A policy toolkit for the app economy - where online meets offline

Brian Williamson, Yi Shen Chan & Sam Wood

March 2016

About Plum

Plum offers strategy, policy and regulatory advice on telecoms, spectrum, online and audio-visual media issues.

This study

This study was funded by a Fortune 500 consumer electronics, software and online services company.
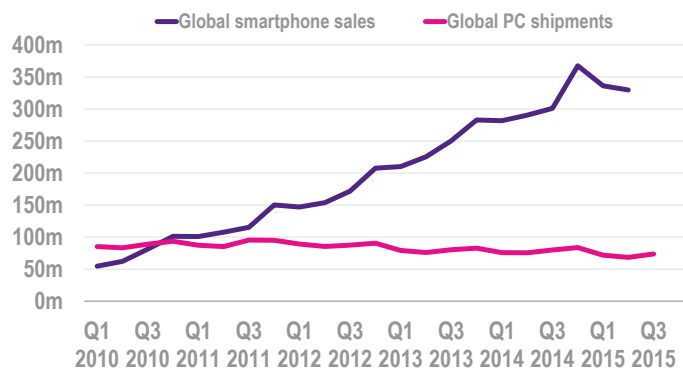
Table of Contents

Executive Summary

Globally the smartphone business dwarfs the PC business. The smartphone's ubiquity and growth in apps means they are key enablers of economic and social progress.

Smartphone sales growing, PC sales declining

Sales to end users

Source: Plum Consulting, Gartner

Smartphone sales overtook PC sales in 2010 and are now five times greater.

Europe is on track to near universal smartphone adoption and app developer revenues are a third of the global total. App economy jobs in Europe have been estimated at 1.64 million. Mobile-apps are a European success.

Europe makes up a third of global app revenues

Apple and Google. Excludes contract app revenues
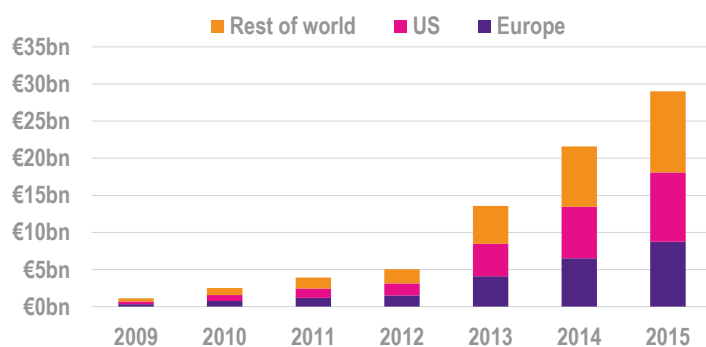
Source: Plum Consulting, Apple, Google

App store revenues for European apps reached €8.75bn in 2015

The development of mobile-apps centric computing is dependent on platforms, including apps stores, which have lowered the costs of development, discovery and monetisation. Apps have also become platforms. For example, Facebook Messenger supports Uber – itself a platform.

European strength extends beyond mobile-apps to include hardware which is complementary to apps, particularly in relation to the personal internet of things and health and fitness related hardware.

CardioSecur – personal ECG

Based in Germany, has developed a mobile clinical grade ECG device for smartphones and tablets. CardioSecur monitors the heart's activity anytime, anywhere. It provides simple feedback and for data to be shared a doctor.

Withings – personal health and fitness

Based in France, Withings offer a range of personal health and fitness devices and apps including scales, fitness trackers, a wireless blood pressure monitor and a thermometer (pictured) announced at the 2016 CES. These devices enable health and fitness information to be shared wireless to an app, tracked and potentially shared with a doctor.

Europe has done well in terms of mobile-apps and complementary hardware innovation. However, the larger prize is the effective use of mobile-apps to improve economic and social outcomes. The relatively greater importance of use versus production is illustrated by the case of information and communications technology in the pre mobile-apps era. We expect the mobile-apps era to mirror this.

ICT-driven productivity growth

Average 1997-2007

■ ICT using - services ■ Communications and computer services ■ ICT producing - manufacturing
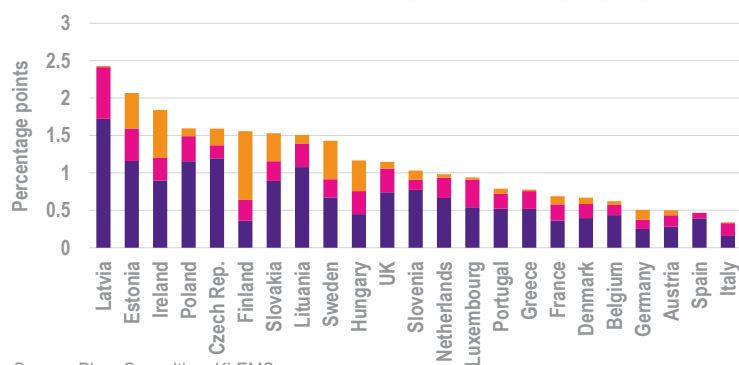
Source: Plum Consulting, KLEMS

ICT, mostly via the use of ICT, has made a substantial, but varied, contribution to overall productivity growth in Europe.

Information and communications technology has made substantial contributions to productivity growth, and productivity growth is the only sustainable source of income and leisure growth. Historical evidence shows that productivity gains have not come at the expense of overall employment.

Growth in adoption of existing mobile devices and apps alone would be transformative, but coupled with ongoing innovation it is revolutionary. Mobile, apps, wireless connectivity and cloud is the latest wave of information and communications technology, and is extending the reach of connected computing to new users and new areas, from home heating to car sharing.

Tado – smart thermostat and app

Tado, a German company, developed a smart thermostat-app. A study estimated savings of around 14-26% for heating. If adopted by 25% of households in Europe heating cost savings would be €14bn with greenhouse gas emission reduction worth an additional €5bn per annum.

BlaBlaCar – car sharing app

BlaBlaCar, established in France, was valued at €1.4 billion in September 2015. Blablacar has 20 million members and operates in 19 countries.

The smart thermostat example illustrates the potential for benefits of the use of apps to greatly exceed developer revenues. The rapidly developing peer-to-peer economy also illustrates the potential of apps and the policy challenge. New approaches may threaten existing interests and prove incompatible with rules adapted to past technology and business models.

Given the scope for mobile-apps to transform previously offline activity, review of the rules throughout the economy should be a key part of digital policy. Further, given the scope for platforms to govern markets and protect consumers by utilising information, for example via journey recording by ride sharing platforms, a level playing-field for regulation may not be appropriate.

The role of information in delivering productivity gains also extends to government. Governments hold information that is valuable for developers and which should be freely available. Governments should also open services, for example health services, to information individuals may collect (for example, using wearables) to promote efficiency and the personalisation of services. We propose a set of principles, illustrative reforms and institutional approaches to reform below.

Guiding principles

1 Take account of technology & market change

• A shift to mobile-apps at the centre of a growing ecosystem
• A shift from things going online to online blending with offline
• A shift to platform & ecosytem governance addressing 'market failure'

2 Factor the pace of change into decision making

• Avoid hasty intervention
• Focus on dynamic benefits and the consumer, rather than producer interests
• Carry out a zero-based review throughout the economy to support innovation

3 Apply a set of policy principles

• Allow innovation (without regulatory permission) where possible
• Aim for technology agnosticism in in the delivery of policy goals
• Separate social and regulatory functions and utilise horizontal approaches

4 Take account of private market governance

• Take account of private governance including use of data to protect consumers
• Assess costs & benefits of regulation including crowding-out marekt governance
• Accept that one size may not fit all taking acocunt of private governance

Illustrative policy proposals

1 Adapt metrics & targets to the pivot to mobile-apps

- Measure smartphone adoption & index openness to disruptive innovation
- Emphasise ubiquitous wireless access & open government data in target setting
- Review current targets given mobile-apps (e.g. smart thermostats vs. meters)

2 Adapt policy in response to, & to faciliate, innovation

- Level regulation down where innovation increases competitition (e.g. OTT)
- Reform services regulation taking account of peer-to-peer governance (e.g. taxis)
- Align hardware approvals with software innovation (e.g. medical devices & apps)

3 Adopt a cautious approach to intervention

- Rely on competition law in addressing competition concerns in digital markets
- Consider unintended consequences for data security
- Consider unintended consequences of data localisation requirements

4 Facilitate data infrastructure & use

- Promote open governernment data by default & more consistent data across Europe
- Ensure data protection, in particular via encryption
- Allows citizen to input data to personalise & improve services including health services

Institutional approach to reform

1 Champion disruptive innovation

- Speak in support of innovative business models
- Develop & share case study examples
- Estimate & publicise the benefits of disruptive innovation for the whole economy

2 Speed up policy adaptation

- Monitor developments in other markets & anticipate the need for change
- Review existing rules rather than seeking to extend them
- Open a dialogue with innovators (e.g. in relation to peer-to-peer models)

3 Promote policy contestability

- Recognise role of market in providing governance
- Include consideration of governance by market in appraisal proceedures
- Support nudge & challenge role for competition authorities regarding regulation

4 Remove barriers to disruptive innovation throughout the economy

- Utilise cross cutting review processes, for example, productivity reviews
- Utilise mutual recognition to open up servic es markets to innovation
- Include consideration of impact on digital diffusion in appraisal proceedures

1 The global mobile-apps revolution

1.1 Smartphones deliver ubiquitous personal computing

Sales of multi-touch smartphones, introduced in 2007, now vastly exceed PCs (Figure 1-1). Not only is this growing the number of users, it is also expanding the pool of more advanced devices.

Figure 1-1

Smartphone sales growing, PC sales declining
Sales to end users

Source: Plum Consulting, Gartner
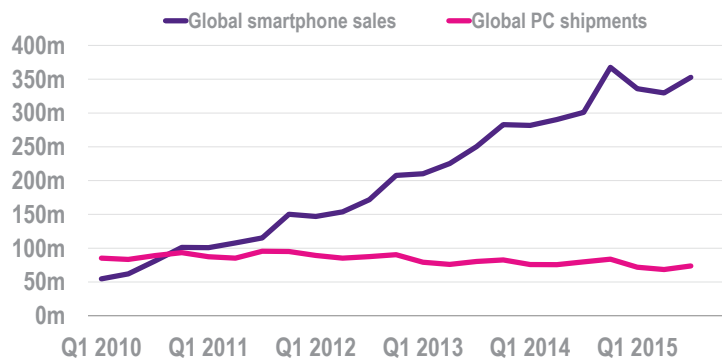
Smartphone sales overtook PC sales in 2010 and are now five times greater

Smartphone and tablet adoption has grown rapidly in the US, with smartphone ownership poised to overtake PC ownership (equivalent time series data for Europe was not available).

Figure 1-2

US smartphone and tablet adoption growing
% of US adults owning device

Source: Plum Consulting, Pew Research Center
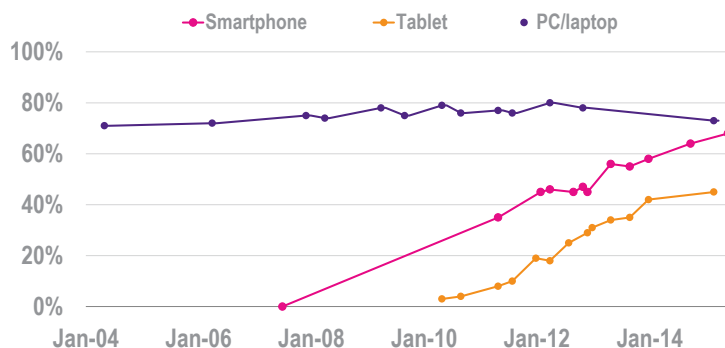
As of July 2015, 68% of US adults have a smartphone

1.2   Apps drive smartphone adoption

The introduction of apps stores from 2008 led to explosive growth in apps availability (Figure 1-3).

App store downloads have grown rapidly

Cumulative app store downloads, Apple and Google. Midyear estimates
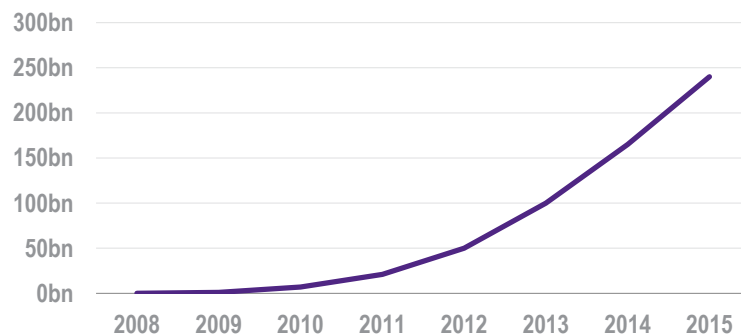
Since 2008 there have been over 250 billion app downloads

Source: Plum Consulting, Apple and Google app stores

1.3   Attention is shifting to mobile-apps

Time spent on mobile devices in the US has overtaken that spent on PCs (Figure 1-4).[1] Existing internet companies have adapted by adopting 'mobile first' strategies. For example, Facebook saw its mobile share of revenues grow from zero to 80% by Q4 2015.

Time spent on mobile overtakes other devices

Per adult per day. US data.
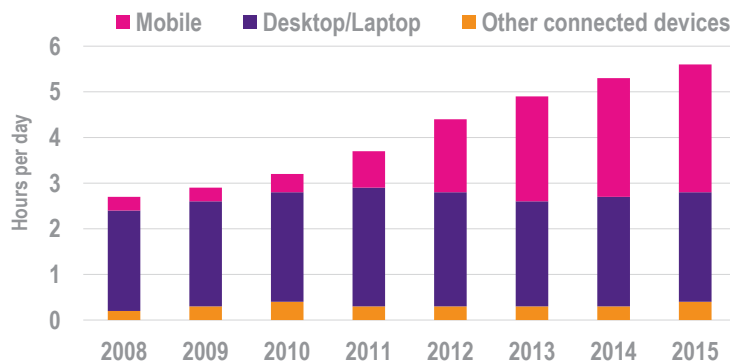
In the US time spent on mobile has risen rapidly to outstrip that on PCs.

Source: Plum Consulting, KPCB Internet Trends

---

[1] Mary Meeker. "Internet Trends 2015." http://www.kpcb.com/internet-trends

2 European success in the mobile-apps era

Europe has seen rapid adoption of smartphones, and after a late start 4G network coverage is growing rapidly. Perhaps less well known is the fact that Europe has a vibrant and globally successful developer community spanning apps and complementary hardware, in particular devices related to the personal internet of things.

2.1 European app developers earn a sizeable share of global app revenues

App store revenues attributable to European developers are 30% of the global total (Figure 2-1).[2]

Figure 2-1

Europe makes up a third of global app revenues
Apple and Google. Excludes contract app revenues
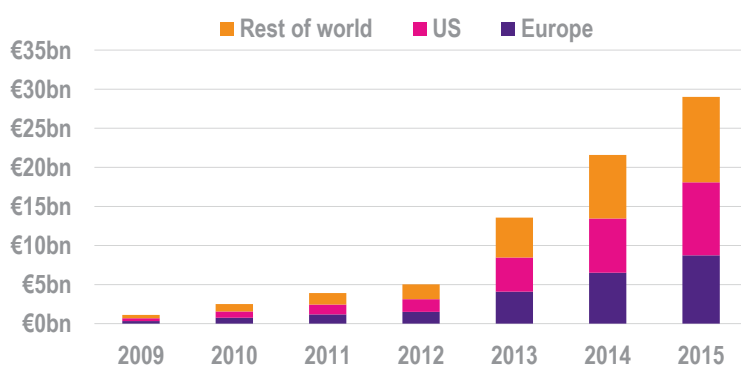
App store revenues for European apps reached €8.75bn in 2015

Source: Plum Consulting, Apple, Google

App store revenues are, however, a partial measure of developer scale since they exclude app developer revenues for enterprise customers under contract, and apps provided free via app stores e.g. Microsoft Office apps and the route planning app CityMapper.

Associated app economy jobs have been estimated at 1.64 million.[3]

2.2 Complementary hardware development is a European success too

Extensions to mobile apps include payments, medical and fitness devices, smart thermostats and location beacons. Figure 2-2 highlights European strength in this area.

---

[2] Based on Apple and Google news releases. Google numbers prior to 2014 calculated using AppAnnie 2013 Retrospective. Converted to Euros using the USD/EUR exchange rate as of 11/11/2015. The 30% European share is for the end of 2014 based on https://www.apple.com/uk/job-creation/

[3] Mandel. 2016. "App Economy Jobs in Europe." http://www.progressivepolicy.org/blog/app-economy-jobs-in-europe-part-1/

Figure 2-2: Devices that extend the capability of mobile-apps

Estimote – location beacons

Based in Poland and New York, offers iBeacons and a software development kit that enable micro location including indoor environments. The Wayfindr application under evaluation on the London Underground enables partially sighted people to navigate using an app and the beacons.

CardioSecur – personal ECG

Based in Germany, has developed a mobile clinical grade ECG device for smartphones and tablets. CardioSecur monitors the heart's activity anytime, anywhere. It provides simple feedback and for data to be shared a doctor.

Withings – personal health and fitness

Based in France, Withings offer a range of personal health and fitness devices and apps including scales, fitness trackers, a wireless blood pressure monitor and a thermometer (pictured) announced at the 2016 CES. These devices enable health and fitness information to be shared wireless to an app, tracked and potentially shared with a doctor.

iZettle – payments system

Based in Sweden, iZettle developed a payments system including hardware, app and vendor software; and integration with the party accounting software Xero. In 2015 iZettle raised €60 million on a €500 million valuation.[4]

Tado – smart thermostat and app

Tado, a German company, developed a smart thermostat-app. A study estimated savings of around 14-26% of heating energy consumption.[5] Access to local weather forecast data allows heating needs to be anticipated, allowing greater savings. If adopted by 25% of households in Europe heating cost savings would be €14bn with the value of greenhouse gas emission reduction valued at an additional €5bn per annum[6] – more than overall app developer revenues in Europe. In Switzerland smart thermostats are eligible for subsidy.

---

[4] FT. August 2015. "Swedish payments company iZettle raises €60m on $500m valuation."
http://www.ft.com/cms/s/0/7346328a-4ce2-11e5-9b5d-89a026fda5c9.html#axzz3wezDisPU

[5] Fraunhofer Institute for Building Physics IBP. 2013. "Simulation study on the energy saving potential of a heating control system featuring presence detection and weather forecasting."
http://www.ibp.fraunhofer.de/content/dam/ibp/en/documents/ResearchNews/IM-527_englisch_web.pdf

[6] Brian Williamson, Yi Shen Chan and Sam Wood. 2015. "All About that App." Page 27.
http://www.plumconsulting.co.uk/pdfs/Plum_March_2015_All_about_that_app.pdf

2.3   Growth in wireless data connectivity is rapid and ongoing

Mobile broadband take-up (individuals) has overtaken fixed broadband take-up (households), as shown in Figure 2-3.[7] Further, 10% of households were smartphone-only by 2014.[8]

Figure 2-3

Mobile access has overtaken fixed access

Broadband takeup, EU
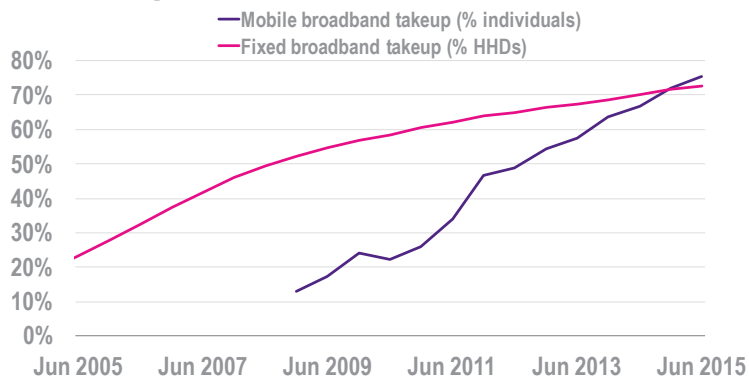
Mobile is helping drive digital inclusion as smartphone adoption outgrows fixed broadband adoption

Source: Plum Consulting, Digital Agenda, Eurostat

4G coverage, which initially lagged that in the US, is expanding rapidly in Europe (Figure 2-4).

Figure 2-4

EU 4G coverage - late start, rapid growth

% of households
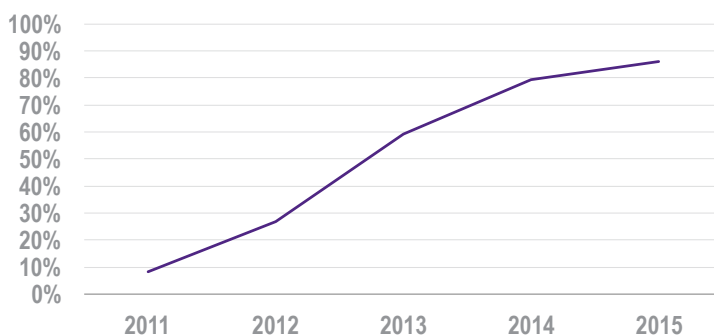
The coverage and quality of wireless will continue to improve, supporting use of connected apps

Source: Plum Consulting, Digital Agenda

---

[7] European Commission. https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators/visualizations Fixed broadband take-up factored by household size data from Eurostat.

[8] European Commission. March 2014. "E-Communications and Telecom Single Market Household Survey." Special Eurobarometer 414. http://ec.europa.eu/public_opinion/archives/ebs/ebs_414_en.pdf

App developers will increasingly build apps which utilise such connectivity.[9] Innovation and additional radio spectrum are also allowing double-digit mobile traffic growth to be accommodated without increasing costs.

2.4   Smartphone adoption is expected to be around 90% by 2020

Smartphone adoption in the EU-5 is similar to that in the US.[10] Figure 2-5 shows projections for the EU and those countries with the highest (Sweden) and lowest (Bulgaria) adoption in Europe.[11]

Figure 2-5

Smartphone penetration projection

Subtitle
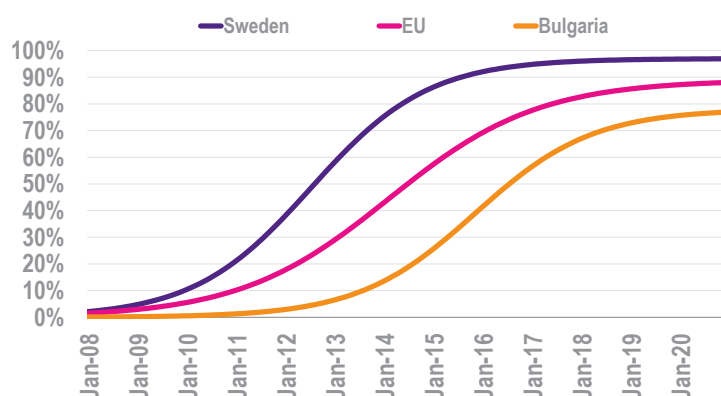
Smartphone take-up is growing rapidly and converging on near universal adoption

Source: Plum Consulting

Digital inclusion policy needs to adapt to the shift in technology given the ease of use and robustness of mobile operating systems and user interfaces compared to the PC and mouse.[12]

Over 100 million adults in Europe had not used in the internet in the past three months in 2015, though the variation in use suggests that substantial progress could be made if the right approach were adopted (Figure 2-6).[13]

---

[9] Ericsson. August 2015. "App coverage." http://www.ericsson.com/res/docs/whitepapers/wp-app-coverage-update.pdf

[10] Asymco. 2013. "When will the European Union Five reach smartphone saturation?"
http://www.asymco.com/2013/10/16/when-will-the-european-union-five-reach-smartphone-saturation/

[11] The projections utilise smartphone penetration data from the Eurobarometer E-Communications and Telecom Single Market Household Survey as a baseline. The end point is based on internet use data from Eurostat, on the assumption that half of the gap in internet use will be closed by 2020 (which is broadly in line with historic growth in internet adoption). Based on the start and end points we fit a logistic curve (a standard curve for the adoption of innovations). Levels of adoption diverge and then converge. Ultimately we would expect almost all adults in Europe to have a smartphone.

[12] Williamson and Wood. March 2015. "Mobile inclusion – a digital future for all."
http://www.plumconsulting.co.uk/pdfs/Plum_March_2015_Mobile_inclusion_-_a_digital_future_for_all.pdf

Kenny and Milne. May 2014 "Mobile: A powerful tool for Digital Inclusion." http://www.commcham.com/pubs/2014/5/12/mobile-as-a-tool-for-digital-inclusion.html

[13] Eurostat. Internet Use statistics. http://ec.europa.eu/eurostat/web/information-society/data/main-tables

Figure 2-6

Wide divergence in European internet use

% of individuals who used the internet in the past 3 months. 2015

● **Highest EU country**   ● **Lowest EU country**

107 million Europeans – 21% – had not used the internet in the past 3 months in 2015
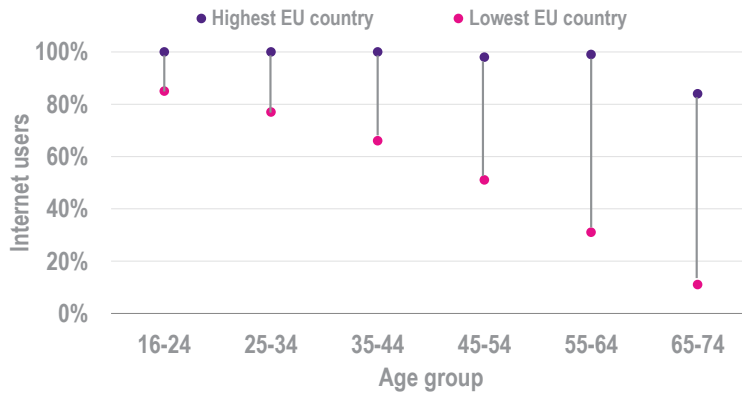
Source: Plum Consulting, Eurostat

Smartphone and tablet adoption is likely to become a key means by which those who are not online get online, thereby helping to close the internet adoption gap. Policy measures should support this.

2.5   Developer revenues from app sales are expected to exceed €10bn by 2020

Figure 2-7 shows European app developer revenues and projected revenues from app stores.[14]

Figure 2-7

European app developer revenues

Revenues paid to European developers. Apple and Google stores. Excludes contract app revenues.

European app developer revenues, excluding contract revenues, are projected to reach €11bn by 2020.
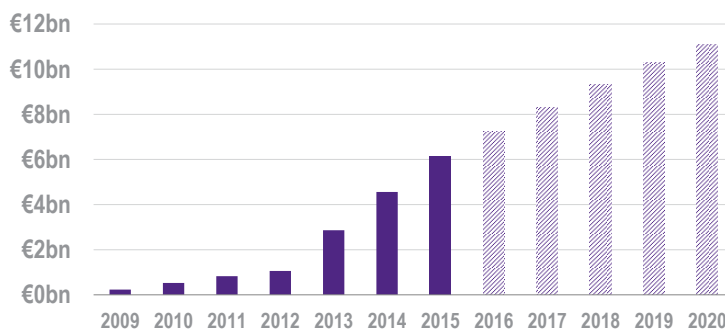
Source: Plum Consulting, Ericsson, Apple, Google

---

[14] Net of the app store revenue share of 30%. Plum projection, based on historic app revenues (Apple and Google) and global smartphone penetration forecast based on the 2015 Ericsson Mobility Report: http://www.ericsson.com/res/docs/2015/mobility-report/emr-nov-2015-regional-report-europe.pdf

Our app store revenues estimates provide a conservative estimate of overall developer revenues. They exclude revenues from outside the Apple and Google apps stores including other app store revenues, contract revenue for enterprise apps development and some (but not all) advertising based developer revenue. These other revenues sources are substantial, but not to our knowledge well estimated.

2.6 Europe is well placed in the emerging area of artificial intelligence

As discussed earlier in this section, European is well placed in terms of app development and complementary hardware, particularly in relation to the personal internet of things. Europe is also well placed in the emerging area of artificial intelligence (AI).

Centres of excellence in artificial intelligence include DeepMind (acquired by Google) in the UK, the Research Centre for Artificial Intelligence in German and a Facebook AI research group in Paris.

Policy takeaway

The pivot to mobile-apps which began in 2008 has, on a range of measures, crossed the tipping point, with smartphone adoption passing 50% and attention on mobile-apps exceeding that on the PC.

Europe is doing well by global standards in terms of smartphone adoption, app developer revenues and complementary hardware development in particular. Europe is also well placed in the emerging area of artificial intelligence, which is augmenting mobile-apps.

Targets, metrics and policy should also be reviewed and updated in light of the pivot to mobile-apps.

3 Apps in the context of a wider ecosystem

"…the ecosystem of ARM, iOS and Android, with 10x the scale of Wintel, will become the new centre of gravity throughout computing. It will take over things like IoT and wearables in one direction and, in due course, the data centre in the other, and it will push onto the desktop."
Benedict Evans, November 2015[15]

Beyond apps, other elements of the ecosystem are undergoing rapid innovation - including mobile devices, operating systems, wireless networks, and cloud storage and processing. Nascent artificial intelligence services now support services such as language translation, image recognition-based search and virtual assistants.

Growth in adoption of existing devices and apps alone would be transformative, but coupled with ongoing innovation it is revolutionary. Mobile, apps, wireless connectivity and cloud is the latest wave of information and communications technology, and is extending the reach of connected computing to new users and new areas.

3.1 Hardware innovation is expanding the potential of apps

Alongside growing smartphone adoption and proliferation of apps, is underlying innovation in hardware, operating systems and apps developer tools. This is enabling more capable apps.

Figure 3-1 shows a non-exhaustive list of Apple hardware and software innovation – with developments in hardware including faster processors, sensors and new forms of interaction often tightly coupled to further developments in software.

Figure 3-1

---
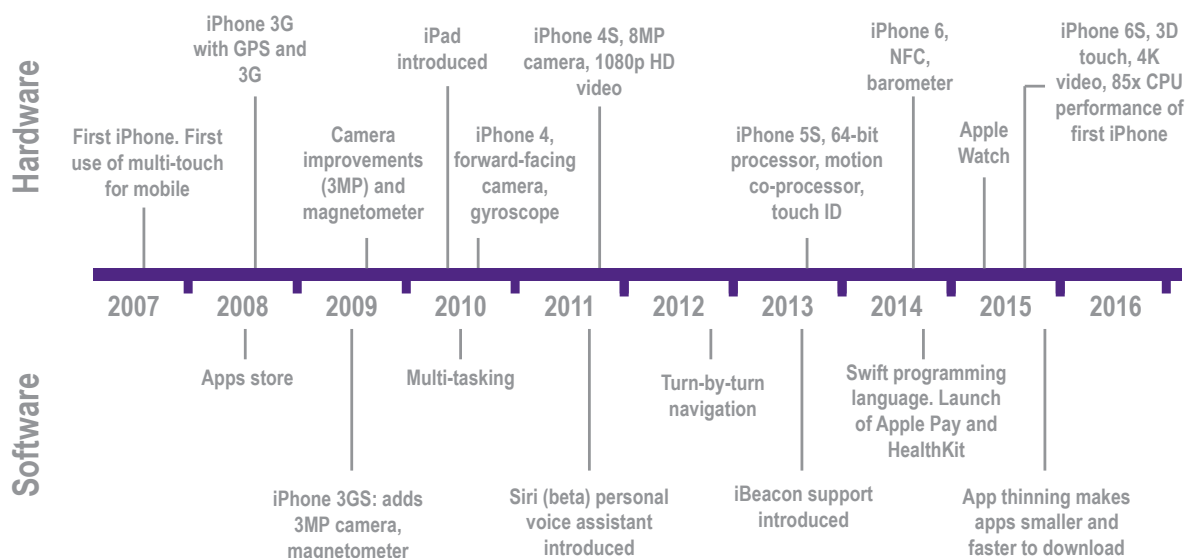
[15] Benedict Evans. November 2015. "Mobile, ecosystems and the death of PCs." http://ben-evans.com/benedictevans/2015/11/7/mobile-ecosystems-and-the-death-of-pcs

Innovation in devices which complement smartphones is also extending the potential benefits of apps. For example, combined with a tiny sensor and wearable insulin pump, a smartphone can stand in for a pancreas, automatically monitoring blood-sugar levels and delivering insulin as needed.[16] The system is under trial.

The parallel development of hardware and software, considered together, extend the reach of computing into the previously analogue world. This greatly extends the reach of computing which, previously, had had the greatest impact on services which could be digitised (such as music and communications) – but which make up a small fraction of overall economic activity. These developments also depend on wireless networks, considered below.

3.2   Apps and networks are independent but complementary

Smartphones and apps extend connected computing to the individual wherever they are. Wireless connectivity – cellular, Wi-Fi and Bluetooth – is further extending the capability and reach of apps. However, the internet and apps have decoupled applications from networks. Voice and messaging services need no longer be integrated, but can operate over-the-top on a network independent basis.

This is not to say networks and apps are not complements and interdependent, merely that they can evolve independent of one another. Further, growth in demand for mobile data driven by video in particular, and demand for more ubiquitous coverage driven by apps such as maps/navigation and services such as peer-to-peer transportation services, is increasing demand and willingness to pay for enhanced connectivity.

From an ecosystem perspective the development of apps and networks are tightly coupled even though network and application innovation and funding are decoupled. Apps developers and consumers benefit from the availability of wireless networks, whilst network owners benefit from the demand for data and ubiquity that applications provide.

3.3   Digital platforms are proliferating

Even though we use the term "platforms" in a broad manner, it is helpful to start with a definition. Hagiu and Wright define multisided platforms as having:[17]

> "…two key features beyond any other requirements (such as indirect network effects or non-neutrality of fees): they enable direct interactions between two or more distinct sides; each side is affiliated with the platform. Broadly speaking, by "direct interaction" we mean that the two or more distinct sides retain control over the key terms of the interaction, as opposed to the intermediary taking control of those terms."

Multi-sided platforms create value by bringing buyers and sellers together and facilitating interactions between them that make all parties better off. App stores are an example. Over 1.5 million apps are now available to consumers and enterprises as a result of apps stores, coupled with hardware,

---

[16] Ars Technica. 2016. "Smartphone-based system does job of pancreas, treats type 1 diabetes."
http://arstechnica.com/science/2016/01/smartphone-based-system-does-job-of-pancreas-treats-type-1-diabetes/

[17] Andrei Hagiu and Julian Wright. March 2015. "Multi-Sided Platforms." Harvard Business School Working Paper 15-037.
http://www.hbs.edu/faculty/Publication%20Files/15-037_cb5afe51-6150-4be9-ace2-39c6a8ace6d4.pdf

operating system and developer tool innovation. App stores bring buyers and sellers together and lower the cost of transacting by:

- Lowering distribution costs for developers and discovery costs for consumers.

- Allowing payment for consumers and lowering monetisation costs for developers.

- Building trust via the vetting of apps for security and privacy.

- Promoting interface coherence and simplifying the user experience across apps.

As the Chairwoman of the FTC noted:[18]

> *"A platform provider has strong incentives to make its platform as attractive as possible to maximize its value to participants."* Edith Ramirez, Chairwoman, FTC

Apps may themselves become platforms, and apps riding on apps may also be platforms. The relationships are constantly evolving. For example, Uber - a peer-to-peer transportation service platform - is available on Facebook Messenger[19], which has opened up as a platform for third party developers.[20] Facebook Messenger is, in turn, available on Apple, Google Play, Microsoft Windows and Blackberry app stores.

Platforms also help SMEs to trade online by providing a range of scalable services.[21] E-commerce apps are also platforms, and an area where European start-ups have seen considerable success.[22] Examples include Zalando (Germany), Farfetch (UK), Yoox Net-a-Porter (Italy) and Delivery Hero (Swedish).

Platforms also face competition from single-sided firms e.g. bricks and mortar retailers, and other multi-sided platforms that may or may not compete on all the same sides of the market.[23] Digital platforms face a particularly dynamic and competitive environment, facing potential market entry and consumers' ability to 'multi-home' – that is, to use more than one service on a given device. A CERRE report concluded that at this stage of their development specific rules for online platforms were not justified.[24]

Finally, platforms also provide services in terms of market governance that complement and substitute for regulation. For example, peer-to-peer network transportation service platforms utilise identity, location data and ratings to reduce information asymmetries, thereby performing what was previously

---

[18] Edith Ramirez. October 2015. Speech. 42nd Annual Conference on International Antitrust Law and Policy, Fordham Law School. https://www.ftc.gov/system/files/documents/public_statements/810851/151002fordhamremarks.pdf

[19] Facebook. December 2015. "Introducing Transportation on Messenger." http://newsroom.fb.com/news/2015/12/introducing-transportation-on-messenger/

[20] https://www.messenger.com/platform
Wired. November 2015. "One app to run your life." http://www.wired.co.uk/magazine/archive/2015/11/features/inside-facebook-messenger

[21] Marks, Adshead, Williamson, Sassoon and Professor Ian Jewitt. July 2010. "Online markets discussion paper." http://webarchive.nationalarchives.gov.uk/20140402142426/http://www.oft.gov.uk/shared_oft/market-studies/onlinemarketsdiscussionpaper

[22] The Analyst. November 2015. "EUROPEAN ECOMMERCE." http://www.ccianet.org/wp-content/uploads/2015/11/European-Ecommerce_Investment_Study.pdf

[23] David S. Evans and Richard Schmalensee. December 2012. "The Antitrust Analysis of Multi-Sided Platform Businesses" University of Chicago Law School. http://www.law.uchicago.edu/Lawecon/index.html

[24] Alexandre de Streel and Pierre Larouche. January 2016. An integrated regulatory framework for digital networks and services." http://www.cerre.eu/sites/cerre/files/160127_CERRE_IntegratedRegulatoryFramework_Final_1.pdf

a regulatory function. The role of information is considered further in Section 5 whilst market and regulatory governance by platforms is considered further in Section 6.

3.4 An ecosystem view of mobile, apps and platforms

Apps and apps stores are part of a broader ecosystem with a complex set of relationships, degrees of integration, openness and interoperability between devices, operating systems, app development languages, wireless connectivity, the cloud and rapidly developing artificial intelligence (AI). Hazlett *et al* set out the ecosystem concept:[25]

> *"Within an ecosystem, the health and vitality of each firm is dependent on the health and vitality of all firms in the ecosystem, although some more than others... The viability of an ecosystem depends, when network externalities exist, on critical mass, productivity, innovation, learning and cooperation. An ecosystem "manager" or "host" is also a critical success factor, especially in digital markets that require compatibility standards (coordination) and complementary services to achieve full functionality. Ecosystems allow, and benefit from, specialized niche players."*

From this broader ecosystem perspective technology companies have an interest in defining the relationship amongst the component parts of the system in manner that promotes efficiency and innovation across the overall ecosystem.

Policy takeaway

Apps are part of wider and growing ecosystem including increasingly sophisticated smartphones and sensors, wireless networks, apps stores, wearables and other devices. This ecosystem is co-evolving with competing platforms seeking an efficient set of rules both to promote innovation and to govern the market and protect consumers.

Platforms are diverse and constantly evolving, and should be judged according to how they behave and how this affects consumers. Market governance, including what should be tightly coupled versus interoperable and open, is also evolving – there are no clear generally applicable *per se* rules that would unambiguously promote efficiency. *Ex post* competition law is the appropriate framework to govern the market.

Further, platforms play a key role in addressing information asymmetries and providing consumer protection. Rather than extending existing regulation, it should be reviewed in light of these new approaches to market governance.

---

[25] Hazlett, Teece and Waverman. November 2011. "Walled garden rivalry: the creation of mobile network ecosystems."
http://www.law.gmu.edu/assets/files/publications/working_papers/1150WalledGardenRivalry.pdf

4 The transformative impact and potential of apps

Mobile-apps have grown rapidly following the launch of apps stores in 2008, with developer revenues reaching close to €30 billion in 2015. The benefits of apps use range from entertainment to health, time savings and enterprise productivity.

The overall impact is, however, not well measured. Available metrics lag developments in the market, and national productivity statistics are available with a lag and at a high level of aggregation.

To gain an insight into the transformative impact and potential of apps we consider lessons from the history of innovation (and information and communications technology in particular), estimates of the benefits of particular applications that already exist[26], and a qualitative discussion of the potential.

In terms of reaching the potential the underlying building blocks are already established. High levels of smartphone adoption are now a given, as are high levels of coverage of wireless data networks. Other elements, including an app developer community and complementary hardware innovation, are also established.

We can now also glimpse the outlines of a deeper transformation of the economy and society through deep integration of mobile-apps into existing businesses (inside-out transformation) and the creation of new business models and services (outside-in transformation including over the top applications and peer-to-peer services) coupled with a blurring of online-offline boundaries.

4.1 Lessons from the history of innovation and productivity growth

In Western Europe over the past 125 years labour productivity grew 10-fold whilst employment – as a proportion of the population – remained constant at around 45% (Figure 4-1).

Figure 4-1

Labour productivity and employment, Western Europe
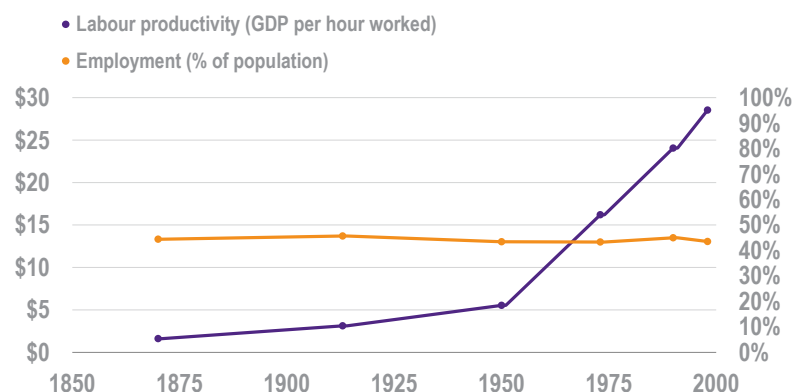
- Labour productivity (GDP per hour worked)
- Employment (% of population)

Over the long-run labour productivity growth has had no impact on aggregate employment

Source: Plum Consulting, OECD

* Weighted average of 12 West European countries

---

[26] Brian Williamson, Yi Shen Chan and Sam Wood. 2015. "All About that App."
http://www.plumconsulting.co.uk/pdfs/Plum_March_2015_All_about_that_app.pdf

Social returns from the 10-fold increase in productivity was divided between increased leisure (working hours halved) and increased income per capita (a 5-fold increase) which resulted in an expansion of private after tax income and of government service provision (Figure 4-2).

Figure 4-2

GDP and hours worked per person, Western Europe
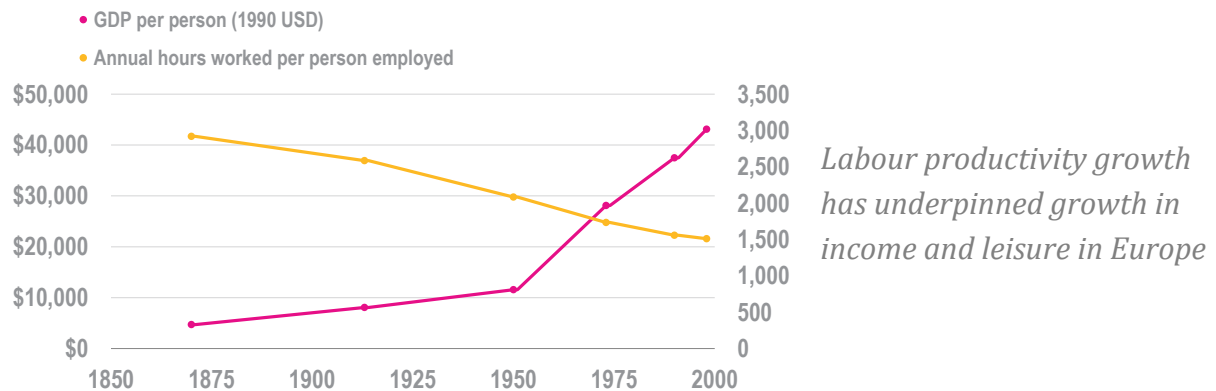
Labour productivity growth has underpinned growth in income and leisure in Europe

Source: Plum Consulting, OECD   * Weighted average of 12 West European countries

Innovation and productivity growth has enhanced income, government services and the quality of jobs with no loss of overall employment. Productivity growth may also not fully reflect the benefits of free services, increased choice, time savings etc.[27]

Information and Communications Technology (ICT) made a substantial contribution to productivity and income growth from the mid 1990's (Figure 4-3).

Figure 4-3

ICT-driven productivity growth
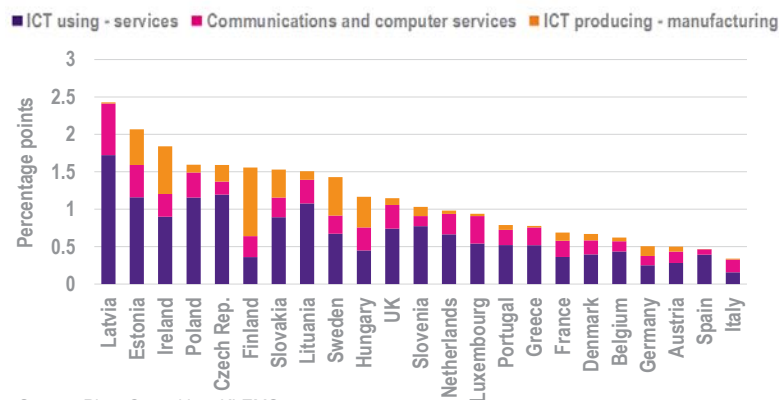
Average 1997-2007

ICT, mostly via the use of ICT, has made a substantial, but varied, contribution to overall productivity growth in Europe

Source: Plum Consulting, KLEMS

---

[27] WSJ. July 2015. "Silicon Valley Doesn't Believe U.S. Productivity Is Down" http://www.wsj.com/articles/silicon-valley-doesnt-believe-u-s-productivity-is-down-1437100700

Figure 4-3 shows that the use of ICT, rather than the production of ICT, was the predominant source of benefit (the share of ICT in the economy in Europe and the US is similar, but the US has made more effective use of ICT). The benefits of ICT also took time to develop, as new ways to organise economic activity around connected computing had to be found (as opposed to the initial step which tended to involve bolting ICT onto existing approaches).[28]

Recent evidence for the US suggests a slowdown in the growth contribution from ICT.[29] In part this may reflect a lag in realising the full benefits from the shift from fixed to mobile computing. It may also reflect the fact that vested interests may have had some success in delaying a deeper transformation of the economy, and that it takes time for policy makers to catch-up.

Concern has also been expressed regarding the distribution of benefits.[30] However, increased returns to capital will not necessarily drive rising inequality,[31] and past productivity accelerations have seen only a temporary increase in the skills premium.[32] Further, the vast majority of the benefits of innovation go to consumers rather than producers:[33]

> *"…only a miniscule fraction of the social returns from technological advances over the 1948-2001 period was captured by producers, indicating that most of the benefits of technological change are passed to consumers rather than captured by producers."*

Concern over the impact of innovation is not new. Elizabeth I refused a patent to William Lee who invented knitting machine in 1589, saying to him:

> *"Thou aimest high, Master Lee. Consider thou what the invention could do to my poor subjects. It would assuredly bring to them ruin by depriving them of employment, thus making them beggars."*

William Lee eventually moved to France. In England the Worshipful Company of Framework Knitters was eventually incorporated under Oliver Cromwell in 1657, and the rest is history. This time it may be different. However, innovation is not new and has delivered overall benefits in the past.

The benefits from use of innovations such as the peer-to-peer economy may also be captured disproportionately by those on lower incomes.[34] They may expand their consumption through rental – for example, people who could not afford a car may gain access to one by using car sharing platforms. Moreover, some may buy better quality products anticipating the gains from renting them out on sharing platforms. The peer-to-peer economy may also serve customers and areas not previously well served.[35]

---

[28] Paul A. David and Gavin Wright. 1999. "General Purpose Technologies and Surges in Productivity: Historical Reflections on the Future of the ICT Revolution." http://www.nuffield.ox.ac.uk/economics/history/paper31/a4.pdf

[29] Fernald. June 2014. "Productivity and Potential Output - Before, During, and After the Great Recession." http://www.frbsf.org/economic-research/files/wp2014-15.pdf

[30] http://openletteronthedigitaleconomy.org/

[31] Mankiw. 2015. "Yes, r > g. So what?" https://www.aeaweb.org/aea/2015conference/program/retrieve.php?pdfid=520

[32] Jovanovic and Rousseau. 2005. "General purpose technologies." http://www.nyu.edu/econ/user/jovanovi/JovRousseauGPT.pdf

[33] Nordhaus. April 2004. "Schumpeterian Profits in the American Economy: Theory and Measurement." http://www.nber.org/papers/w10433

[34] Arun Sundararajan. Oct 2015. "Peer-to-Peer Rental Markets in the Sharing Economy". http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2574337

[35] FiveThirtyEight. August 2015. "Uber Is serving New York's outer boroughs more than taxis are." http://fivethirtyeight.com/features/uber-is-serving-new-yorks-outer-boroughs-more-than-taxis-are/

4.2   Inside-out enterprise transformation

Inside-out transformation refers to the adoption by existing business of mobile apps as a way of transforming their business from the inside. Business processes have tended to rely upon desktop solutions and legacy software and hardware, if they were digitised at all. While businesses have utilised mobile over two decades, they have only recently progressed beyond the baked-in application set of messaging, calendar and contacts.

However, there are now indications that the enterprise apps market, after lagging the consumer market, is growing rapidly.[36] Because enterprise apps include a growing number of apps developed within businesses or under contract, they are not visible within apps stores or included in app store developer revenues. However, enterprise related mobile revenues are growing rapidly:

> *"We estimate that enterprise markets accounted for about 25 billion dollars in annual Apple revenue in the last twelve months, up 40 percent over the prior year, and they represent a major growth vector for the future."* Tim Cook, Apple Conference Call Q4 2015

The availability of apps primarily or exclusively designed for enterprise use – ranging from app available in apps stores to specialist off-the-shelf apps is growing fast. Microsoft Office was only comparatively recently made available for mobile with Office made available on a cross-platform basis for iOS and Android phones in mid-2013. Some other examples are given below.

Slack – business collaboration app

Slack launched in August 2013, was valued at $2.8 billion in March 2015 and had 1.7 million daily active users and 470,000 paid users by October 2015.[37] Slack is also a platform allowing integration with other apps and supporting app development and discovery.[38]
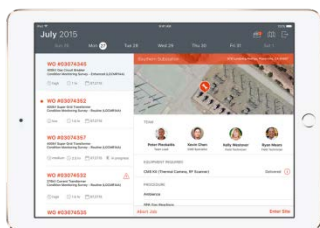
Apple-IBM enterprise app partnership

Apple and IBM announced a partnership in July 2014[39] to develop enterprise apps. Over 50 apps are available,[40] spanning finance, utilities, electronics, employee engagement, utilities, government, healthcare, industry, insurance, retail, telco and transportation.[41] An example is "Asset Inspect" which supports field technicians to inspect infrastructure whilst enhancing safely and efficiently.[42]

Bespoke apps built for a particular client also offer solutions, and typically involve reengineering of business processes alongside app development. To gain an insight into this we spoke to enterprise app developer Mubaloo. Illustrative case studies are provided below.

---

[36] Red Hat. January 2016. "Red Hat Survey: Mobile Investments Are Paying Off." http://www.redhat.com/en/about/press-releases/red-hat-survey-mobile-investments-are-paying

[37] http://uk.reuters.com/article/2015/11/10/us-websummit-slack-idUKKCN0SZ16I20151110

[38] http://slackhq.com/post/134878632730/launch-platform

[39] Apple. July 2014. "Apple and IBM Forge Global Partnership to Transform Enterprise Mobility."
http://www.apple.com/pr/library/2014/07/15Apple-and-IBM-Forge-Global-Partnership-to-Transform-Enterprise-Mobility.html

[40] ZDNET. October 2015. "Apple's enterprise push will depend on more than just hardware."
http://www.zdnet.com/article/apples-enterprise-push-will-depend-on-more-than-just-hardware/

[41] http://www.ibm.com/mobilefirst/us/en/mobilefirst-for-ios/

[42] http://www.ibm.com/mobilefirst/us/en/mobilefirst-for-ios/industries/energy-and-utilities/asset-inspect/
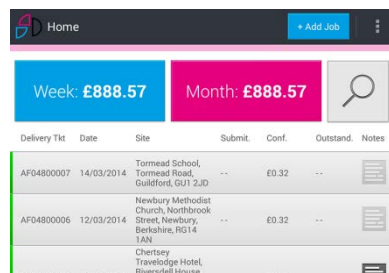
SD Sealants - field force management app

SD Sealants, an established family-run sealant business, eliminated paper work by supporting data entry on site, delivered to head office in real time. The app freed up five hours per worker each week and improved business intelligence.

London Air Ambulance – dispatch app

The app, developed in partnership with mobile operator EE, improved London Air Ambulance's processes and response time. Deployment of the app has allowed the Air Ambulance to cut up to two minutes off dispatch times, giving it a better chance of saving lives and improving patient outcomes.
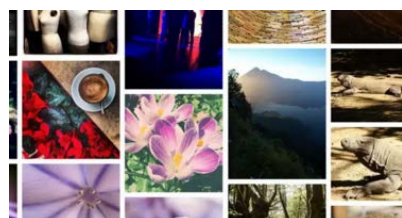
Alamy – stock photo app

Photographers can use the app to tag and upload their photos to Alamy, which distributes the images and pays the photographer. In its first year, 132,000 photos had been submitted and approved via the app. Mobile photos submitted through the app have outgrown photos taken with SLR cameras.

Mubaloo also highlighted future directions in terms of enterprise apps including the use of wearables[43] and location beacons.[44] Beacons support a contextual internet of things which has a wide range of enterprise and other applications including health care. Beacons extend the power of mobile apps by allowing a more immersive interaction with the immediate environment and the ability to track and record those interactions.

4.3   Outside-in economy wide transformation

Outside-in transformation involves a new business model creating a new market and/or partially or completely replacing an existing business model. This type of innovation is likely to bring the greatest benefits, but also the greatest challenges in terms of the need for policy and regulation to adapt to new technology and business models.

Early examples of outside-in transformation involved digitisation of services including music, video and communications. Mobile-apps ushered in an era of widespread adoption of over-the-top communications apps including WhatsApp, Facebook Messenger and Slack. The low cost and

---

[43] Mubalooo. March 2015. "Considerations for Wearables in Enterprise. http://mubaloo.com/wp-content/uploads/2015/03/Considerations-for-Wearables-in-Enterprise.pdf

[44] Mubaloo. April 2015. "Beacons in enterprise – the opportunities. http://mubaloo.com/wp-content/uploads/2015/04/Mubaloo-MiBeacons-in-Enterprise-2015-.pdf

innovative service attributes of over-the-top messaging has seen rapid growth with WhatsApp messaging alone overtaking SMS.[45]

To the extent that mobile operators were dependent on messaging, as opposed to data revenues, over-the-top messaging has proved disruptive for them. However, once tariff structures are rebalanced towards data, over-the-top will drive data and revenue growth.

Regulation has been slow to adapt. Increased competition from over-the-top should see a relaxation of regulation on legacy services. The European Commission took a first step in removing voice origination from the list of 'relevant markets' susceptible to regulation. The review of the Framework for Electronic Communications Networks and Services provides an opportunity to remove communications services from regulation and focus remaining regulation on access bottlenecks.

The experience in relation to over-the-top is illustrative of the impact of new forms of competition on existing business models and of the slowness of policy and regulation to adapt. It provides lessons in anticipating and responding to the online-offline transformation which will impact a much wider segment of the economy.

Mobile-apps are facilitating transformation not just in terms of services going online but via digital complementing "offline" services. Such transformations blur the boundary between online and offline. Given that most economic activity is "offline" (ICT accounts for around 5% of GDP), this new phase of transformation offers the greatest scope for benefits.

Software changes faster than hardware, and software updates can be applied retrospectively. The smart thermostat-app Tado (considered in Section 2) is an example. The benefits from wider adoption of smart thermostat apps alone could exceed overall app developer revenues in Europe. This illustrates that 'use' benefits are the greatest prize. Outside in transformation involving blurring of online-offline boundaries is also illustrated by the example of peer-to-peer transport services.

BlaBlaCar – car sharing app[46]

BlaBlaCar, established in France, was valued at €1.4 billion in September 2015. Blablacar has 20 million members and operates in 19 countries. Passengers cover vehicle running costs. As drivers do not make a profit insurance remains valid and regulation applying to hire car services does not apply.

Taxify – taxi hire app

Taxify, established in 2013 in Estonia, operates in Latvia, Lithuania, Estonia, The Netherlands, Georgia and Finland and plans to open several new countries in Europe. The app connects riders with licensed taxis.

Peer-to-peer transportation apps, including Uber and Heetch, have proved contentious - but offer substantial benefits[47] (not all of which are necessarily reflected in GDP[48]). Peer-to-peer services may

---

[45] The Economist. March 2015 "The message is the medium." http://www.economist.com/news/business/21647317-messaging-services-are-rapidly-growing-beyond-online-chat-message-medium

[46] FT. September 2015. "BlaBlaCar zooms ahead with $200m investment valuing it at €1.4bn." http://www.ft.com/cms/s/0/24d1ac00-5c74-11e5-9846-de406ccb37f2.html#axzz3sRGTzQaR

[47] European Parliament. January 2016. "The cost of non-Europe in the sharing economy." http://www.europarl.europa.eu/RegData/etudes/STUD/2016/558777/EPRS_STU(2016)558777_EN.pdf

[48] Diane Coyle. January 2016. "The sharing economy in the UK." http://www.sharingeconomyuk.com/perch/resources/210116thesharingeconomyintheuktpdc.docx1111.docx-2.pdf

extend to delivery and passenger pooling[49], and widespread adoption could see reduced car ownership. Peer-to-peer models are also being explored in the trucking industry.[50] Apps will also play a role in relation to self-driving vehicles. French company Easzymile has developed the self-driving EZ10, to be deployed at a business park in California.[51] Peer-to-peer services highlight the need for policy and regulation to adapt to changes in technology.

More generally, over 70% of economic activity in Europe is in the services sector (a substantial share of which is non-tradable). Whilst non-tradable are not part of a single market, they can be provided by businesses operating throughout Europe, and provided more efficiently when information and communications technology, including mobile-apps, is deeply integrated into provision.

In some areas Europe policy is ahead of the US in facilitating cross-border services, for example, in terms of openness to provision of telemedicine services on a cross-border basis.[52] However, to take full advantage of the potential consistent regulation, on a basis which allows innovation, is required. Liberalisation of service markets should therefore be a central part of the digital single market initiative. One way to achieve this is through mutual recognition.[53]

4.4   The challenge of government services transformation

Government services make up 20% of GDP in Europe (excluding income transfers). They do not in general face direct competition, so transformation based on technology including mobile-apps may lag that in the private sector.

Achieving higher levels of digital inclusion by leveraging mobile-apps would open up greater scope for digital services by default, whilst government can leverage information to transform existing services. Richer information could foster innovation in relation to government services including the use of government data by app developers and for the use of personal data to enhance and personalise government services. These opportunities are considered in the next section.

Policy takeaway

The benefits of innovation and new technology relate primarily to its use, not its production. The primary focus of digital policy should therefore be to harness the power of digitisation across the whole economy.

The transformation of enterprise around mobile-apps is at an early stage, whilst apps are now beginning to transform offline activity, particularly via new business models. Challenges include the transformation of government, which will not happen without active management, and reforming regulation throughout the economy which was not designed with digital service models in mind.

---

[49] http://newsroom.uber.com/announcing-uberpool/

[50] WSJ. October 2015. "Startups Accelerate Efforts to Reinvent Trucking Industry." http://www.wsj.com/articles/startups-accelerate-efforts-to-reinvent-trucking-industry-1445918403

[51] "Robot Buses Are Coming To America, To Pave The Way For Driverless Cars." http://www.fastcoexist.com/3052100/robot-buses-are-coming-to-america-to-pave-the-way-for-driverless-cars

[52] The Economist. 2014. "Telemedicine - Stuck in the waiting room". http://www.economist.com/news/international/21623710-long-touted-health-care-revolution-may-last-be-about-arrive-stuck-waiting

[53] John Springford. September 2012. "How to build European services markets." CER Policy Brief. http://www.cer.org.uk/sites/default/files/publications/attachments/pdf/2012/js_markets_sept12-6206.pdf

5   The role of information in transforming services

Mobile-apps, and the wider ecosystem developing around them, facilitate the collection and processing of and access to information. This not only supports new services and offers scope for the transformation of government services, but also allows the role of existing regulation throughout the economy to be re-assessed in light of the ability of platforms to address market governance and information asymmetries. We consider the role of information in relation to government services in this section, and the implications of platform governance of markets for regulation in the following section.

5.1   Personal data and smart services

The trade-offs involved in sharing private information are changing. In the classic "free" business model, information is implicitly traded for free services including search. However, private information is increasingly a direct input to services including government services (personalised health) and private services (artificial intelligence based personal assistants, for example, Siri, Cortana and Google Now).

Artificial intelligence may change the value of sharing personal information. Intelligent agents will be better able to serve users' needs if they know us well. However, increased processing power also allows more to be done locally on a device. Users may therefore be able to get the benefit of artificial intelligence without sharing all their personal information with cloud services. However, whether shared or stored on a device the only effective way to protect users' information is via strong encryption.[54]

Some users may value the benefits they gain from sharing data more than others. A diversity of competing platforms and service ecosystems, with different forms of data governance, might be anticipated. This may be preferable to a one size fits all regulatory approach, and would certainly prove more adaptable as the costs and benefits of sharing data change over time. While baseline regulations on data protection are paramount, these should leave scope for diversity and adaption.

5.2   Open government data and apps

> "The deluge of transport timetables, crime logs, pollution readings, property-tax records and the like has been a boon. It has allowed governments to serve citizens better, powered innovative startups and improved people's lives." The Economist, 21 November 2015[55]

Governments collect and hold a substantial amount of data, much of which does not contain personal information and can be opened up for use by government, app developers and others. By doing so governments may also be able to reduce their costs whilst expanding and improving services.

---

[54] On the possible trade-offs involved with strong encryption see:

Economist. January 2016. "Internet security - When back doors backfire." http://www.economist.com/news/leaders/21684783-some-spy-agencies-favour-back-doors-encryption-software-who-will-use-them-when-back

Abelson *et al*. July 2015. "Keys Under Doormats: Mandating insecurity by requiring government access to all data and communications." http://dspace.mit.edu/bitstream/handle/1721.1/97690/MIT-CSAIL-TR-2015-026.pdf?sequence=8

[55] http://www.economist.com/news/international/21678833-open-data-revolution-has-not-lived-up-expectations-it-only-getting?frsc=dg%7Cc

Innovative use by app developers of open government data includes apps in areas including transport, environment, disaster management, education, weather forecasts, health and public service delivery.
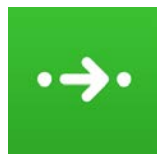
Citymapper – journey planner

Citymapper, launched in 2012, provides journey planning for multiple modes of transport in major cities by collating open data such as static data on transport routes and real time data feeds from transport authorities. Its features include context-aware direction data, 'get off the bus' alerts and cycle routing.

Walkonomics – pedestrian route finder

Walkonomics allows pedestrians to find not just the fastest walking route to any destination, but also the most beautiful, through tree-filled streets and parks. The app, available for eight cities, is built using open data from government and OpenStreetMap. It rates the walkability of streets according to different categories such as road safety, hilliness, fear of crime and cleanliness.

Captain Train – train ticket booking

Captain Train, launched in France after the French National Railway Company was required by the competition authority to make its reservation system available to third parties, offers an efficient interface for booking train tickets. Captain Train now covers train services across Europe including Deutsche Bahn, Eurostar, Thalys and Trenitalia.

Consistent data, both nationally (including all cities for example) and on a pan-European basis, would allow seamless services and maximise the benefits of the single market. For example, CaptainTrain can provide a superior service if data is available from all rail services across Europe.

The key principles of open government data are encapsulated in the G8 Open Data Charter[56] and the International Open Data Charter.[57] In Europe, the Commission's 2013 Directive on the re-use of public sector information require member states to transpose the rules into national legislation.[58]

Progress should be assessed not only in terms of implementation of the Directive, but also in relation to open data outcomes. A number of open data indices could be utilised for this purpose, including the European PSI Scoreboard[59], Open Knowledge Foundation's Global Open Data Index[60], World Wide Web Foundation – Open Data Barometer[61], and the OECD – OUR Data Index.[62]

Of these the Global Open Data Index covers a wide set of countries (122 in 2015) and is appropriate for assessing the range and quality of published government data. Figure 5-1 shows the rankings of the US and EU countries based on the 2015 Global Open Data Index (not all EU countries are included in the index).

---

[56] G8 Open Data Charter, June 2013
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/207772/Open_Data_Charter.pdf

[57] International Open Data Charter, September 2015 http://opendatacharter.net/wp-content/uploads/2015/10/opendatacharter-charter_F.pdf

[58] EC. September 2015. "Open Data: Commission launches infringement cases due to the late transposition of the revised PSI Directive in 17 EU Member States". https://ec.europa.eu/digital-agenda/en/news/open-data-commission-launches-infringement-cases-due-late-transposition-revised-psi-directive

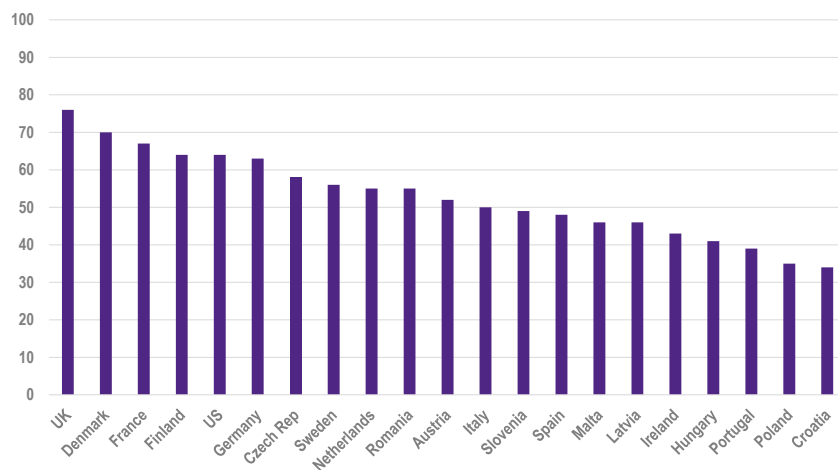[59] http://www.epsiplatform.eu/content/european-psi-scoreboard

[60] http://index.okfn.org/place/

[61] http://barometer.opendataresearch.org/report/analysis/rankings.html

[62] http://www.oecd.org/gov/public-innovation/open-government-data.htm

Figure 5-1

Open data rankings (%), 2015

Source: Plum, Open Knowledge Foundation

Open data also involves the grassroots and community levels. For example, York Council in the UK have built a data portal using an open mapping data API and combined it with information on a range of topics including art and culture, environment, demographics, crime and community safety.[63] Governments should identify key user communities and work alongside open data advocacy groups, start-up incubators, local authorities and user communities to promote data use.[64]

Developers are also developing approaches and tools to support authorities in opening up data, for example, CityMapper are helping transport agencies and city authorities provide appropriate data for their route planning app.[65] The approach to open data needs to be collaborative.

5.3   Ensuring comprehensive open government data availability

Alongside publication of existing data it is important that appropriate data is collected, and that private provision of public services does not deny developers the opportunity to innovate and add value. Valuable information, such as the real-time location of public transport vehicles, may not be available to developers because responsibility for service provision lies with private operators and contractual provision was not made for the collection of such data, or a previously public data base was privatised alongside service privatisation.[66]

---

[63] https://www.yorkopendata.org/

[64] http://opendatatoolkit.worldbank.org/en/demand.html

[65] https://medium.com/@Citymapper/building-a-city-without-open-data-124356672deb#.246awqijc

[66] As happened in the UK with the address database (Postcode Address File) which is now a subscription-only database after it was included in the privatisation of Royal Mail in 2013. BBC. March 2014. "Ministers criticised for sale of postcode database." http://www.bbc.co.uk/news/business-26605375

5.4 Voluntary data sharing by citizens to enhance services

Government services, for example, health care, may be enhanced via individuals sharing data with the government service provider. To allow this, government systems and services need to allow data to be shared whilst also ensuring that it is protected. This is likely to prove a challenging, particularly given that government agencies have weak (financial) incentives to be open and secure. Achieving the desired change will require active management and clear accountability.

An example of a government service empowering medical patients to generate and submit their own medical data to their doctors is iCOR, a collaboration between the Hospital del Mar in Barcelona and Telefónica, which telemonitors chronic heart failure patients.[67] Participants can use mobile technology (a scale and blood pressure monitor with Bluetooth) and app to self-monitor their weight and heart rate and send it to their doctor in real-time. iCor reduced readmissions of heart failure patients by 43%.

Apple ResearchKit provides another example of a "platform". ResearchKit is an open source software framework launched in March 2015, which depends on encryption to ensure the integrity of individuals private medical data, to enhance medical research (see below).

ResearchKit - a platform for medical research

With user permission, researchers can access data such as weight, blood pressure, glucose levels, and other data measured by third-party devices and apps. Access to the accelerometer, microphone, camera, gyroscope and GPS sensors deliver additional insight into gait, motor impairment, fitness, speech and memory. Studies include research into autism, melanoma and epilepsy.[68] In relation to melanoma digital images can be used to learn about mole growth and melanoma risks with participants will be able to document changes and share them directly with health professionals. Researchers will be able to capture images from tens of thousands users to help create detection algorithms for melanoma.

Governments can also harness apps to capture information that might not previously have been available. For example, a number of apps allow reporting of local infrastructure issues including potholes in roads (combining a photo and location), whilst 'Premise' collects information globally by paying individuals to photograph and record information regarding food prices and quality.[69]

Policy takeaway

Information is central to delivering the benefits of a digital economy, and non-confidential information held by government should be open by default. Open government data initiatives should also be extended to include the more consistent collection of data. This would facilitate the availability of apps utilising such data on a pan-European basis and the provision of improved cross border services.

Government should open services to the contribution of private data from individuals to enable more personalised health care, more efficient delivery and greater attention to prevention and early warning. This will require a robust data protection framework for government handing of data.

---

[67] http://www.mobilehealthglobal.com/in-the-news/news/174/empowered-patients-take-better-care-of-their-hearts

[68] Apple. October 2015. "Apple Announces New ResearchKit Studies for Autism, Epilepsy & Melanoma."
http://www.apple.com/uk/pr/library/2015/10/15Apple-Announces-New-ResearchKit-Studies-for-Autism-Epilepsy-Melanoma.html

[69] https://www.premise.com/

WSJ. 30 July 2015. "Larry Summers-Based Startup Tracks Economic Data Via Smartphones."
http://blogs.wsj.com/digits/2015/07/30/larry-summers-backed-startup-tracks-economic-data-via-smartphones/

6 The role of platforms in providing market governance

Platforms and other ecosystem participants have an interest in ensuring that the overall ecosystem is attractive to third party developers and hardware innovators, and to customers. Aside from setting commissions for trade, platforms also perform market governance functions that are 'regulatory' in nature. Commenting on the governance role of platforms Cohen and Sundararajan (2015) noted that:[70]

> "…platforms should not be viewed as entities to be regulated but rather as actors that are a key part of the regulatory framework…For nonintermediated peer-to-peer exchange in the past, the primary solution to market failure was intervention by a government agency. But today, the existence of third-party platforms that mediate exchange fundamentally alters what the market is capable of providing on its own, and it creates a new institution capable of affecting what \Michael Foucault referred to as the "conduct of conduct.""

We illustrate this general point in relation to peer-to-peer transport platforms, app store rules and data protection and decisions regarding integration versus modularity of systems.

6.1 Peer to peer transport platforms

Focussing on the peer-to-peer or sharing economy Cohen and Sundararajan noted further that:

> "The sharing economy promises tremendous decentralized innovation but needs a new regulatory framework in order to realize its potential. The approach that we propose is to utilize digital platforms as partners in the regulation of exchange, rather than view these platforms as adversaries or entities that require governmental regulation."

As the Chairwoman of the US Federal Trade Commission noted: [71]

> "…existing regulatory schemes tend to mirror, and perhaps even entrench, traditional business models and thereby chill pro-consumer innovation" Edith Ramirez , October 2015

Peer-to-peer platforms including transportation platforms are able to utilise information to resolve problems previously addressed via regulation. Tracking of identify, location and ratings can enhance safety. Uber are also testing using smartphones to monitor driver behaviour including phone use whilst driving and speeding.[72]

Platforms may also establish eternal supervisory bodies, for example, Uber have established a safety advisory board.[73] Existing regulation should be reviewed in light of this. As Joshua Gans (2015) put it:[74]

---

[70] Mary Cohen and Arun Sundararajan. Feb 2015. "Self-Regulation and Innovation in the Peer-to-Peer Sharing Economy". University of Chicago Law Review. http://lawreview.uchicago.edu/page/self-regulation-and-innovation-peer-peer-sharing-economy

[71] Speech by Edith Ramirez, Chairwoman of the FTC. October 2015. https://www.ftc.gov/system/files/documents/public_statements/810851/151002fordhamremarks.pdf

[72] Ars Technica. January 2016. "Uber tests out using smartphones to monitor driver behaviour." http://arstechnica.co.uk/cars/2016/01/uber-tests-out-using-smartphones-to-monitor-driver-behavior/

[73] http://newsroom.uber.com/2015/11/safetyadvisoryboard/

[74] FTC. June 2015. "Workshop Transcript - The "Sharing" Economy: Issues Facing Platforms, Participants, and Regulators. Page 25. https://www.ftc.gov/system/files/documents/public_events/636241/sharing_economy_workshop_transcript.pdf

"Uber and Airbnb are in fact some of the most regulated ecosystems in the world. They have massive regulations that would make any would-be bureaucrat proud. The problem is essentially that we have a compatibility issue between the public and private regulations…"

6.2   Apps stores and data protection

App store platforms include numerous guidelines and rules designed to ensure that consumers have a good experience and are protected from abuse. For example, apps stores have privacy policies and clear guidelines for apps on what data they can collect, and how they should seek permission.[75] [76] App stores may also remove apps for breaching guidelines, and this may be necessary to protect users.[77]

Whilst consumers could in principle navigate the terms of apps individually and make their own judgment regarding risk and reward, the transaction costs of doing so would likely be prohibitive, and either the market would not develop or considerable harm would result. Platforms help overcome these problems and by creating trust help create the market. Not only do they operate a set of rules, but their brands are at stake.

In practice we observe a diversity of approaches and constant adaption by platforms regarding privacy. This diversity and adaptation is almost certainly a good thing. Different consumers have different preferences regarding data privacy, and the costs and benefits of varying levels of protection change over time as technology and the market changes.[78]

6.3   Integration versus modularity

As discussed in Section 3 a degree of hardware and software integration offers benefits. However, modularity of systems and scope for third party innovation in relation to hardware and software can also be beneficial. The balance of costs and benefits of integration versus modularity, of closeness versus openness, is therefore not subject to a hard and fast rule.

Within the ecosystem there is a constant search for the right level of openness and interoperability versus integration.[79] Some elements of the system need to be able to evolve independently of others, whilst other elements benefit from tighter integration. Imposing interoperability in the wrong circumstances could harm innovation:

---

[75] https://developer.apple.com/app-store/review/guidelines/#privacy

[76] https://support.google.com/googleplay/android-developer/answer/4450969?hl=en

[77] http://www.telegraph.co.uk/technology/apple/iphone/11941323/Hundreds-of-iPhone-apps-to-be-removed-from-Apple-App-Store-for-illegally-collecting-your-private-information.html

[78] An example of change impacting on the costs and benefits of a policy approach is cookie laws which were developed when browsers were predominant and cookie policy banners took up little space. As activity has shifted to mobile cookie notices tend to take up a far higher proportion of screen real estate and to impose greater costs in terms of wasted time.

[79] Autorité de la concurrence and CMA. December 2014. "The economics of open and closed systems". https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387718/The_economics_of_open_and_closed_systems.pdf

"You can choose to interoperate or innovate; you cannot do both at the same time."
Talmon Marco, Viber [80]

Whilst a degree of coupling of hardware and software innovation is universal, the extent of integration varies. The extent of integration may also vary as technology and the market change, and is an important competitive consideration for each platform.[81] Some innovations are dependent on innovations in other parts of the ecosystem, and these may prove more powerful and be adopted more rapidly if they are developed together.

The advantage of competing market participants deciding what should be integrated versus modular is that they have an incentive to identify the combination that works best for the overall ecosystem and for consumers. If they get it wrong they create an opportunity for others to attract developers, independent hardware manufacturers and consumers.

6.4   Competitive governance by platforms

Whilst some have expressed concern that platforms themselves may act in a manner that is anticompetitive, they are subject to constant challenge and the threat that innovation (for example, including the transition to mobile and the development of artificial intelligence) will undermine their position. In these circumstances it has been argued that general competition law is likely to be the most appropriate framework to govern the market.[82]

> *"Given the value created and the existing market constraints, there are few reasons to fear that Internet platforms pose a unique challenge to markets and competition. Moreover, regulators already have sufficient legal powers to act against the most likely problems. The question is whether they will instead divert their attention to unlikely ones, and in the process risk reducing Internet platform innovation."*

Regulation on the other hand, presents a different challenge. Whilst regulators are accountable as public bodies, they tend to be in a position of monopoly and operate under weak incentives in terms of maintaining a focus on consumer interests. To the extent that platforms adopt governance roles, and to the extent the use of technology and information supports such as role, there are therefore likely to benefits from rebalancing the role of regulation.

The OECD has developed a competition checklist to help ensure that competition and innovation are not harmed by regulation.[83] Such a checklist can be applied in developing legislation or by regulators themselves in their decision making.

The public interest may also be better served in circumstances where platforms can reduce information asymmetries in the market through the use of technology and data if regulators focus on monitoring outcomes and promoting accountability, rather than prescribing how good outcomes are achieved.

---

[80] The Verge. May 2013. "Alone together: will one messaging app rule them all?"
http://www.theverge.com/2013/5/2/4293460/one-messaging-app-to-rule-them-all-one-app-to-find-them

[81] Mossberg. November 2015. "It's Time for Google to Make Its Own Hardware." http://recode.net/2015/11/04/mossberg-nexus-should-be-pure-google/

[82] Joe Kennedy. October 2015. "Why Internet Platforms Don't Need Special Regulation" ITIF
https://itif.org/publications/2015/10/19/why-internet-platforms-don%E2%80%99t-need-special-regulation

[83] OECD. "Competition Assessment Toolkit – Principles." http://www.oecd.org/daf/competition/46193173.pdf

The use of technology to overcome information and consumer protection problems is evolving, for example, with peer-to-peer transport platforms experimenting with the monitoring of driver behaviour and safety via their smartphone. It would not be wise to lock in a particular approach. Further, competition between platforms, not just in relation to services but also the way in which services are governed, is desirable. To the extent possible, consistent with the public interest, scope should be left for competition over governance to develop.

Finally, competition authorities might introduce a degree of regulatory competition into the market, not only acting as guardians of competitive market conduct but also commenting on and/or challenging decisions and proposed rules by sector specific regulatory bodies.

An illustrative example is provided by the response of Alex Chisholm (Chief Executive of the UK Competition and Markets Authority) to the proposals by Transport for London in relation to private hire taxi companies. Transport for London proposed, for example, that: [84]

> *"Must not show vehicles available for hire either visibly or virtually via an app, or permit other apps to show this information".*

Alex Chisholm responded in the Financial Times to this egregious example of a regulator acting to protect incumbents rather than consumers:[85]

> *"Of course there is a role for regulation, especially where safety is an issue. But technologies, such as satellite navigation, cashless payments systems and user ratings platforms, have the potential to overtake the role of regulation, and safeguard consumers by empowering them with information."*

Transport for London ultimately decided against imposing restrictions on app based transportation services.[86]

In the US the Federal Trade Commission (FTC) has performed a similar function, speaking out publicly in relation to the sharing economy (for example at the 2016 Consumer Electronics Show). The FTC has also, in the past, performed both an advocacy and litigation role in relation to regulation that harms competition and innovation rather than protecting consumers. There is a question over who can perform such a role in Europe, beyond action by competition authorities at the national level.

Policy takeaway

The role of platform and ecosystems in utilising rich information to provide market governance including consumer protection should be taken into account in reforming existing regulation. Taking into account the governance mechanisms facilitated by platforms, the same regulation designed for services delivered via different means may neither be applicable nor desirable.

---

[84] Transport for London. 2015. "Provisional Taxi and Private Hire Strategy 2015." http://content.tfl.gov.uk/taxi-and-private-hire-strategy2.pdf

[85] FT. December 2015. "Let consumers pick the winner in the battle over London cabs." http://www.ft.com/cms/s/0/dc4a746a-953c-11e5-8389-7c9ccf83dceb.html#axzz3tL43wYaY

Competition and Markets Authority. December 2015. "CMA's response to TfL's private hire regulations proposals." https://www.gov.uk/government/publications/cmas-response-to-tfls-private-hire-regulations-proposals

[86] BBC. January 2016. "Uber avoids car pick-up app restrictions in London." http://www.bbc.co.uk/news/technology-35361153
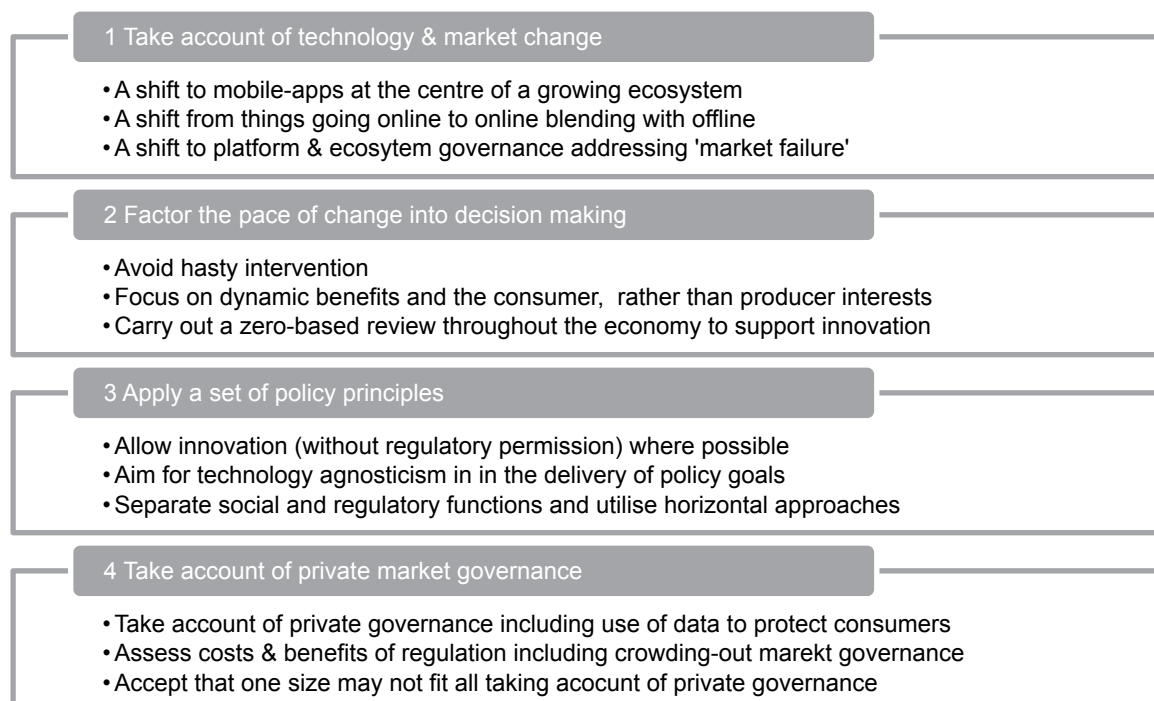
7   Policy toolkit

"In each epoch the rules of the economy tend to be best adapted to the wave that has passed, not the wave that is breaking." Alex Chisholm[87]

Drawing on the analysis of technology and market changes, and the associated policy challenges considered in this paper, we propose a set of guiding policy principles, specific illustrative measures and institutional approaches to reform.

We also note that the focus for reform should extend beyond the digital sector – which is and will remain comparatively small – to the rest of the economy, including services (which comprise over 70% of GDP in Europe). Given the scope for mobile-apps to transform previously offline activity, the reform of rules governing the analogue economy should receive weight alongside narrow digital policy issues

In deciding what form of regulation is appropriate throughout the economy account should be taken of market governance by the market and platforms in particular. Platforms may overcome market failures by utilising information, for example, by recording the identity and journey of providers and users of ride sharing services. This implies that the appropriate level of regulation of services may differ depending on the mode of service delivery i.e. a level playing field for regulation may be appropriate.

7.1   Guiding policy principles

1 Take account of technology & market change
- A shift to mobile-apps at the centre of a growing ecosystem
- A shift from things going online to online blending with offline
- A shift to platform & ecosytem governance addressing 'market failure'

2 Factor the pace of change into decision making
- Avoid hasty intervention
- Focus on dynamic benefits and the consumer, rather than producer interests
- Carry out a zero-based review throughout the economy to support innovation

3 Apply a set of policy principles
- Allow innovation (without regulatory permission) where possible
- Aim for technology agnosticism in in the delivery of policy goals
- Separate social and regulatory functions and utilise horizontal approaches

4 Take account of private market governance
- Take account of private governance including use of data to protect consumers
- Assess costs & benefits of regulation including crowding-out marekt governance
- Accept that one size may not fit all taking acocunt of private governance

---

[87] https://www.gov.uk/government/speeches/alex-chisholm-speaks-about-online-platform-regulation

7.2 Illustrative policy proposals

1 Adapt metrics & targets to the pivot to mobile-apps

- Measure smartphone adoption & index openness to disruptive innovation
- Emphasise ubiquitous wireless access & open government data in target setting
- Review current targets given mobile-apps (e.g. smart thermostats vs. meters)

2 Adapt policy in response to, & to faciliate, innovation

- Level regulation down where innovation increases competitition (e.g. OTT)
- Reform services regulation taking account of peer-to-peer governance (e.g. taxis)
- Align hardware approvals with software innovation (e.g. medical devices & apps)

3 Adopt a cautious approach to intervention

- Rely on competition law in addressing competition concerns in digital markets
- Consider unintended consequences for data security
- Consider unintended consequences of data localisation requirements

4 Facilitate data infrastructure & use

- Promote open governernment data by default & more consistent data across Europe
- Ensure data protection, in particular via encryption
- Allows citizen to input data to personalise & improve services including health services

7.3 Institutional approach to reform

1 Champion disruptive innovation

- Speak in support of innovative business models
- Develop & share case study examples
- Estimate & publicise the benefits of disruptive innovation for the whole economy

2 Speed up policy adaptation

- Monitor developments in other markets & anticipate the need for change
- Review existing rules rather than seeking to extend them
- Open a dialogue with innovators (e.g. in relation to peer-to-peer models)

3 Promote policy contestability

- Recognise role of market in providing governance
- Include consideration of governance by market in appraisal proceedures
- Support nudge & challenge role for competition authorities regarding regulation

4 Remove barriers to disruptive innovation throughout the economy

- Utilise cross cutting review processes, for example, productivity reviews
- Utilise mutual recognition to open up servic es markets to innovation
- Include consideration of impact on digital diffusion in appraisal proceedures