

A REPORT PREPARED BY:



THE EUROPEAN APP ECONOMY

Creating jobs and driving growth

Sizing the European App Economy and
advocating policy options to drive growth

September 2013

SPONSORED BY:



THE EUROPEAN APP ECONOMY: CREATING JOBS AND DRIVING GROWTH

A report prepared by VisionMobile and Plum Consulting. Sponsored by ACT4Apps.
4 September 2013

EXECUTIVE SUMMARY

The App Economy began with the launch of the Apple App Store just five years ago. Today the App Economy is a dynamic and expanding sector with several competing stores and platforms, including offerings from Apple, Google, Microsoft, BlackBerry, Amazon and others. Downloads of applications – “apps” – total around 100 billion with nearly 1 million apps available across an increasing number of app stores. The economic impact is significant and growing.

In the EU28 we estimate that the App Economy contributes:

- 794,000 jobs across the whole economy;
- 529,000 direct App Economy jobs, 60% of which are developers;
- 22% of the global production of app-related products and services comes from the EU;
- Revenues of more than €10 billion per annum.

This represents only the beginning – further advances in the App Economy are anticipated as a result of increased apps availability and functionality, and improvements in devices and connectivity.

Mobile devices, wireless connectivity and apps together make up the current wave of innovation in information and communications technology (ICT) and are driving productivity, growth and jobs. Mobile devices give us access “on the go” to computing power and applications thus hugely extending what is possible compared with the fixed PC era.

Mobile platforms and app stores have lowered entry barriers for developers. At the same time, app stores provide global market access, discoverability, low cost distribution and monetisation. Consumers can download an enormous variety of purpose-built apps at low prices from various types of stores. App stores serve a wide range of users and promote choice through app curation and recommendations.

While the app development sector of the economy is large and growing, the contribution of the App Economy to the overall economy through app use is much wider. Time spent using apps is a measure of the value placed on them – both in terms of time spent on communication and entertainment, but also time saved for businesses and individuals through messaging, maps and other productivity tools. Wider social benefits are also becoming clear with apps for education, health and transport (illustrated below). In the health sector, for example, apps provide new tools for fitness monitoring, medical self-management, remote consultation and hospital administration.

The current state of connectivity and apps can be likened to the pre-broadband fixed internet era. In parts of Europe wireless coverage is patchy with variable-to-poor service quality. LTE (4G) with additional spectrum is changing this while offering lower costs per bit carried and enhancing the potential of the App Economy through ubiquitous connectivity and cloud services.

There are a number of areas where we believe governments in Europe can make a difference and support the App Economy:

- Facilitating access to government data for developers, e.g. mapping, meteorological and real time public transport data as well as information on community level services.
- Enhancing connectivity by making more spectrum available for wireless services.
- Advancing the European single market in intellectual property and communications.
- Embracing app-driven innovation across all sectors, e.g. health, education, enterprise, lifestyle.
- Ensuring a flexible and supportive business environment for start-ups and entrepreneurs.

Europe has an opportunity to lead and the time to act is now.

1 THE APPS ECOSYSTEM WITHIN THE CONTEXT OF ICT

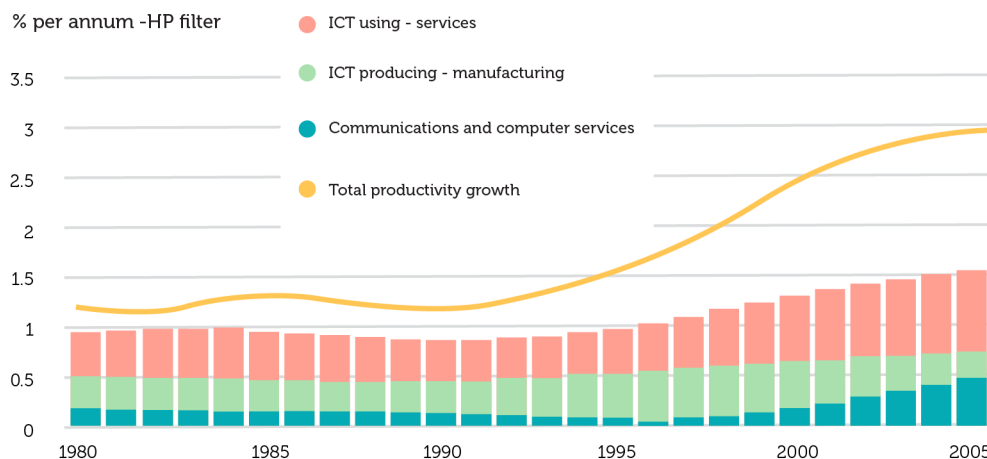
Since 2007 the app economy has experienced an explosive growth and has had a profound impact in the way people use mobile phones. The economic impact of this growth can be measured in a number of ways; as number of jobs created, contribution to the GDP, efficiency gains through the use of mobile apps, and spillovers into verticals that are not directly related to mobile app development but have benefited from mobile apps. These spillovers are not restricted to economic benefit but also include social benefits, in areas such as health, education and media.

CONNECTED COMPUTERS ERA

ICT is general purpose technology that can be used almost everywhere. Like previous general purpose technologies (such as electricity) the economic impact is far greater than the size of the ICT sector.¹ ICT contributes around 6-7% of GDP in the US and Europe, but contributed as much as half of productivity growth post the mid-1990s (see following chart).

ICT CONTRIBUTION TO PRODUCTIVITY GROWTH, US

Compared to overall productivity growth



Source: Plum Consulting, EU KLEMS data

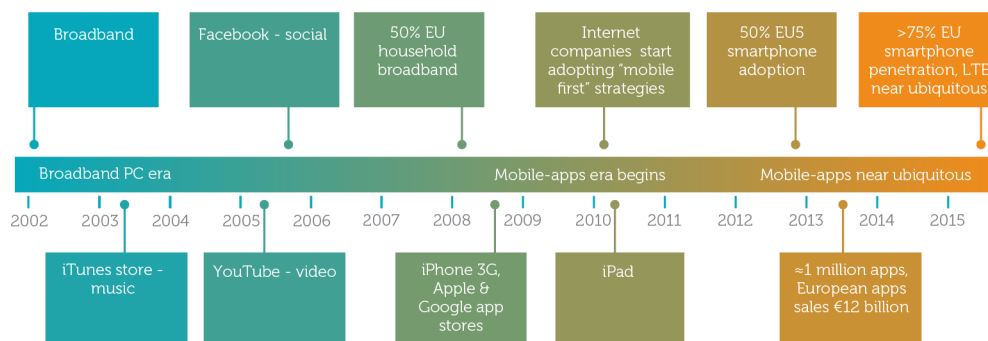
The majority of benefit comes from the use, rather than the development, of ICT. The ICT-driven acceleration of growth in the US was accompanied by a deceleration in Europe. Europe had, up to the mid-1990s, higher post-war growth than the US.

A key finding in the academic literature is that in order to benefit substantially from ICT, markets needed to be transformed and organisations and individuals needed to find different ways of doing things. Bolting ICT onto old systems only gives a fraction of the benefits. The same lesson applies to the App Economy. For the necessary transformation to occur, both labour and product markets must be sufficiently flexible.

APPS IN THE POST-PC ERA

As illustrated in the timeline below, we are in transition from connected desktop computers to smartphones and other devices that are constantly with us and always connected. The apps ecosystem has also evolved. Formerly software was generic or bespoke and of limited diversity. It was also often costly and slow to market. The App Economy is creating a new world characterised by enormous variety, short time to market, lower costs and competitive pricing.

FROM PC TO MOBILE-APPS ERA

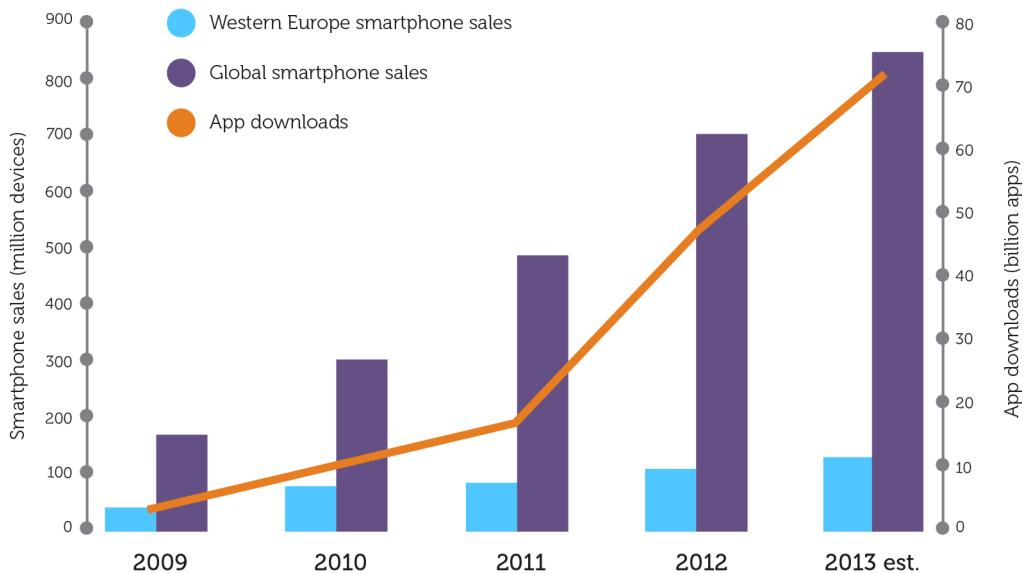


Source: Plum Consulting

While the timeline illustrates key consumer-oriented developments the enterprise market has also benefited from these developments, both through the consumerisation of IT and, increasingly, through a conscious transformation towards mobile and apps.² The combination of always available connected mobile computing and low cost applications focussed on specific tasks represents a fundamental transformation.

The real momentum in terms of mobile and apps began in 2008 with the launch of app stores, coupled with ever more powerful smartphones and subsequently tablets in 2010. By lowering discovery and distribution costs and time to market, app stores have unleashed a wave of innovation. Furthermore app stores also build trust and offer a means of monetisation for developers. As the diversity of apps increases, different types of specialised stores are also emerging to cater to different app market segments (e.g. enterprise app stores).

SMARTPHONES SALES AND APP DOWNLOADS

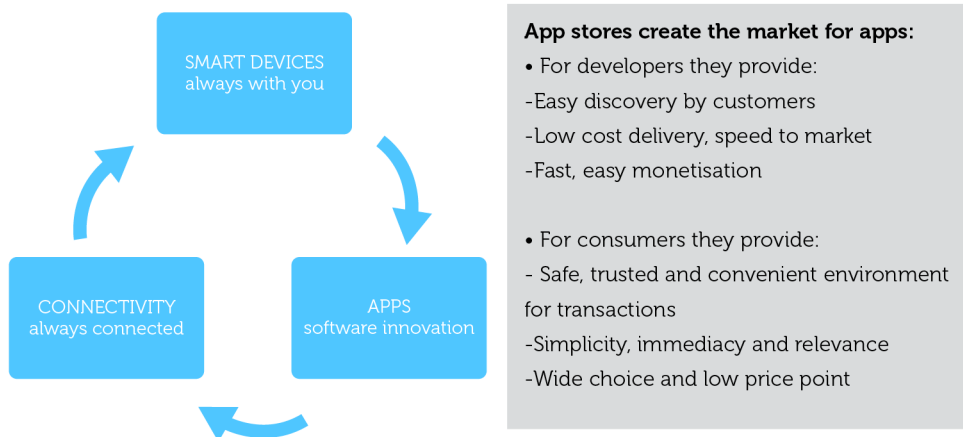


Source: Gartner, IDC, Plum Consulting, VisionMobile

As of 2013, smartphone adoption among mobile users in the EU is around 50% and growing at around 10% per annum.³ A similar proportion of mobile users in the EU have internet access on their mobile phones.⁴ Globally the adoption of smartphones and then tablets is shifting the entire ICT ecosystem towards mobile and apps.

Devices and connectivity are steadily improving, thereby creating a virtuous circle of always available connected computing and a growing number of apps, factors which work together to drive innovation that meets individual and enterprise needs.

THE VIRTUOUS CIRCLE OF THE APP ECONOMY



Source: Plum Consulting

WHAT NEXT FOR THE EUROPEAN APP ECONOMY?

The App Economy, while successful, is still at a nascent phase. Mobile and apps today are at a stage of development that is analogous to the internet pre-broadband. This is changing in a number of ways:

- Smart device ownership is growing and may become almost universal in the near future. If that happens, the transformation of business and government services will accelerate. Ubiquity would also increase the benefit to all users, especially for applications involving network effects (e.g. communications, social networks, mobile commerce).
- The capability and diversity of apps is growing with technology advancements and use of cloud computing. Apps are being developed to meet niche needs in a global market, which may not have been viable previously due to high costs and discovery barriers.
- Wireless connectivity is improving with 4G rollout. Coverage is expanding, along with enhancements in quality of service (speed, capacity, latency). If this continues, a genuine mobile broadband era will allow cloud services to be leveraged by apps and app functionality can become richer.

For Europe, the extent and pace of these changes will depend not just on the market but also the European policy environment. The right policy environment in Europe can strengthen each element of the virtuous circle and enhance the complementarities between them. To seize this opportunity, European policy actions are needed. Before we discuss the European policy actions, we will examine the apps ecosystem in Europe – both in terms of apps production and use – and how it provides a foundation for future growth and jobs.

2 THE APP ECONOMY'S IMPACT ON JOBS AND GROWTH IN THE EU28

In Europe the growth of the App Economy to date has been remarkable especially considering that it started from zero in mid-2008 and was achieved during a period when real GDP growth has been flat overall. Europe, with its strong adoption of smartphones, is behind only North America in terms of production and consumption of app-related products and services.

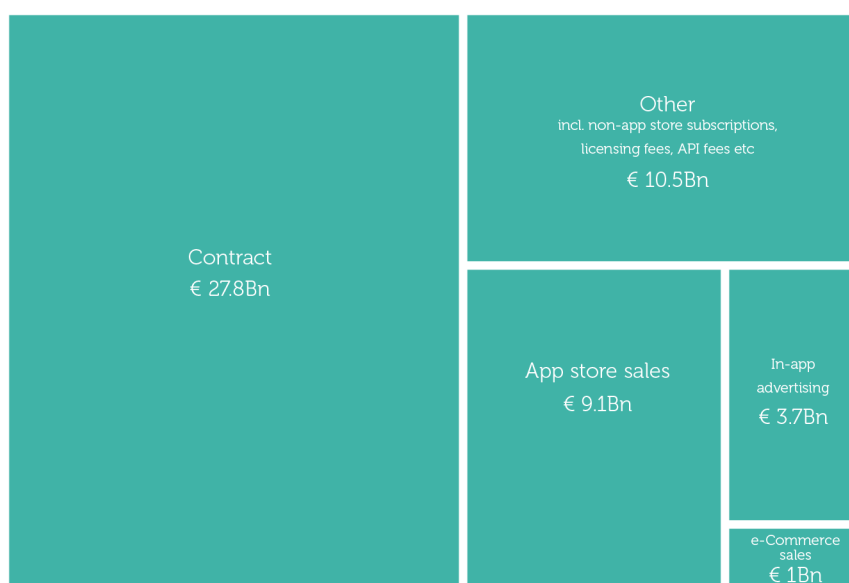
At the global level we estimate that revenues from app-related products and services will reach €51 billion in 2013. Most of this amount (82%) comprises revenues outside app stores, which includes contracted services, advertising revenues and e-commerce sales.

Previous studies on the size and impact of the App Economy have focused on app store sales and mobile advertising. However, the App Economy has far outgrown app stores to become a much wider and richer ecosystem of products and services that comprise:

- business to consumer services (e.g. apps sold in app stores, e-commerce)
- business to enterprise services (bring-your-own-device, mobilising assets, reducing total cost of ownership)
- business to developer services (tools and services targeting app developers and App Economy stakeholders)
- business to brands services (building digital presence, creating new revenue opportunities)

THE GLOBAL APP ECONOMY 2013

Revenues by revenue source



Source: VisionMobile

In this study we size the direct App Economy in EU28 in terms of revenues and jobs, and consider the wider impact of directly associated activity, for example, apps procurement by different vertical segments of the economy.

The findings are largely based on VisionMobile's Q3 2013 Developer Economics global survey conducted from April to May 2013 of more than 6,000 responses from stakeholders across the app ecosystem including developers, designers CTOs, management and hobbyists. Among other questions, respondents were asked to provide revenue breakdown by region and by source (e.g. app sales, advertising, contract development).⁵

CONTRIBUTION TO EMPLOYMENT IN THE EU28

We estimate that there are currently 529,000 people in EU28 who are directly linked to the App Economy and in full time employment. This includes 330,000 developers and another 199,000 in other roles such as management, design and marketing.

EU28 APP ECONOMY JOBS, 2013

(thousands)



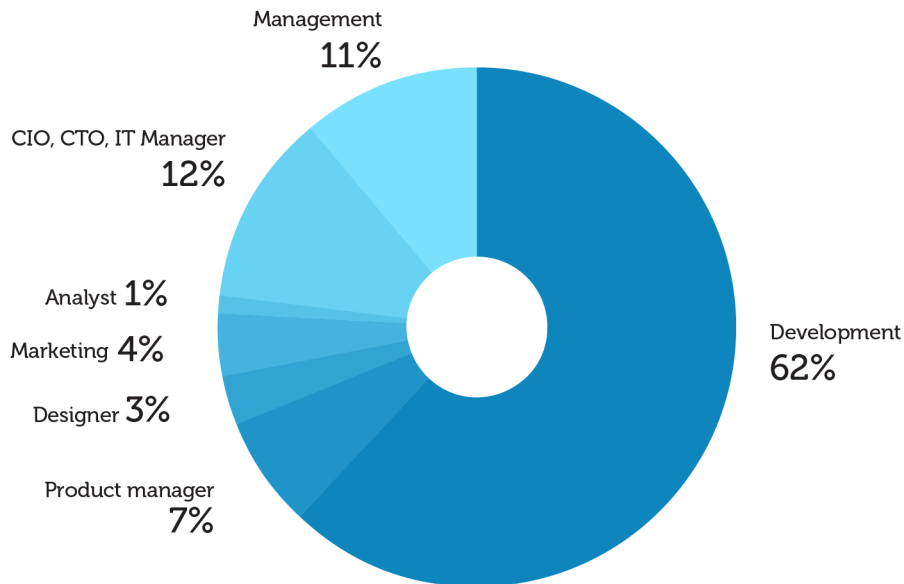
Source: VisionMobile

In addition the App Economy also has a potentially wider impact on jobs in the EU28. For example the App Economy may create additional demand for employment in other sectors that leverage app-related products and services in their business (e.g. health care, education, media and entertainment). More importantly, the use of apps is likely to generate productivity improvements and GDP growth, which may in turn drive employment in Europe.

The 529,000 direct jobs in the EU28 are estimated based on VisionMobile's survey data but assessing the wider employment effect across the economy is non-trivial. In a 2012 study of the US App Economy by Dr. Michael **Mandel** of South Mountain Economics LLC, a conservative multiplier of 1.5 was used to derive an estimate for the overall job market, which includes spill over of the App Economy into other vertical sectors.⁶ Other studies have used higher multipliers but if we apply the same conservative

multiplier to the EU28, we estimate that the App Economy contributes an additional 265,000 jobs, bringing the total to 794,000 jobs across the whole economy.

ROLES IN THE APP ECONOMY



Source: VisionMobile

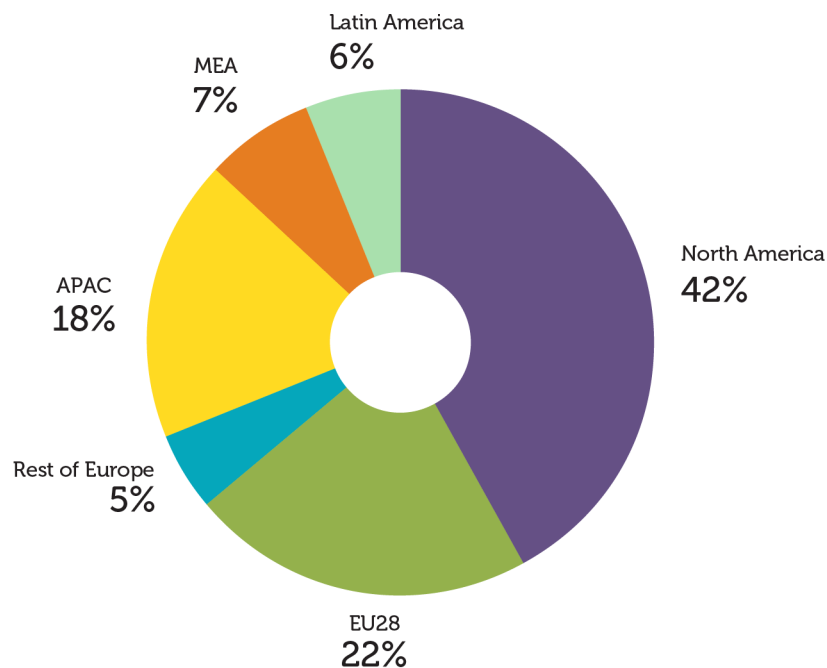
The majority of people directly involved in the App Economy are developers (62%) while CIOs, CTOs and IT managers account for 12%. The ratio of non-developers to developers, currently at 1 non-developer for every 1.6 developers, may grow as start-ups become more business-oriented and seek to bring their products to market. Non-developers include people in management, HR, sales, design and marketing. Employment growth will depend on the success of app development in the EU28 and whether the right policy environment is in place to support the app ecosystem.

Beyond this, we estimate there are a further 180,000 people involved on a part-time basis or as hobbyists or enthusiasts. This segment is an important part of the App Economy, not least because it is already contributing to the App Economy in terms of revenue generation. Indeed, many app success stories involve hobbyists who saw their idea grow into a sustainable business, which has since become their full-time occupation. Hobbyists and part-timers are therefore a key element of the job creation process in the App Economy.

CONTRIBUTION TO GROWTH IN THE EU28

The EU28 accounts for a quarter of the global App Economy in terms of both consumption and production of app-related products and services. Consumption of app-related products and services in EU28 reached €10.2 billion in 2012, and is estimated to rise to €11.2 billion in 2013, accounting for 22% of the global market.

THE GLOBAL APP ECONOMY 2013



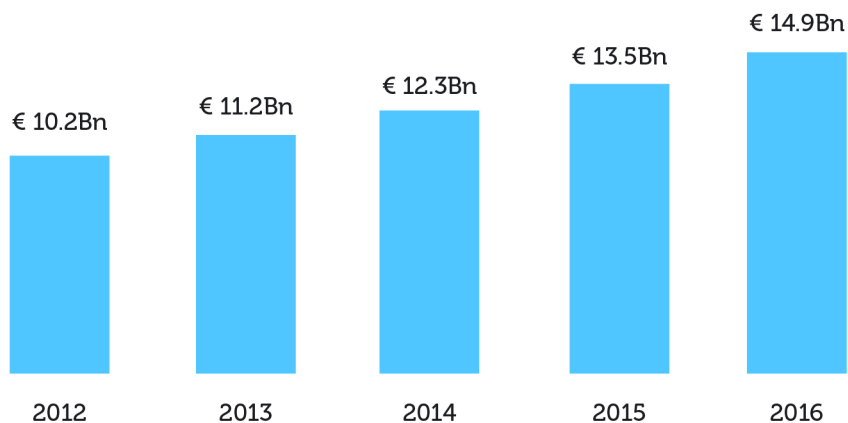
Source: VisionMobile

The rate of growth of app consumption and revenues depends on a variety of factors (e.g. rate of smartphone and tablet adoption, consumers' willingness to pay, range of apps, competition, etc.). The global App Economy is likely to grow at a faster rate than EU28 due to the rapid adoption of smartphones in the massive markets of Asia, Latin America and even Africa, which in turn creates significant demand and opportunities in these markets.

A simple projection based on a 10% annual growth rate of smartphone adoption⁷ suggests that consumption of app-related products and services in EU28 could reach €15 billion by 2016.

EU28 APP ECONOMY SIZE, 2012 - 2016

Consumption of app-related products and services



Source: VisionMobile

In terms of production, €10.3 billion worth of app-related products and services were produced in EU28 in 2012. In order to drive growth in production, the EU28 needs to better address the fast growing markets in Asia and Latin America.

While app stores offer developers access to a global marketplace and apps can be easily traded across nations and continents, there are significant barriers to international expansion in practice, particularly for small-scale developers who do not have the resources to invest in localisation or international sales and marketing. This creates a "location bias" which sees many apps currently targeting local markets. These barriers are being increasingly lowered, however, as off-the-shelf services allow developers to research international markets, localise their apps and market their apps across borders.

Key indicators for UK, Germany and France

Indicators	UK	Germany	France
Smartphone penetration ⁸ (% of mobile users)	64%	51%	53%
Internet access on mobile phone ⁹ (% of mobile users)	65%	43%	59%
Start-up environment ranking	London 7th	Berlin 15th	Paris 11th
Total app downloads	7.8Bn	4.8Bn	4Bn
App downloads in June 2013	357M	217M	154M
% of global app downloads	7%	4%	3%
% of one-person companies	40.2%	31%	18%
% of companies employing less than 5p	57.8%	43.9%	36.7%
Average experience in mobile	3.2 yrs	3.4 yrs	4.33 yrs
% of mobile devs earning < \$1000/mo	35%	19%	14%

Source: VisionMobile, ComScore, Priori, Startup Genome

COUNTRY CASE STUDIES

The EU28 exhibits high variability across nations, with some leading in terms of smartphone adoption and app consumption while others are still at early stages of the smartphone adoption curve. The widest gap exists across the East-West axis, with Western Europe having the highest adoption of smartphones and the highest exposure to app-related products and services. In this section we present three case studies for UK, France and Germany.

UNITED KINGDOM

The UK is characterised by high smartphone ownership, with 64% of mobile users having smartphones and very high demand for apps. The UK accounted for 7% of global app downloads¹⁰ in June 2013

although it accounts for less than 3% of global smartphones. This suggests that consumers in the UK consume mobile apps at over twice the average global rate, showing very high familiarity with apps. This is partly due to the prominence of the English language in mobile apps.

Among UK organisations involved in app development 40% are one-man operations, while 58% employ up to five individuals. Thirty-five percent of organisations involved in app development in the UK earn less than \$1,000 per month from this activity. The UK resembles the US in this respect, with a high degree of entrepreneurship and start-up activity and a high-risk attitude that does however result in a higher failure rate for start-ups.

London is ranked 7th in the Global Startup Ecosystem Index¹¹ by Startup Genome, which assesses global start-up hotspots in terms of funding opportunities, support, mind-set, availability of talent and other factors. London tops EU28 start-up activity in terms of start-up output although this is 63% lower than the output of Silicon Valley. Apart from being the top choice for EU28 start-ups, it is also a prime choice for US start-ups that want to establish presence in European markets.

The UK offers a favourable environment for start-ups: setting up a company can take less than an hour, and while office space is expensive, particularly in London, shared offices and co-working spaces such as TechHub can help start-ups along their initial steps. There are also a large number of events and training courses targeting start-ups, which bring together the community and provide networking opportunities for local and foreign entrepreneurs.

The UK government is actively involved in fostering tech start-up activity, backing such initiatives as the East London Tech City, a European alternative to the Silicon Valley, and facilitating start-up IPOs¹² on LSE's "High-growth segment". The latter aims to provide an alternative option for entrepreneurs who target an IPO in the US.

TESCO OPENS MOBILE DEVELOPMENT OFFICE IN LONDON'S TECH CITY



Tesco reported online revenues over £3 billion in April. While mobile is probably still a small part of this, it is seen a key element in Tesco's digital strategy. The UK retailer has invested heavily in its mobile presence, having created apps for a range of product and service offerings such as loyalty cards, online shopping, insurance claims assistance and photo printing.

Tesco's digital strategy is not limited to driving online sales but also in leveraging smartphone capabilities to improve and augment the user experience both in-store and out of store. For example, Tesco's app allows consumers to add items to their shopping list by scanning a barcode, rather than browsing a catalogue, the latter being particularly burdensome on small screens. At the same time Tesco is trialling self-checkout technology that will enable customers to scan and pay for products without waiting in lines, reducing checkout time by up to 80%.

Tesco recently opened a mobile development office in London's "Silicon Roundabout". The office will house a team of mobile developers that will create Tesco's next generation apps and deliver smartphone shopping trends to inform the retailer where it needs to invest. The team will focus on digital user experience design and software engineering across a range of devices.

FRANCE

In France 53% of all mobile users own smartphones, while France accounts for 3% of global app downloads.

In 2009, the French government established the “auto-entrepreneur” status providing low-tax and low-bureaucracy benefits to small-scale businesses. By end of 2012, 870,000 businesses had been set up under the status.¹³ However, France has a very low level of one-man operations (18%), and a small share of companies that employ fewer than five people (37% vs. 49.5% for EU28). French developers are less likely to be involved in app development on a part-time basis, with just 13% doing so, compared to 31% for EU28 and 45% for the US.

At the same time, France-based organisations that are linked to the App Economy seem to perform better than EU28 counterparts when it comes to generating income, with less than 15% reporting revenues of less than \$1,000 /month (EU28-average: 25%). According to Isai, an investment fund based in France, angel investment in France is lower than US and UK levels but there are several state support schemes for start-ups¹⁴.

Paris is ranked 11th in the Global Startup Ecosystem Index, which makes it the second-ranked city in EU28 in terms of the overall environment for start-ups. While Paris-based start-ups perform better in terms of growth and revenue, Paris lags behind London and Berlin when it comes to attracting foreign talent, which can in turn create job opportunities and economic growth. The US Startup Visa initiative aims to tackle this exact problem in the US by allowing easier access to the US for non-US citizens. A similar approach was recently announced by François Hollande, President of France¹⁵ as part of a 10-point plan to promote entrepreneurship in France.

WORD WIZARD – AN INDEPENDENT APP DEVELOPER SUCCESS STORY



Weeks after the launch of the iPad in 2010, Pierre Abel decided to start making apps, having seen a lack of education apps and motivated by a desire to help his kids and their friends learn to read.¹⁶ His first app, a version of Montessori Crosswords, took about three months to develop and had limited success initially.

The big breakthrough came with his second effort. Drawing on his first experience and feedback received, he then spent six months designing, testing and making refinements before he launched Word Wizard, a language learning tool which transforms the iPad into a talking typewriter.

The reaction to Word Wizard exceeded all expectations. After being featured on the Apple App Store it reached the Top 10 in the iTunes education apps chart in US. It was reviewed by the *New York Times* and won the Editor's Choice Award from Children's Technology Review.

Word Wizard is now available in several languages (French, Spanish, German, English, Dutch, Finnish) and Pierre now has more than 20 apps available on the Apple App Store. As of August 2013, his apps have reached some 800,000 downloads and generated close to \$1 million.

GERMANY

In Germany 51% of mobile subscribers own smartphones and 4% of global app downloads come from Germany. The majority of German mobile start-ups (43.9%) employ fewer than five employees; 31% are one man operations while 38% of developers in Germany are involved on a part-time basis.

A common concern among developers in Germany (as well as other EU nations) is that failure is frowned upon. However, in successful start-up ecosystems failure is a necessary step towards success and an outcome that should be embraced rather than feared. It is indicative that Rovio, the Finnish firm behind the massively successful Angry Birds, developed tens of other (failed) apps before they finally made it.

Start-up activity in Germany is concentrated in Munich, Hamburg and Berlin. Berlin, the main tech start-up hub, is only the third city in EU28 to feature in the Global Startup Ecosystem Index and ranks 15th out of 20 cities. It supports about a tenth of the number of start-ups per year compared to Silicon Valley. Funding is biased towards bank loans rather than accelerators and VCs.

Setting up a start-up in Berlin is relatively cheap in terms of rental and living costs. While seed funding is generally available, growing businesses have less access to late series funding and mentoring opportunities, which may lead them to other more accessible markets such as the US or UK. High-profile start-ups in Berlin, such as SoundCloud and Wunderlist, have turned to non-German funds for late stage funding.

Being closer to Eastern Europe than London and Paris, Berlin benefits from a significant influx of developers and entrepreneurs from this region. Berlin's development into a multi-cultural, dynamic and vibrant city is also a huge attractor, particularly for young entrepreneurs and developers.

BABEL: A LANGUAGE LEARNING SERVICE BASED IN BERLIN



Babbel is a language learning service created by Berlin-based Lesson Nine GmbH. It currently offers 11 languages on a number of different mobile platforms and on the web. Since 2008 its user base has grown to over 16 million, half of which use the mobile app.

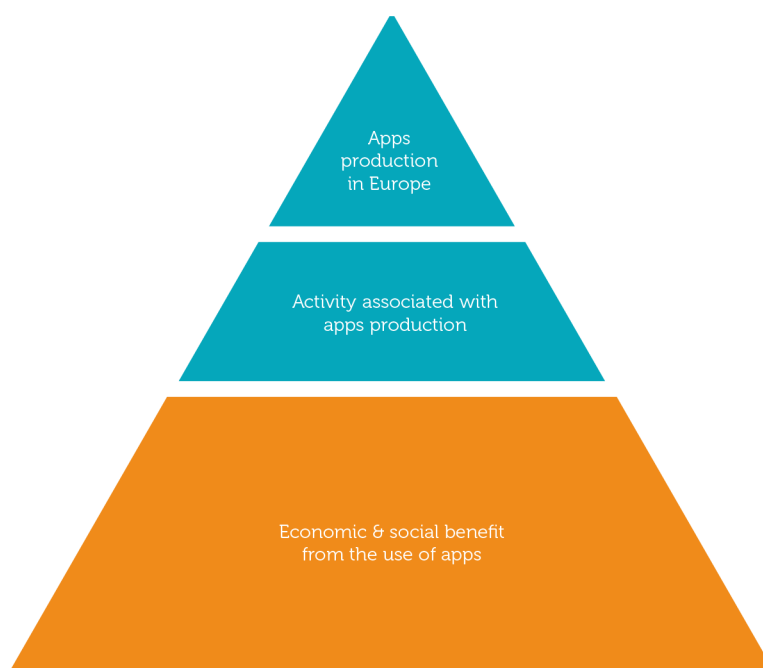
In 2009 Babbel received around €1 million from the European Regional Development Fund and the State of Berlin. It raised €1 million in its most recent funding round to fund international expansion in the US and other European markets. In March 2013 it acquired San Francisco-based competitor PlaySay, aiming to establish a strong presence in the US market and hired PlaySay's CEO as a strategic advisor for its US operations. Today the company employs 180 full-time employees and freelancers.

The company focuses on undercutting alternative learning services on price, while gamifying the learning experience to motivate users. According to Babbel CEO Markus Witte, the fact that the company is based in Europe has helped since language diversity is seen as an opportunity rather than a barrier. He also points out that starting in Europe forces companies to seek international expansion early on, as national markets in the EU are much smaller than the US. While this creates several difficulties it also helps entrepreneurs gain international experience, while US companies may become too focused on their domestic market, developing a "domestic DNA" which may be hinder their international efforts.

3 THE WIDER ECONOMIC AND SOCIAL IMPACT OF THE APP ECONOMY IN EUROPE

Apps development, as discussed in the previous section, is a significant and growing source of employment and growth in Europe. However these numbers alone do not capture the full scope of the economic and social contribution of apps, as illustrated below.

ECONOMIC AND SOCIAL IMPACTS OF THE APP ECONOMY



Source: Plum Consulting

The bigger picture relates to the use of apps to improve people's lives and productivity. Users benefit from apps regardless of whether they are developed in Europe or elsewhere, or whether they are free or paid. These benefits range from personal and social to productivity related applications that improve business management and communication.

Many tens of billions of apps have been downloaded globally, with ABI research estimating global app downloads of 56 billion in 2013 alone.¹⁷ Time consumed via communication and entertainment apps and time saved via productivity apps (including communications, maps and office productivity tools) represent economic value. People value their time, and time spent or time saved both represent economic value gains.¹⁸

Apps, mobile operating systems, smartphone sensors and location awareness also bring social benefits beyond their immediate economic value. For example, some of these applications use sensors in novel ways, for example using the camera to detect radiation¹⁹ and using the microphone to identify rare cicadas.²⁰ The use of mobile applications to enhance public safety is illustrated by the case of the London

Air Ambulance service which now utilises wireless data and tablets to get to people in need more quickly – and therefore saving lives.

LONDON AIR AMBULANCE – MOBILE APPS SAVING LIVES ²¹



“When the medical team arrives the patient may not have a pulse. In such a situation, where every second counts, improving take-off times by minutes will make a huge difference.”

Gareth Davies,
Medical Director, London's Air Ambulance

London Air Ambulance (LAA)'s paramedics respond to medical emergencies using a helicopter by day and rapid response cars by night. Due to the nature of the missions time is critical. However, the paramedics were hampered by outmoded practices. Pilots had to manually print incident details before setting off, and unreliable 3G meant that the teams often had to resort to using paper maps. Rapid response vehicles were also affected by the loss of satnav signal around tall buildings.

LAA entered into a strategic partnership with Everything Everywhere (EE) to develop two 4G-enabled initiatives to overcome these problems. The first was a bespoke mapping app delivered over 4G to reduce reliance on paper maps and 3G. The use of 4G is essential because it allows the mapping app to refresh frequently enough to keep up with the LAA's high speed helicopters and cars.

The second initiative allows the incident details (checklists, directions and key situational data) to be transmitted wirelessly to a tablet, instead of the current system of printing the information manually. This should allow the helicopter to scramble more quickly, saving precious seconds in an emergency response.

In the sections below we illustrate some of the benefits from the use of apps across a number of categories: consumer benefits, productivity benefits and transformation of industry sectors or verticals (focussing on health and education).

CONSUMER BENEFITS

One of the most evident impacts of apps is the improvement in consumer welfare. Individuals have benefited through apps in many ways. Apps have provided access to a large variety of digital goods and services including TV, radio, news, music, movies and games. Mobile represents a new distribution channel for these services and apps enable consumers to access and consume them anytime and anywhere at their convenience.



In communications, apps have led to tremendous changes over the last five years. Social networking apps such as Facebook, Instagram and Twitter allow users to keep in touch with family and friends, and share information and other forms of digital content at any location. Communications apps such as Skype have made video calls more affordable, simpler and accessible to the extent that it now accounts for a third of all international calls.²² Globally, the use of instant messaging apps such as WhatsApp have overtaken SMS.²³

Mobile apps also greatly improve access to information and information gathering processes (e.g. crowd sourcing). A myriad of information is now available at our fingertips through apps for weather, transport, finance and shopping, to name but a few. Better information often means better decisions and time saved. A recent survey of US smartphone owners estimates that usage of apps helps save up to 88 minutes a day, equivalent of \$12,000 in time-saving value a year per person.²⁴

Mapping and location-based services are another new function which has brought significant benefits. Navigation apps (e.g. Google Maps, Waze, TubeMap) provide real time information for drivers and commuters, finding the most efficient route to their destinations. Others help users find the nearest services in their community, such as GPs, dentists, recycling points, bike stations, taxis and local businesses (e.g. Hailo, Yelp, spotcycle). By helping businesses and consumers discover and connect with each other, apps reduce the cost of search and widen choice in many markets, and thus improve consumer welfare.

PRODUCTIVITY BENEFITS

Mobile apps represent the next phase of the ICT revolution. They are transforming the way business tasks are accomplished. Business apps cover a range of functions (e.g. supply chain management, retailing, general administrative tasks, recruitment) and worker activities (e.g. word processing, communications).



For businesses and organisations, apps contribute in variety of ways including:

- Flexible work arrangements – remote working facilitated by communications apps, online collaboration tools (e.g. Yammer) and cloud based systems (e.g. Box, SugarSync) which make online information storage and retrieval available from any mobile device.
- Mobile commerce – apps which enable payments and transactions (e.g. iZettle), improve market efficiency and exchange by reducing transaction costs and time.
- Organisational management – apps can enhance work task management (e.g. Asana), operational efficiency (e.g. mobile CRM tools) and administrative processes (e.g. Expensify).
- Client relationship building – social apps (e.g. Twitter, LinkedIn) enable companies to widen their business networks, expand visibility and attract new clients and customers.

ORGANIZATIONAL CHANGE THROUGH MOBILE APPS – ENTERPRISE IT



For most people, the mention of mobile apps immediately brings to mind the image of games, entertainment or social networking. Few, if any, would mention work. This is in direct contrast to the PC era, particularly pre-web, when productivity rather than consumption was the norm.

For all the benefits smartphones and mobile devices can potentially bring to the workplace (e.g. efficiency, revenue growth, competitive ability, customer and employee relationships), take-up among business has been slow to date. Yet this is changing rapidly. The reason: third party mobile enterprise apps.

While executives were quick to recognise the potential of mobile, concerns over security and control meant organisations initially focused on internal app development which required significant efforts on development, management, integration of data and technology standardization. However easy-to-use cloud services such as Dropbox and Box.net and communications apps which provide low cost video conferencing services are shifting perceptions and driving adoption among large businesses and SMEs alike.

For SMEs, many specialised business productivity tools (e.g. cloud storage, finance management) are available through app stores, often at a fraction of the price they would pay for a full business software solution. CRM solutions are now mobile-enabled and cater to businesses of all sizes. At the other end of the market, SAP, the German enterprise software giant, offers a suite of mobile apps for inventory management, customer relationship management, finance and human resource.

Mobile apps designed to meet business needs regardless of size, industry or geography are becoming more widespread and their impact on businesses will be enormous.

TRANSFORMATION OF INDUSTRY SECTORS OR VERTICALS

The rise of apps is transforming the business environment across different segments of the economy. The most obvious case is in the media and entertainment industries where the internet has provided new ways of aggregating and delivering digital goods and services to consumers (e.g. over-the-top services and apps like Spotify, Netflix and YouTube). These have contributed to the disruption of traditional business models, increased competition and paved the way for new market entrants.

Another example is the “sharing economy” phenomenon²⁵ in which the internet and apps facilitate sharing of unused or underused resources and assets from cars (e.g. ZipCar) and homes (e.g. Airbnb, CouchSurfing) to clothes and human resources.

The pace of change and the resulting impact on industry verticals is likely to quicken as the App Economy grows and the take-up of smartphones and tablets continues. The following sections discuss this in relation to the health and education/research sectors.

HEALTHCARE AND HEALTHY LIVING

Health is an important sector where apps are beginning to have a profound impact in terms of new methods of delivering healthcare and new techniques for managing health and fitness.



There are three key areas where apps are driving change:

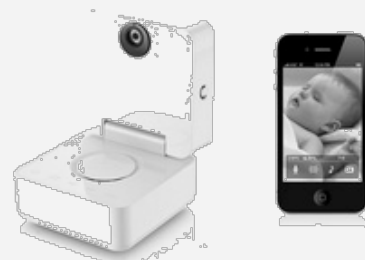
- Health measurement and monitoring – mobile devices and apps provide information and measurement tools which enable individuals to better manage health and fitness (see box below).
- Clinical interaction with patients – apps which enable better self-management of medical conditions such as diabetes and asthma (e.g. Asthma Sense) through medication reminders, diary logs and monitoring can reduce risks and save time for both patients and doctors.
- Hospital administration and management – apps which provide integrated portals with features such as appointment booking, access to medical records, billing and insurance, can improve efficiency of hospitals or reduce paperwork for healthcare staff.

The range of healthcare and health-related apps is growing and these cater to the full spectrum of society from babies to the elderly and from fitness buffs to the disabled. For example, the European Directory of Health Apps 2012-2013 lists 200 apps recommended by patient groups and consumers.²⁶ These cover a wide range of health topics and are available in various European languages.

DIGITAL HEALTH INNOVATION THROUGH APPS AND SMART DEVICES

Apps and mobile devices are transforming the health sector, empowering individuals through new tools for self-tracking and self-sensing. We can track what we eat, how we sleep and how we exercise. The networked fitness and 'quantified self' movement is gaining momentum. For individuals the potential benefits for improving day-to-day health and long term well-being are enormous.

In Europe a vibrant digital health ecosystem has emerged over the last couple of years with start-ups and incubator activities taking root in a number of countries (e.g. Belgium, Netherlands, Spain, Hungary).²⁷ Exemplifying this is Withings²⁸ – a health app start-up founded in 2008 by two French executives, Cedric Hutchings and Eric Carreel.



Withings offers a series of user-friendly mobile apps and devices designed to improve well-being – from body pressure monitors and baby monitors to health activity trackers and internet-connected weighing scales which also measure air quality and heart rate.

Withings are also playing a part in growing the digital health ecosystem. Not only do they design and create their own apps and products, they have made available their API free to other developers, providing a platform for others to create new apps and to improve user experience through better data analytics. Today Withings has over 100 partner apps and devices.

As the above developments illustrate, apps can contribute to improvements in general public health and quality of healthcare as well as address escalating healthcare costs and government expenditures. Their role and impact in this sector are set to get bigger in the years ahead.

EDUCATION AND RESEARCH

In the education sector apps are having an increasing influence both inside the classroom and outside.



The benefits of apps include:

- Easy access to learning materials at any location and time
- Innovative and engaging modes of instruction and learning (e.g. through multimedia and games)
- New ways of communication and interaction between teachers and students.

The variety of educational apps is growing by the day and they include text books and general reference (e.g. Wikipedia, Dictionary), language learning tools (e.g. Mindsnacks, Duolingo), subject-specific apps (e.g. Maths Board, 3D Brain, The Elements), massive open online courses (e.g. Coursera, EdX) and learning games (e.g. Dragonbox).

The use of one-to-one iPads and other mobile devices as education tools is catching on in Europe.²⁹ For example, the Essa Academy³⁰, a state school in the UK, is among a new breed of schools making use of iPods and iPads to engage pupils in creative ways. Not only has the school seen big improvements in test scores within two years, it has also managed to reduce operating expenses.

For scientists and researchers, apps offer new methods for conducting research. Citizen science – crowd sourcing involving citizens and amateur scientists – is increasingly common across academic disciplines for large scale data collection and research projects.³¹ Cancer researchers in the UK are developing a gaming app in which users will be analysing genetic data and helping to pinpoint the genetic causes of cancer as they play.³² These examples exemplify how mobile technology and apps are extending new ways of utilising “cognitive surplus”.³³

As more powerful sensors (e.g. accelerometer, camera, digital compass, gyroscope, GPS, microphone) are built into smartphones and other mobile devices, new forms of research use will become possible.³⁴

4 MOBILE APPS – CONTRIBUTING TO THE EUROPEAN DIGITAL AGENDA

The Digital Agenda for Europe includes seven policy pillars aimed at enhancing the role of the digital economy in Europe and helping achieve the Lisbon agenda for growth and jobs.³⁵

Below we illustrate ways in which the apps ecosystem is contributing to the seven pillars, and the ways in which delivering the seven pillars can stimulate the apps ecosystem.

App Economy Contribution to the Seven Pillars of the European Digital Agenda

Seven pillars	How apps contribute
Digital Single Market	Apps have contributed to the single market, in particular communications apps. A single market for intellectual property including patents and copyright would stimulate apps development.
Interoperability & Standards	Apps improve interoperability since they work across different devices and forms of connectivity. Standards, including APIs for access to government data, would foster development of new kinds of apps.
Trust & Security	Curated app stores contribute to trust and security for consumers. Appropriate measures to promote trust and security could foster new areas for app development including mobile payments.
Fast and ultra-fast Internet access	Apps are driving consumer demand for ubiquitous high speed, high capacity networks. Fast wireless access would stimulate development and use of connected apps and cloud computing.
Research and innovation	Apps support the crowdsourcing of data, citizen science and collaborative research and innovation. Research and innovation in areas including 5G, big data and 'AI' will stimulate apps development.
Enhancing digital literacy, skills and inclusion	Apps solve the problem of relevance and reduce skill barriers to digital literacy, while helping overcome barriers due to disability. Getting more people online will enlarge the market for apps.
ICT-enabled benefits for EU society	Apps development and use is driving a new wave of innovation, growth and jobs for EU society.

Source: Plum Consulting

5 THE EUROPEAN POLICY OPPORTUNITY - LEVERAGING THE APPS ECOSYSTEM

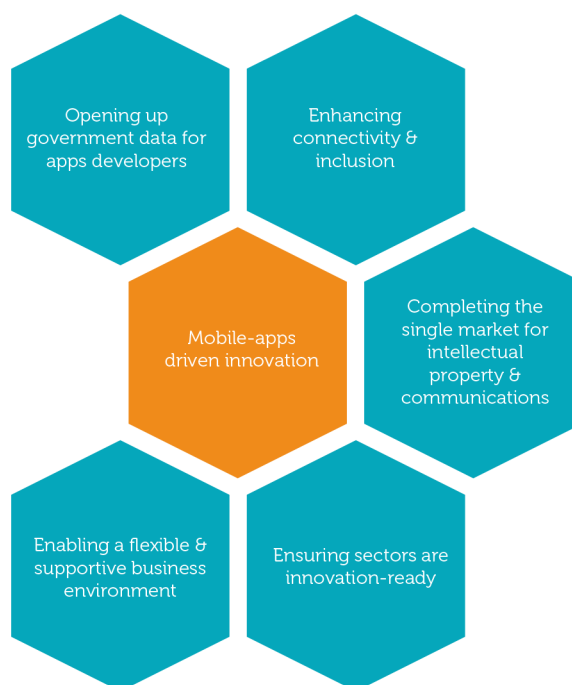
The European App Economy can continue to be an engine of growth. However the speed of growth and the breadth and depth of wider economic and social benefits in Europe, as well as European competitiveness, will depend on the policy environment in Europe.

Europe has a strong base to build on in terms of an established ecosystem of apps developers, comparatively high levels of smart device take-up, high household penetration of Wi-Fi and an accelerating transition to LTE. However, to realise the full benefits, and to become global leaders in the App Economy, the following challenges in Europe will need to be addressed:

- First, Europe needs more labour market flexibility to allow transformation of the economy.³⁶ A recent review of European growth prospects noted that *“the environment must be accommodative to the processes of resource reallocation required for diffusion of new technology through the economy.”*³⁷
- Second, where Europe once led on wireless it now lags. Europe is behind in the transition to LTE (4G) because a fragmented market has led to staggered spectrum release and a lack of scale for equipment vendors, network operators and service providers.³⁸
- Third, different sectors or verticals in Europe will present unique policy challenges in adapting to mobile apps. Existing regulations may not be fit for purpose in the new environment; for example, the peer-to-peer sharing economy in relation to transport, finance and accommodation. Getting the right regulatory framework would allow Europe to be a global leader in the new phase of development in fast moving industry sectors.

The potential for ICT to drive a return to sustainable productivity, income and employment growth in Europe is well recognised.³⁹ The App Economy will be integral in achieving this vision. In this chapter we discuss five policy pillars to maximise the economic and social benefits of the European apps ecosystem.

MAXIMISING THE ECONOMIC AND SOCIAL BENEFITS OF THE EUROPEAN APP ECONOMY



Source: Plum Consulting

DEVELOPER ACCESS TO EUROPEAN GOVERNMENT DATA SETS

Data held by European governments can support the development of innovative apps that increase the value of such data for citizens and potentially reduce the cost of government service provision. Examples include mapping, meteorological and real time public transport data, as well as information on schools, education and other community-level services

Making data available in Europe, as opposed to providing data services directly, has a number of benefits:

- App developers have technical expertise and are better placed than governments or public agencies to provide innovative services based on government data.
- Apps extend the ways in which data can be used, and ensure it is available in an appropriate form on mobile devices.
- Apps will provide better accessibility to government services compared to the desktop environment.
- By making data available rather than putting resources into developing information services, governments may reduce costs while also enhancing service.

To deliver on this vision the following are required:

- Access to government data in a machine readable format with appropriate application programming interfaces (APIs)

- Free non-exclusive access to encourage innovation and competition

Several initiatives to make government information available have been established, notably in the US and some European countries.⁴⁰ These initiatives need to be accelerated and extended throughout Europe.

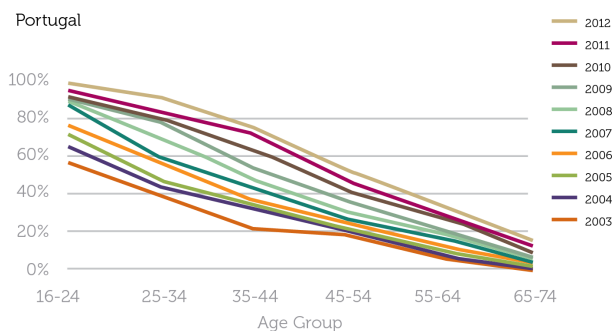
ENHANCING CONNECTIVITY AND INCLUSION TO GROW THE MARKET

Connectivity enables apps to offer enhanced and real time services including communications, navigation and cloud services. Reliable and robust connectivity improves the user experience (e.g. apps can be downloaded anytime, anywhere) and extends the usefulness of apps. Higher upload and download speeds, lower latency, greater capacity and better coverage can fundamentally change what is possible, including allowing new classes of enterprise apps to leverage cloud services.

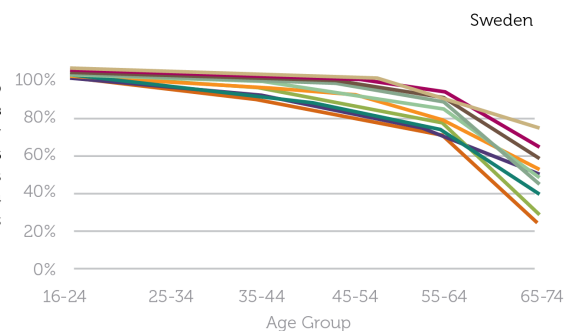
By 2020 it is predicted that mobile networks will be able to profitably (and affordably) deliver one gigabyte of data per user per day (around 100 times the level in Europe today).⁴¹ For this form of enhanced wireless connectivity to be achieved in Europe, additional licenced and unlicensed spectrum will be required.^{42 43 44}

Connectivity is only part of the picture. For the full benefits to be realised, all Europeans need to be a part of the app ecosystem, and many today in Europe are not. Differences between age groups and between countries, as illustrated by the two charts below on internet use in Portugal and Sweden, highlight the considerable challenges in getting everyone online. The proportion of mobile phone users with internet access **on their mobile phones** also reflects this – Sweden is at 71% and Portugal is at 26%.⁴⁵ So while apps and mobile devices may change the picture, the right policy will be necessary.

% OF INDIVIDUALS IN PORTUGAL WHO USED THE INTERNET IN THE LAST 3 MONTHS, BY AGE



% OF INDIVIDUALS IN SWEDEN WHO USED THE INTERNET IN THE LAST 3 MONTHS, BY AGE



Source: Plum Consulting, Eurostat

Digital literacy and digital inclusion efforts in Europe are still focussed on the PC, yet mobile operating systems, devices, apps and connectivity offer the following potential advantages in terms of getting people online:

ADVANTAGES OF MOBILE APPS IN GETTING PEOPLE ONLINE

High relevance: Individual apps offer specific services such as maps, video communications with family, weather and travel information. People can see the relevance and benefits of apps whereas the internet and going online are abstract notions without immediate relevance.

Simplicity, accessibility and trust: Mobile operating systems are more robust and less complex than PC operating systems. Accessibility tools (e.g. white on black text, speak auto-text and voice control) built into mobile operating systems lower the skill barrier and enhance the experience especially for those with special needs. Individual apps also cater to special needs including communication for those with cognitive impairments, reading aids for those with dyslexia, etc.

Reducing cost: Mobile devices, apps and basic mobile data packages offer a lower cost of ownership, compared to a PC, conventional software and a fixed broadband connection.

Getting everyone online would offer social benefits, enable e-government and foster the mobile apps ecosystem.

The following policy steps are therefore proposed:

- The cost effectiveness of using tablets and apps to get people online in Europe should be evaluated against the conventional PC route. Where mobile proves more effective and less costly, funding aimed at getting people online should be redirected.
- Government and public service websites in Europe should be accessible and offer full functionality across all platforms including mobile devices, particularly as mobile may be the first and only route online for many people.

COMPLETING THE EUROPEAN SINGLE MARKET

Apps, by their very nature, work across borders, networks and devices and thus contribute to a single market. This is apparent in the communications market where apps, such as Viber and WhatsApp, are gaining users globally and stimulating demand for ubiquitous high quality mobile data connectivity.

Apps open up new markets, compete with existing services, drive innovation and widen choice for consumers and enterprises. To support continued growth of the apps ecosystem and the role of apps in relation to the European single market consumers must be able to access and use apps (i.e. apps must not be subject to blocking or anti-competitive discrimination).^{46 47}

In relation to intellectual property there are two European policy requirements:

- Protection of the intellectual property of app developers to ensure that they are prepared to invest in risky new ventures, and to foster an environment conducive to innovation, creativity and consumer trust.

- Copyright, trademarks and patents ought to apply throughout Europe on a common basis. Application developers need ways of utilising and paying for content rights throughout Europe without having to incur costs in agreeing rights on a country-by-country basis.⁴⁸

EMBRACING INNOVATION THROUGHOUT THE EU ECONOMY

Regulation should be appropriate, thoughtful and, above all, supportive of app-enabled innovation. For example existing regulation should not automatically be extended to new apps-based services to achieve a “level playing field”. Rather regulations should be reappraised and adapted, sector by sector, to ensure that individuals, firms and society can benefit from app-driven innovation in every sector and industry.

We identify two areas for immediate attention:

- The sharing or peer-to-peer economy, for example regulation of financial services, the rental car industry and rental accommodation all appear not to sit well with existing regulation.⁴⁹
- Medical apps and sensors linked to smart devices and medical services delivered through apps may face regulatory barriers or uncertainty even where the balance of benefit versus risk favours freedom to innovate.⁵⁰

Europe has an opportunity in these and other areas to adopt appropriate frameworks that jump start the App Economy. Where regulations may be required (e.g. for health and safety reasons), a multi-stakeholder co-regulatory approach should be preferred to ensure that the development of new innovative uses is not hindered.

ENABLING A FLEXIBLE EUROPEAN LABOUR MARKET TO ALLOW INNOVATION

The apps ecosystem has low barriers to entry for entrepreneurs, but scaling such a business involves costs and risk. For start-ups and small-medium developer outfits, labour market flexibility in Europe can reduce these risks. This would in turn stimulate the start-up ecosystem by allowing innovation and transformation throughout the European economy.

Alongside a flexible European labour market the labour supply requires the necessary skills including Science, Technology, Engineering and Mathematics (STEM) skills to meet demand. Development of these skills in Europe needs to be fostered throughout the education system.

6 CONCLUSION

The app ecosystem is a dynamic and growing sector of the European economy. From nothing five years ago, today the App Economy in the EU28 contributes 794,000 jobs across the whole economy and more than €10 billion in revenue per annum. To foster the continued growth of the App Economy in Europe, we propose that the European Commission and member states focus on the following policy levers.

PROPOSED POLICY LEVERS TO GROW THE EUROPEAN APP ECONOMY

Facilitating developer access to government data sets	<ul style="list-style-type: none">• Allow access to machine readable data for developers• Ensure government presence online on all devices
Enhancing connectivity and inclusion to grow the market	<ul style="list-style-type: none">• Make more spectrum available• Make mobile & apps central to digital inclusion policy
Completing the European Single Market	<ul style="list-style-type: none">• Foster the single market for electronic communications• Facilitate development of Europe-wide patents & copyright
Embracing innovation throughout the economy	<ul style="list-style-type: none">• Adapt regulation in all sectors to allow apps driven innovation• Adopt multi-stakeholder co-regulatory approach
Enabling a flexible labour market to allow innovation	<ul style="list-style-type: none">• Ensure flexibility to enable app developers to grow• Ensure flexibility to allow transformation driven by apps

Source: Plum Consulting

ENDNOTES

-
- ¹ Cecile Denis et al. An analysis of EU and US productivity developments – a total economy and industry level perspective. European Economy Economic Papers, July 2004.
http://ec.europa.eu/economy_finance/publications/publication664_en.pdf
- ² Arthur D Little (2012). The business benefits of 4G LTE. <http://files.ee.co.uk/business/ADL/ADL-UK-Business-Benefits.pdf>
- ³ ComScore. Smartphones reach majority in all EU5 countries, 15 March 2013.
<http://www.comscoredatamine.com/2013/03/smartphones-reach-majority-in-all-eu5-countries/>
- ⁴ European Commission. E-Communications Household Survey, Special Eurobarometer 396, August 2013
http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=2629
- ⁵ VisionMobile (2013). Developer Economics: App Economy forecasts 2013-2016.
- ⁶ Michael Mandel. Where the jobs are: the App Economy. February 2012 <http://www.technet.org/wp-content/uploads/2012/02/TechNet-App-Economy-Jobs-Study.pdf>
- ⁷ ComScore. EU5 smartphone penetration reaches 55 percent in October 2012. Press release, 17 December 2012
http://www.comscore.com/Insights/Press_Releases/2012/12/EU5_Smartphone_Penetration_Reaches_55_Percent_in_October_2012
- ⁸ ComScore. Smartphones reach majority in all EU5 countries, 15 March 2013.
- ⁹ E-Communications Household Survey, August 2013
- ¹⁰ Priori, VisionMobile
- ¹¹ Startup Genome. Startup Ecosystem Report 2012. <https://s3.amazonaws.com/startupcompass-public/StartupEcosystemReportPartIv1.2.pdf>
- ¹² Wired. Government to make London IPOs easier for tech companies, 20 September 2012.
<http://www.wired.co.uk/news/archive/2012-09/20/opening-up-equity-markets>
- ¹³ Financial Times. Feathers fly in France over 'auto-entrepreneurs', 2 June 2013 <http://www.ft.com/cms/s/0/c045be3a-cb6a-11e2-b1c8-00144feab7de.html>
- ¹⁴ Financial Times. French dreams of a start-up renaissance, 16 July 2013. <http://www.ft.com/cms/s/2/bcef0f78-ed4f-11e2-ad6e-00144feabdc0.html>
- ¹⁵ Wall Street Journal. Hollande woos entrepreneurs, 29 April 2013
<http://online.wsj.com/article/SB10001424127887323528404578452631264478500.html>
- ¹⁶ Pierre Abel. My sales & experience in the education app market – 2012 report. Pierre Abel blog, 17 December 2012 <http://blog.lescapadou.com/>
- ¹⁷ ABI. Android will account for 58% of smartphone app downloads in 2013, with iOS commanding a market share of 75% in tablet apps, 4 March 2013 <http://www.abiresearch.com/press/android-will-account-for-58-of-smartphone-app-down>
- ¹⁸ According to an estimate in 2013 by Flurry, the US consumer spends an average of 2 hours and 38 minutes per day on smartphones and tablets. <http://blog.flurry.com/bid/95723/Flurry-Five-Year-Report-It-s-an-App-World-The-Just-Web-Lives-in-It>
<http://gammapix.com/sites/>
- ¹⁹ <http://gammapix.com/sites/>
- ²⁰ University of Southampton. University develops app to help search for the rare New Forest cicada, 3 June 2013
https://www.southampton.ac.uk/mediacentre/news/2013/jun/13_100.shtml
- ²¹ EE. London's Air Ambulance. 4GEE speeds emergency helicopters on their way, May 2013
<http://files.ee.co.uk/business/case-study/London-Air-Ambulance.pdf>
- ²² Telegeography. The bell tolls for telcos? 13 February 2013, <http://www.telegeography.com/press/press-releases/2013/02/13/the-bell-tolls-for-telcos/>
- ²³ BBC. Chat app messaging overtakes SMS texts, Informa says, 29 April 2013, <http://www.bbc.co.uk/news/business-22334338>
- ²⁴ Click Software. Your smartphone could be worth \$12,000, new survey finds, 21 May 2013
<http://www.clicksoftware.com/087d7277-cabb-431d-ae82-1514343e13f9/news-press-releases-detail.htm>
- ²⁵ The Economist. The rise of the sharing economy, 9 March 2013. Technology Quarterly: Q1 2013.
<http://www.economist.com/news/technology-quarterly/21572914-collaborative-consumption-technology-makes-it-easier-people-rent-items>
- ²⁶ Patient View (2012). European Directory of Health Apps 2012-2013: a review by patient groups and empowered consumers.

-
- ²⁷ Health Collective. How Europe is growing health apps, 6 February 2012
<http://healthworkscollective.com/node/28707>
- ²⁸ <http://www.withings.com/>
- ²⁹ New York Times, Tablets in Dutch Schools Usher in a New Era, 9 June 2013.
http://www.nytimes.com/2013/06/10/world/europe/tablets-in-dutch-schools-usher-in-a-new-era.html?_r=0
- ³⁰ An ailing UK school makes an incredible transformation, Apple education profile
<http://www.apple.com/uk/education/profiles/essa/>
- ³¹ From climate studies to wildlife (<http://www.projectnoah.org/>) to happiness (<http://www.mappiness.org.uk/>)
- ³² Wired, Smartphone game 'GeneGame' to crowdsource cancer research, 19 July 2013
<http://www.wired.co.uk/news/archive/2013-07/19/genegame-app-cancer-research>
- ³³ This is the idea put forward by US academic Clay Shirky that people are now learning to redirect their free time to more constructive activities particularly with new online tools which facilitate new forms of collaboration.
- ³⁴ Nicholas Lane et al. (2010) A survey of mobile phone sensing. IEEE Communications Magazine, September 2010
- ³⁵ Europe Commission. Digital Agenda for Europe: a Europe 2020 initiative. <http://ec.europa.eu/digital-agenda/>
- ³⁶ Salvador Barrios and Jean-Claude Burgelman (2008). Europe Needs More Lisbon to Make the ICT Investments Effective. Intereconomics, Volume 43(3) <http://www.intereconomics.eu/downloads/getfile.php?id=633>
- ³⁷ Karl Pichelmann. Economic growth perspectives for Europe. ECFIN Economic Brief, April 2013
http://ec.europa.eu/economy_finance/publications/economic_briefs/2013/pdf/eb21_en.pdf
- ³⁸ European Commission. Connected continent? Three-quarters have no 4G access! Press release, 25 July 2013
http://europa.eu/rapid/press-release_IP-13-742_en.htm
- ³⁹ Eric Bartelsman. ICT, reallocation and productivity. European Economy Economic Papers, April 2013
http://ec.europa.eu/economy_finance/publications/economic_paper/2013/ecp486_en.htm
- ⁴⁰ Examples of open data initiatives include data.gov (US), data.gouv.fr (France), data.gov.uk (UK) and dati.gov.it (Italy). In June 2013 the European Parliament agreed on new rules to facilitate the opening up of public sector data.
- ⁴¹ NSN. Technology Vision 2020. June 2013. <http://www.nokiasiemensnetworks.com/innovative-thinking/technology-vision>
- ⁴² European Commission. RSPG Opinion on "Strategic challenges facing Europe in addressing the growing spectrum demand for wireless broadband". 13 June 2013. https://circabc.europa.eu/d/a/workspace/SpacesStore/c7597ba6-f00b-44e8-b54d-f6f5d069b097/RSPG13-521_RSPG%20Opinion_on_WBB.pdf
- ⁴³ European Commission. Europe loves Wi-Fi: new study recommends more spectrum should be made available. Press release, 1 August 2013. http://europa.eu/rapid/press-release_IP-13-759_en.htm
- ⁴⁴ Plum. Future proofing Wi-Fi – the case for more spectrum. A report for Cisco, January 2013
http://www.plumconsulting.co.uk/pdfs/Plum_Jan2013_Future_proofing_Wi-Fi.pdf
- ⁴⁵ E-Communications Household Survey, August 2013
- ⁴⁶ Brian Williamson. Over-the-top – hindering or helping achieve European Digital Agenda goals? Plum Insight, April 2013. http://www.plumconsulting.co.uk/pdfs/Plum_Insight_April2013_Over_the_top_-_hindering_or_helping_achieve_Europ....pdf
- ⁴⁷ European Commission. Safeguarding the open internet for all. Neelie Kroes blog, 18 July 2013.
<http://blogs.ec.europa.eu/neelie-kroes/open-internet/>
- ⁴⁸ European Commission. Copyright: Commission proposes easier music licensing in the Single Market. Press release, 11 July 2012. http://europa.eu/rapid/press-release_IP-12-772_en.htm
- ⁴⁹ The Economist. All eyes on the sharing economy. Technology Quarterly: Q1 2013. 9 March 2013.
<http://www.economist.com/news/technology-quarterly/21572914-collaborative-consumption-technology-makes-it-easier-people-rent-items>
- ⁵⁰ For example the Food and Drug Administration (FDA) did not object to visual self-analysis of test strips for urine it did object to analysis of strips using a smartphone camera and app since this was deemed to constitute "medical device". Wired (2013). FDA can't hold back stream of mobile health apps. 6 March 2013.
<http://www.wired.com/business/2013/06/fda-gets-pissy-with-urinalysis-app/>