Mock location sources for testing		Display Sistem Level Alerts	Record audio		Use the authentication credentials of an account	Change WiMAX state	Edit SMS or MMS	Write contact data
View Wi-Fi State		Coarse (network-based) location		Modify Global System Settings	Change your audio settings		Manage the accounts list	Modify battery statistics	Send Gmail	Set alarm in alarm clock
Create Bluetooth connections				Send Sticky Broadcasts	Take pictures and videos		Contacts data in Google accounts	Change Screen orientation	Modify Gmail	Read browser's history and bookmarks
Market license check				Change Wi-Fi State			View configured accounts	Read Google settings	Read Gmail	
Receive data from Internet				Change network connectivity			Read Google service configuration	Modify Google settings		
Control Near Field Communication				Bluetooth administration			Google mail	Recorded audio access		
Download files without notification				Change/intercept network settings and traffic				Modify secure system settings		
				Set wallpaper				Voice search shortcuts		
				Automatically start at boot				Market billing service		
				Read sync settings						
				Wwrite sync settings						
				Read subscribed feeds						
				Read sync statistics						
				Retrieve running apps						

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