Deloitte.

Technology, Media & Telecommunications Predictions 2016

Contents

Foreword

Welcome to the fifteenth edition of Predictions for the Technology, Media and Telecommunications (TMT) sectors.

The last 15 years have been a golden era for innovation: multiple TMT products and services that we now take for granted were niche or non-existent back then.

In 2002, homes typically had dial-up Internet access, boxy television sets, wired speakers, standalone digital cameras, shopping catalogues and fixed line telephones. Photos were stored in albums and shelves bulged with CDs and DVDs; LPs had been banished to the attic or sold off.

'Candy bar' shaped mobile phones had monochrome screens and were predominantly used to make calls and exchange text messages. Instant messaging, e-mail, e-commerce, maps, search engines, photos, videos and other online services that are now routinely accessed via smartphones were predominantly PC-based at the start of 2002.

3G networks had only just launched commercially, offering speeds of a few hundred kilobits per second. As most homes still had dial-up Internet, it was faster for most people to visit a video rental store, return home, watch the film, and then return it rather than to wait for a file to download.

Over the last 15 years, connectivity has become steadily faster, enabling many new categories of service to become mainstream, including a number of current staple applications: search engines, social networks, video-on-demand, e- and m-commerce, app stores and online video games.

These new services have driven the growing appeal of digital devices; smartphones and tablets being the two standout devices to have emerged over the period. These new device types have tended to complement rather than usurp existing products.

While the past 15 years has witnessed startling change, it has also seen remarkable continuity. Broadcast television, radio, cinema, live entertainment, printed books and in-person meetings remain popular despite multiple digitally-enabled alternatives.

2016 promises to be yet another exciting year for the TMT sector. In this year's edition we look at a fascinating array of trends, each developing at its own momentum.

We look forward to the progress of cognitive technologies in enterprise software, to new approaches in accelerating mobile commerce check-out, and to the progression of graphene. We highlight the continuing strength of demand for the PC – especially among millennials.

We welcome the commercial launch of virtual reality, and note the continued growth of both premium sports (with a focus on football in Europe), as well as the emerging eSports sector. We expect mobile should become the biggest games platform in 2016, overtaking console and PC.

We observe that the key traditional media of television and cinema should continue to hold their own, even if not growing. We explore the current and near-term impact of ad-blockers on mobile advertising revenues.

We discuss key drivers of bandwidth demand including the emergence of Gigabit to the home, trends in photo sharing and a continued rise in data exclusive communicators, as well as the potential impact of the take-up of network-managed voice over data services.

Finally, we expect the used smartphone market to surpass $17 billion in trade-in value, making it a significant consumer device market in its own right.

We hope that you find this year's set of predictions an interesting read and that they bring a useful dynamic to your discussions.

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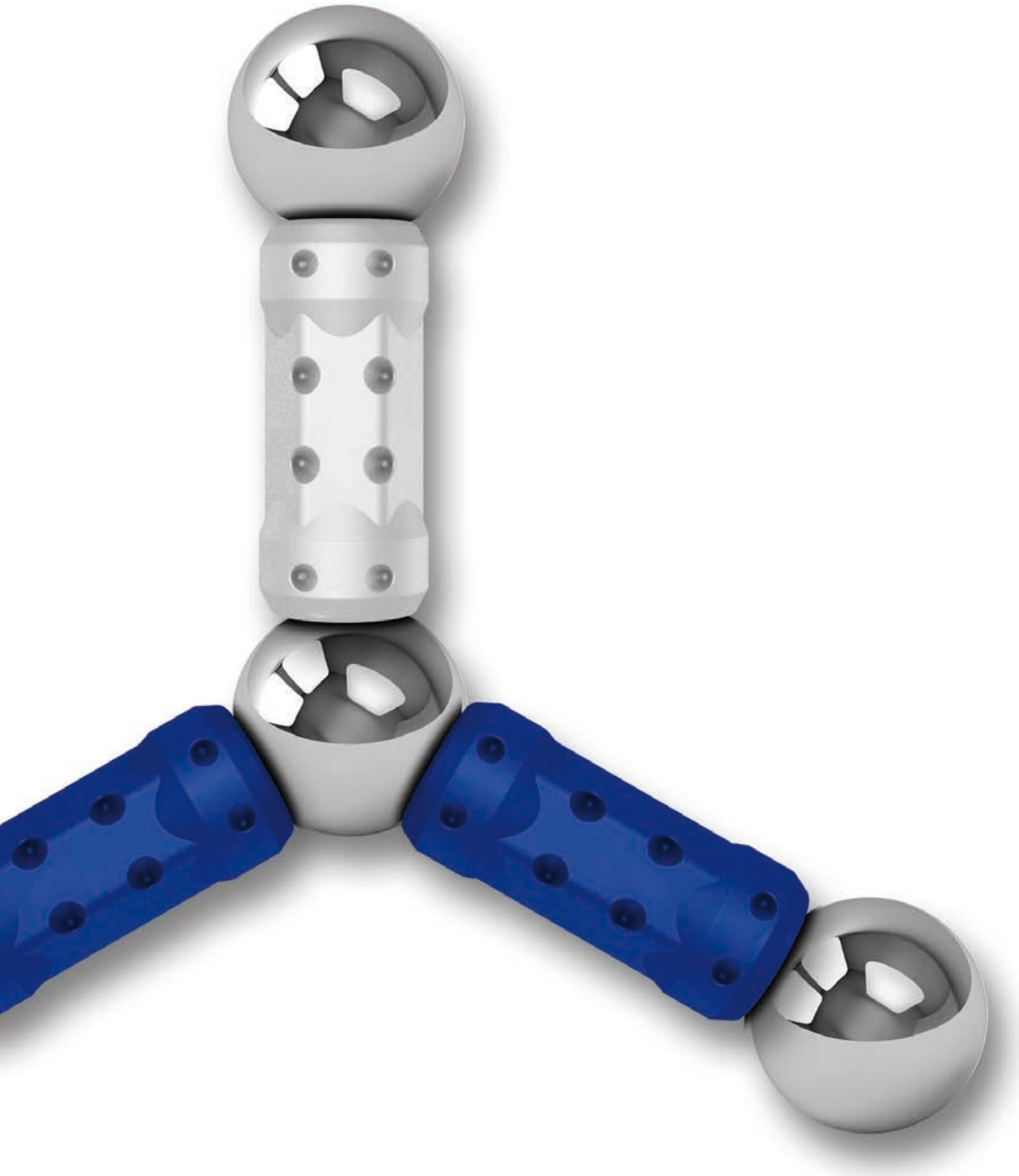
Technology



Women in IT jobs: it is about education, but it is also about more than just education

Deloitte Global predicts that by end-2016 fewer than 25 percent of information technology (IT) jobs[1] in developed countries will be held by women, i.e. women working in IT roles (see Figure 1)[2]. That figure is about the same as 2015, and may even be down. Lack of gender diversity in IT is both a social and economic issue. Global costs may be in the tens of billions of dollars; according to one study, the gender gap in IT costs the UK alone about $4 billion annually[3]. Given that cost, gender parity (roughly 50 percent women in IT jobs) seems a reasonable goal over the long term. Why are the 2016 numbers less than half that goal, and why aren't they improving faster?

Gender imbalance in IT has been recognized as an issue since at least 2005[4]. One might have expected some improvement since then, and perhaps even faster change since 2010, when there was a surge in articles about women in technology jobs[5]. That has not been the case.

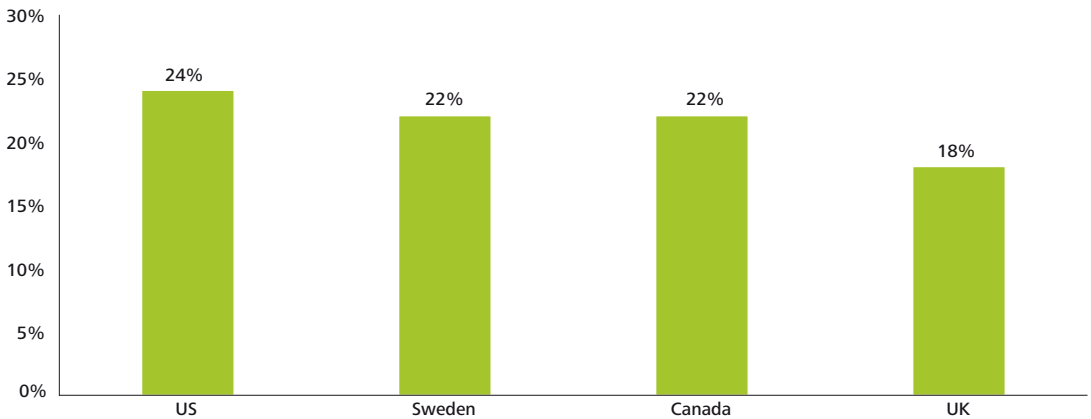
For example, in the eight years between 2005 and 2013 the percentage of women in IT jobs in Sweden fell from 23 percent to 22 percent (although the percentage of women in senior IT roles did rise from 16 to 21 percent). In the US, which has five million IT jobs, the ratio of female IT workers also fell from 25 to 24 percent from 2010 to 2014[6], with the proportion of women in more senior roles declining three percentage points to 27 percent in 2014. In the UK, with 1.2 million IT posts, the percentage of women in IT jobs increased from 17 percent to 18 percent 2010-2015[7]. In each market, the total number of IT jobs increased by over 20 percent in the last five years.

The education pipeline

Not every current IT worker has an educational background in computer science or other similar field. But in those fields of study, and especially in computer science, there are clear problems with gender diversity in the educational pipeline.

Only 18 percent of US university computer science (CS) graduates in 2013 were women[8]. And that was down from 1985, when 37 percent of graduates were women. UK figures are very similar: in the 2013/14 educational year, only 17.1 percent of computer science students were women[9]. That is much lower than overall female participation in higher education in the UK of 56 percent, and actually down very slightly from 17.4 percent in the 2012/13 educational year[10]. The percentage of women enrolled in mathematics, computer and information sciences at universities and colleges in Canada is higher, at 25 percent in 2014[11], but that is down two percent since 2009, when it was over 27 percent[12]. But at the best known computer science school in the country, the University of Waterloo, women made up only 13 percent of 2010 enrollment in computer science, down from 33 percent in the late 1980s although they now have a number of programs to get more women to enroll, and to retain them once they are in the program[13]. In Sweden as of 2010, women were 24 percent of computer science graduates[14], down from 30 percent in 2000[15].

Figure 1: Women as percentage of total IT workforce by country for US, Sweden, Canada and UK



Source: The statistics for the chart above were obtained from government websites or documents. The US data is for 2014, Sweden data is for 2013, Canada data is 2011 and UK data is for April-June 2015. See endnotes for information on sources.

But the gender gap in the educational pipeline precedes university (tertiary) education. Only 18 percent of US students taking the Advanced Placement Exam for Computer Science in 2013 were women[16]. Once again, UK data is roughly similar: a 2012 survey showed that only 17 percent of girls had learned any computer coding in school, about half the level of the 33 percent of boys who had coded[17]. And some argue that girls are often steered away from science and math courses in primary school[18]. Other experts go earlier still, stressing the role parents need to take in encouraging girls younger than school age to be interested in science and technology[19].

Challenges beyond the education pipeline

Recruiting. According to a 2014 study among UK firms, half of all companies hiring IT workers stated that only one-in-twenty job applicants were women[20]. Gender-neutral job descriptions are an important first step, but may not be sufficient, since the various algorithms driving online recruiting advertisements may mean women do not see the job placement ads[21]. In several studies, researchers found that the software showing ads for certain senior jobs targeted users tagged as men nearly six times as often as users labeled as women.

Hiring. Hiring more female recruiters may help, but will likely be an insufficient step. Various studies from multiple countries show that both men and women are twice as likely to hire a man for an IT job as an equally qualified woman[22]. That may not necessarily be conscious sexist behavior: there appears to be a number of unconscious biases at work that prompt even female recruiters to choose male candidates over equally qualified women. There are initiatives to help make people aware of their biases[23] (the process is called 'unbiasing') but training and education may only partially offset them. Further, men and women in IT write their CVs in styles that vary by gender, and those stylistic differences may be making recruiters less likely to hire women[24].

Retaining. Women in IT roles are 45 percent more likely than men to leave in their first year, according to a 2014 US study[25]. The study found that retention was a problem after the first year as well: one in five women with a STEM degree is out of the labor force, compared to only one in 10 men with a STEM education[26]. Issues that may be contributing to this lack of retention include pay and promotion (see below). A hostile or sexist 'bro-grammer' culture can also be an issue: in one study, 27 percent of women cited discomfort with their work environment, either overt or implicit discrimination, as a factor in why they left their IT job[27]. Further, workplace policies not suited to women, whether marathon coding sessions, expectations around not having children (62 percent of female IT workers don't have children, compared to 57 percent of men[28]) or lack of childcare may all play a role.

Paying and promoting. A US female web developer makes 79 cents to the dollar men make for the same job[29]; and while female computer and information systems managers have a narrower gap of 87 cents to the dollar, a pay difference is still prevalent[30]. The single largest category of IT workers in the US is 'software developers, applications and systems software' at over one in four of all IT workers – the pay gap for that group is 84 cents to the dollar[31]. In the US a quarter of women with IT roles feel stalled in their careers. In India the proportion is much higher, at 45 percent[32]. The number of female CIOs in the UK is 14 percent, and this has not changed in the last 10 years[33]; and a UK survey states that 37 percent of women in IT say that they have been passed over for promotion because of their gender[34].

On the other hand, the issue of senior women in IT roles varies significantly by country. In the UK, where 18 percent of the IT workforce is female, the percentage of senior roles filled by women is half of that, at nine percent. In Sweden, 21 percent of IT chiefs are female, in line with the 22 percent of the IT workforce that are women. And in the US and Canada, the percentage of IT managers that are women is 2-3 percentage points higher than the percentage of all IT workers who are female. It is unclear why the gender gap for senior roles varies between countries, but it does suggest that cultural factors are playing a role.

The percentage of women in IT varies significantly by specialization and that variation also varies by country. As an example, in the US over 35 percent of web developers are female, while only 12 percent of computer network architects are women. Canada has a similar pattern, with web developers at the very high end of the diversity range and computer and network operators and web technicians at the lower end. On the other hand, the UK data shows that the percentage of web design and development professionals who are female is only slightly higher than the UK average for all IT jobs, likely one of the factors (along with the low number of women in senior IT positions) that contributes to the UK's poor performance on gender diversity in IT roles compared to all the other countries mentioned[35].

It is important to note that diversity and inclusion are about much more than gender. As an example, ethnicity appears to be a significant factor in reaching senior levels in leading Silicon Valley tech companies: all of Hispanics, Asians and blacks are at a disadvantage to white men or white women at executive levels, according to a 2015 US study[36]. And of course, industries other than IT suffer from gender gaps for both participation and pay.

Although some of the numbers on gender diversity in IT may appear disappointing, there are also hopeful signs. At one leading US technology school, computer science is now the most popular degree for women[39].

Furthermore, education may not be the gating factor that some think it is. While less than a fifth of US computer science graduates were women in 2013, as of 2014 the proportion of women in tech roles in US companies was 24 percent in 2014, and 27 percent of IT managerial roles were held by women[40].

And speaking of leadership, there have never been more senior women in tech[41], particularly high-profile female C-suite executives[42]: this is providing leadership, role models and mentors for women and girls considering a career in IT.

Another positive is that the IT job categories with the lowest female representation are shrinking over time, and the more balanced categories are growing[43], suggesting that we may be nearing a tipping point in diversity. Further, tech companies are leading the broader IT industry: the US tech companies that released their gender diversity numbers in 2013 had an average of 30.3 percent female employees, and that number rose in 2014 by 0.15 percent[44].

Women in IT companies

Although the focus of this prediction has been on women in IT professions, there is a distinct but related topic of gender diversity within IT companies, specifically at the large American (usually Silicon Valley-based) companies. There are tech companies that currently publish their diversity numbers on an annual basis[37] and they average about 32 percent female employees in 2014.

These companies are a key part of the technology sector, likely represent the broader tech company employment picture, and are likely to be an important source of IT jobs for women going forward. But these companies have many workers in many different occupations, not all of which are IT jobs. One sample of six US tech companies showed that although their total workforce was 30-39 percent women, the number of women in 'tech jobs' was only 10-20 percent[38]. Increasing the gender diversity at these companies is likely an important goal, but only tangentially connected to the larger picture of women in IT jobs.

Because of the considerable public spotlight on these companies as bellwethers for women in technology, it seems a reasonable prediction that the gender diversity numbers at high-profile publicly traded companies are likely to rise at a faster rate than for women in IT functions or jobs. Therefore it will be important to recognize that even if some Silicon Valley companies have 50 percent female employees that may not mean that the diversity of women in IT jobs across the US or developed countries in general has improved to the same extent.

Bottom line

Getting more girls and young women into streams that will lead to careers in IT will likely be difficult. Initiatives are under way to depict more positive female IT role models in the media[45].

But even if real progress is made immediately in improving gender parity in STEM at levels of the educational pipeline, it may take time (possibly decades, in the case of improvements to primary education) for those improvements to translate into IT job parity.

Recruiting: firms could use software to screen for job descriptions that use words that are likely to turn away women: major technology companies are already doing this[46]. Another barrier can be tenure-related requirements: given the IT gender gap, requiring 20 years of IT experience shrinks the pool of qualified female candidates enormously. If lengthy tenure is a genuinely necessary requirement for the position, then it is appropriate, otherwise it would be an artificial barrier to hiring women.

Hiring: having both men and women as part of the hiring process is likely to help. At one tech company, women who were interviewed only by men were more likely to turn down a job offer[47]. Now that at this company every female candidate meets with at least one woman from the company during the hiring process, more women are being hired. Women are sometimes less likely to promote themselves in interviews, and the same company now gets hiring managers to ask more detailed questions to paint a fuller picture.

Retention: the attrition rate for mothers at one tech company was double that for employees as a whole: extending maternity leave from three months to five, and from partial pay to full pay, led to the attrition rate following childbirth falling by half[48]. A number of technology companies are looking at the role of mentoring: having more senior women support more junior IT workers is likely to lead to better retention[49].

Paying and promoting: IT prides itself on being a merit-based field. But gender differences need to be overcome: one company had its employees nominate themselves for promotions, and women were less likely to do so. In response, there are now workshops where women encourage other women to nominate themselves, and they are now being promoted proportionately[50].

The role of government: one possible solution may be for governments to take the lead, and attempt to increase the percentage of women in IT jobs in the public sector. Across all job types, the public sector tends to be more diverse than the private sector. According to the OECD (Organization for Economic Co-operation and Development), women make up 45 percent of the total employment across all industries in 2013, but 58 percent of public sector employment, and the figure is 70 percent in Sweden[51].

Government leadership in IT employment of women does seem to work partially. Public sector IT jobs are 15 percent of all IT jobs in Sweden[52]. While 22 percent of Swedish IT jobs are held by women, for public sector IT workers it is a third, which suggests that government initiatives can at least help narrow the tech gender gap. On the other hand, that also means that private sector IT employment for women in Sweden is only a fifth. It seems likely that this dynamic also holds true in other developed countries: the public sector IT gender disparity is less pronounced than the national averages, and the private sector is therefore worse (by some amount) than the national average[53].

Trailing millennials are the pro-PC, not the post-PC generation

Deloitte Global predicts that trailing millennials (18-24 years old) are likely to be the most pro-PC of all age groups in 2016. They are very unlikely to be post-PC and abandon personal computers (any operating system). This age group is the smartphone generation, but its ownership, intent to purchase and use of PCs will likely be higher than any other age group in 2016.

According to research by Deloitte member firms on average over 85 percent of trailing millennials in 13 developed countries had access to a laptop in 2015[54]. This is a little lower than the 89 percent who have access to a smartphone in these markets (see Figure 2)[55]. In most countries access to smartphones is slightly higher, but in the US, France, and Canada more 18-24 year-olds have access to a laptop than a smartphone. Further, laptop access for the trailing millennial demographic was either highest or second highest of the six age groups in the survey in all but two markets, Norway and Finland. Access to a laptop among trailing millennials was seven percent higher than for the population as a whole, and in some countries was much higher than the average: 17 percent in the US, 15 percent in Canada, 12 percent in Australia and 10 percent in France.

It appears that 18-24 year-olds consider smartphones and PCs as complements, not substitutes. This may be partly because laptops are more affordable than they once were, with many sub-$500 devices available. Trailing millennials in developed countries may not have to choose between a PC and a smartphone.

The large screens, keyboards and trackpads or mice of the laptop provide an ease of input and display that is superior to even the largest phablet. It appears millennials (and other age groups) are more than willing to have a laptop open in front of them and hold a smartphone in their other hand.

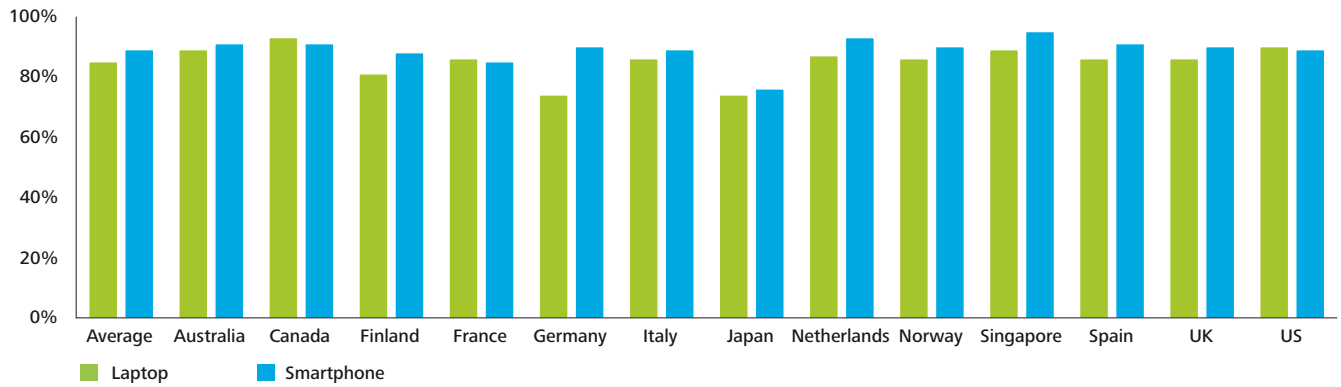
When it comes to substitution, it appears to be the large tablet (nine inches or larger) that is being partly passed over by 18-24 year-olds. In every country surveyed, access to laptops for trailing millennials was between 38 and 60 percentage points more than access to large tablets, and averaged 52 percentage points higher across all 13 countries.

Trailing millennials are actively interested in acquiring new laptop models. Purchase intent may be at a lower level than for smartphones, along with every other device, but laptops are still the second-most desired device in every country surveyed. About a third of 18-24 year-olds in developed countries surveyed planned to buy a new smartphone in the next 12 months, and a quarter intended to buy a new laptop (see Figure 3).

That number is roughly double the percentage of other devices one might expect a post-PC generation to be thinking about buying, such as tablets, wearables or portable games players. Once again, the intent-to-purchase data for laptops for millennials was higher than for any other age group in 12 of the 13 countries surveyed, with Norway as the only exception.

Figure 2: Laptop and smartphone adoption among 18-24 year-olds

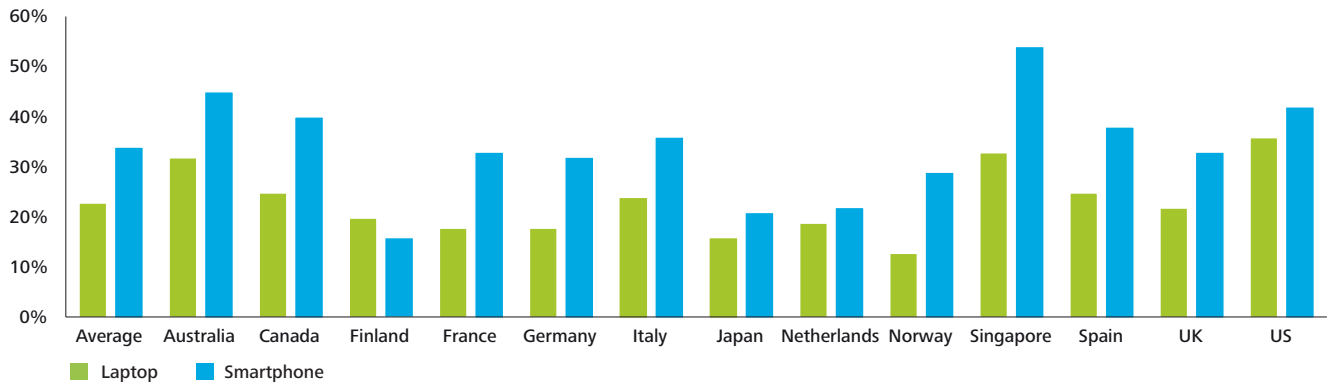
Q: Which of the following devices do you own or have ready access to?



Weighted base: Respondents aged 18-24: Australia (265), Canada (253), Finland (120), France (242), Germany (212), Italy (193), Japan (185), Netherlands (253), Norway (130), Singapore (327), Spain (193), UK (510), US (279)
Source: Deloitte member firms' Global Mobile Consumer Survey, developed countries, May-July 2015

Figure 3: Intent to purchase a smartphone or laptop within the next 12 months among 18-24 year-olds

Q: Which of the following devices are you likely to buy in the next 12 months?



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Source: Deloitte member firms' Global Mobile Consumer Survey, developed countries, May-July 2015

Other Deloitte US research into the US market suggests that 14-25 year-olds rank laptops among their most valued devices[56]. About three-quarters of 14-25 year-olds placed laptops and smartphones in their top three valued devices. That percentage was higher than laptop ranking for any other demographic studied. It was also much higher than any other device for trailing millennials, whose next top-ranked devices were gaming consoles, flat-panel TV and desktop computers at 45, 40 and 35 percent respectively.

Further, the younger millennials appear to be getting good use out of their computers. Studies suggest that 18-24 year-olds in the US spend 49 minutes per day using the Internet or watching video on a PC, in addition to email, games, and work/study applications such as word processing[57]. That 49 minutes per day is less than older Americans (35-49 year-olds are using the Internet or watching video on their computers 69 minutes per day[58]) but it does not suggest that the younger group is about to abandon their laptops or desktops in the near future. But the same data shows that millennials make use of their smartphones even more, spending 99 minutes per day using the web, an app or watching video on their smartphone. So 18-24 year-olds spend 148 minutes per day in front of smartphones or PCs, with 67 percent of this time on the smartphone.

Daily time spent on all media reflects the same trend. Another study found that millennials (18-34 years old, not just trailing millennials) use mobile devices (smartphones and tablets) quite frequently, spending a third of total media time on them[59].

Desktop and laptop computers are close behind at 27 percent of total media time: which is more than for the adult population as a whole (only 21 percent); and higher than the percentage of time millennials spend on traditional TV (23 percent). In fact, based on time spent, millennials are closer to being the post-TV generation than the post-PC generation.

In a comScore study[60], millennials in all of the US, UK and Canada are definitely mobile-first: in each country 18-34 year-olds spend at least 20 hours more per month on mobiles than on their laptops or desktop PCs. In fact, American millennials spend 90 hours per month on their mobiles, nearly 50 hours more than on their computers. However, that has not meant they have abandoned their PCs: millennial PC usage is 39-46 hours per month across the countries, which is a little less than usage for the population as a whole (about two hours per month), but not materially so.

Looking at media platform usage by all adult Americans (and not only trailing millennials,) there has been enormous growth in time spent on digital mobile devices, from 19 minutes daily in 2008 to 171 minutes in 2015, an 800 percent growth over only seven years[61]. In the same period, TV usage has been flat; up only a minute per day to 255 minutes; and other connected digital devices (such as gaming consoles connected to the Internet) have grown to 25 minutes per day from nine. But time spent on print newspapers, print magazines, and broadcast radio all fell sharply: their combined daily time fell from 165 minutes to 109 minutes, a 33 percent decline.

Meanwhile desktop/laptop media consumption (not including time spent on email, work applications, or playing offline PC games) rose from 131 minutes to 142 minutes.

Mobile usage for adult Americans appears to be a mix of additive and substitutional. It has increased the total cumulative time per day people spend consuming media across all platforms, from 578 minutes in 2008 to 701 minutes in 2015, or over 20 percent, although there is also some growth in simultaneous usage with the rise of the second screen. Smartphones and tablets have become the digital devices of choice for media consumption, and appears to have been accomplished by a combination of substitution for traditional media (but not taking media time from the PC) and adding to the total amount of media time.

It seems likely the trend for mobile media usage taking over newspaper, magazine and radio is true for 18-24 year-olds too. And when we look at data for that age group between Q1 2011 and Q1 2015, total computer time (on the Internet and watching video) is virtually unchanged, falling from 54.1 minutes per day to 53.9 minutes[62]. There was a shift in how the computer is being used, with video usage increasing by nine minutes per day in four years, but total time spent was flat.

What are millennials doing on PCs? The answer is computer games, longer-form video, downloading or streaming content, and creating or editing content (text, videos). In fact, when we look at how PCs compete with tablets or smartphones, and how they are used by demographic groups, it might be those aged 55 and over who are more likely to become the post-PC generation.

There are also age and cohort effects at work. As today's 18-24 year-olds grow older, it seems likely that their PC use may rise when they are 25-34, and then possibly increase again when they are 35-49, which is the age group that currently uses computers the most per day in the US. After that, and as they begin to spend less time playing complex PC-based games, moving increasingly to legal sources of content, and shift from being content creators to spending more time exclusively consuming or reviewing content, their PC usage is likely to fall and shift towards tablets.
But it seems equally probable that the cohort of 18-24 year-olds of 2020 or 2025 will still use devices that are more or less PC-like: they will have full-size keyboards, much larger screens, and pointing devices that are more precise than a finger on a screen. Based on recent trends, they are likely to use those devices for fewer minutes per day than today's 18-24 year-olds use their computers, but it will still be a significant device: widely-owned, widely-valued, often required by schools or employers, and used for hours per week.

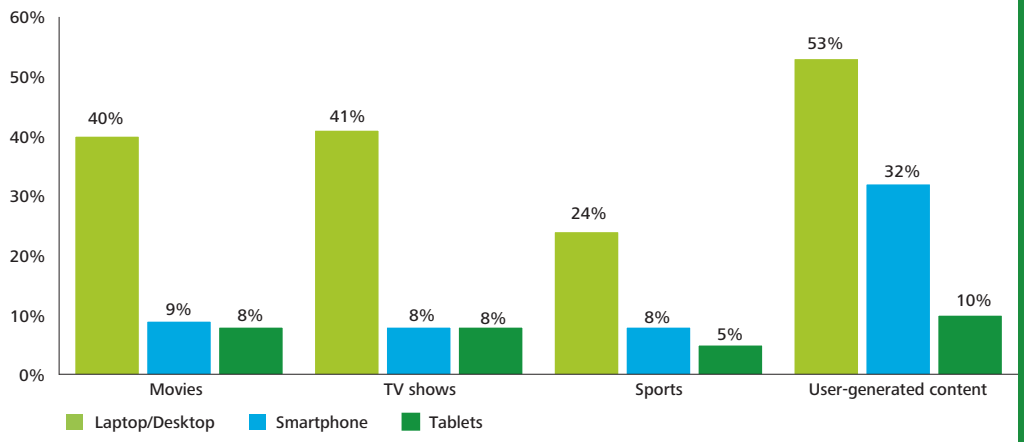
Bottom line

It appears that having a mobile strategy will be necessary in 2016, especially if your market is millennials. In fact, a mobile-first strategy is almost certainly a good idea. But a mobile-only strategy that assumes millennials have already abandoned (or are about to abandon) their computers is almost certainly an equally bad idea. Depending on the content or use case, millennials still use their PCs, and sometimes even prefer the PC to mobile.

One excellent example of this distinction is video content. In a Deloitte US survey published in 2015, trailing millennials (14-25 years old) reported the percentage of time spent watching four different forms of video content: for smartphones, tablets, desktop/laptop computers and TV sets[63].
As Figure 4 shows, leaving TV sets aside, the computer screen was the dominant device, even for user-generated content. In fact, for movies and TV shows (30-60 minutes), millennial use of computers was more than double the screen time for smartphones and tablets combined[64]. Although games and social media are indeed heavily mobile-first for trailing millennials, the larger screens of desktops and laptops seems to be preferred to mobile.

Figure 4: Time spent watching video content by device, US, among 14-25 year-olds

Q: Of the time you spend watching movies/TV shows/sports/user-generated content, what percentage do you watch on the following devices?



Base: Respondents aged 14-25 (424 respondents)
Source: Deloitte US's Digital Democracy Survey, Ninth edition, November 2014. See endnotes for further information on the research.

Another example is online banking. According to a 2014 US study[65], 20-34 year-olds were much more likely than any other demographic to conduct banking-related activities via digital channels, with 65-80 percent using digital to make internal transfers, check for fraudulent charges or check account balances. They were also the most likely to use the bank's mobile app: more than twice as likely as Generation X (35-49 year olds) and nearly eight times as likely as Baby Boomers (50-70 year olds)[66]. However, although they did use the mobile app for checking balances, and external and internal transfers, when asked to express a preference for the mobile app or the bank website, millennials preferred the website more than two-to-one over mobile for each type of transaction.

Shopping is another use where the PC still has its place. US 18-34 year olds spend $2,000 per year on digital purchases, 79 percent said in a survey that they discovered a new brand or product through mobile, and more than half said they prefer the mobile shopping app to the online site[67]. But a 2014 survey of US 19-33 year-olds showed that they still prefer using their computer over either the smartphone or tablet for checking product details or availability, and especially for making the actual purchase, with nearly two-thirds using their computer, and only about 40 percent using their smartphone or tablet[68]. In a more recent 2015 Deloitte US survey, 18-24 year olds were most likely to use their mobile devices to find the location of stores, shop/browse online and compare prices. However, only 39 percent used their smartphone for actual purchases, and only 27 percent used their tablets[69].

Touch commerce: the mobile online checkout gets an express line

Deloitte Global predicts that in 2016, the number of individuals who use a third party touch-based payment service to make a purchase on their mobile devices (smartphones and tablets) should increase by 150 percent, to reach 50 million regular users[70].

Touch commerce enables a customer to make a secure first-time or subsequent payment on any merchant's website or app without having to provide registration or log-in details either to the merchant or to the payment service. Authorizing the transaction on a mobile device simply requires the application of a fingerprint or a few (typically two) touches of a screen.

Critically, touch commerce reduces significantly the time taken from browsing to transaction on a mobile phone, and on an app or website which the customer has not used before, to mere seconds from tens of seconds or even minutes.

Touch commerce enables retailers to exploit shoppers' increasing use of mobile devices to browse retail sites and apps. Transactions on sites and apps remain scarce, with laborious payment processes often to blame. Indeed cart abandonment in mobile commerce can be as high as 80 percent[71]. Easier checkout has been identified as a key factor/key requirement for increased mobile buying[72].

Deloitte member firm research has found that as of mid-2015 about a third of respondents in developed markets browse shopping websites/apps on a weekly basis, but only nine percent purchase (see Figure 5). A first-time visitor to a mobile website or app may need to type in name, address, email, phone number, and sometimes purchase preferences, security details (passwords, security questions) and finally payment details to complete a transaction. The wide scope of information required, coupled with the difficulty of entering it on a touch screen, likely contributes to the abandonment of baskets.

Submitting all these data on a computer with a full-size keyboard is a chore. On a five-inch touch screen, with predictive text in a mischievous mood and on a juddering bus, it can be tortuous.

Touch commerce enabled by third-party services removes much of the 'grit' from mobile transactions, reducing the entire process to the application of a fingerprint or one or two touches of the screen.

There are likely to be two principal types of third-party touch-based mobile payment services in 2016.

One is linked to the device's operating system (OS). Shopping applications can use existing information associated with the OS, including payment card details and home address. Payments for this service are typically authenticated by a fingerprint and can be used within apps[73]. Goods can be shipped to the default address stored in the OS.

Figure 5: Respondents who use their phone to browse or purchase from shopping websites/apps at least weekly
Q: How frequently do you use your phone to do any of these (browse shopping websites/apps, make an online purchase of a product)?

Weighted base: Respondents who own or have access to a standard phone/smartphone: Australia (1,837), Canada (1,676), Finland (963), France (1,829), Germany (1,821), Italy (1,873), Japan (1,420), Netherlands (1,886), Norway (925), Singapore (1,903), Spain (1,891), UK (3,682), US (1,828)
Source: Deloitte member firms' Global Mobile Consumer Survey, developed countries, May-July 2015

Deloitte Global expects this category should represent the majority of touch-based payments made in 2016: there are billions of smartphones that have payment card and home address information associated with them. Additionally, the base of fingerprint reader-equipped devices is steadily rising, with more than 450 million forecast to ship this year, adding to the existing base of hundreds of millions'[74].

The second type of third-party touch-based mobile payment service is linked to existing payment service providers. Prior to being able to make purchases by one or two touches of the screen, the user would need to have opened an account with the payment provider and elected to stay logged in for future purchases. Once this feature is enabled, the user simply has to press buy and confirm buttons[75]. Confirmation can be via a fingerprint with some devices[76].

The combination of these data and technology enables retailers to outsource mobile transactions to third parties, and by so doing, convert payment from a frustrating to a friction-free experience. One merchant reported that the checkout process via their legacy app required 103 seconds for customers to type in their full credit card and shipping information; third-party touch payment reduced this to just 17 seconds[77].

Other payment services may emerge soon. For example, some large retailers could enable their customers to use pre-stored payment data to validate purchases made on other retailers' apps[78].

Third-party touch-based mobile payment services are just a first step towards an overall improved shopping experience on mobile.

Consumers are increasingly likely to expect simplified authentication services, and may want this approach for online as well as in-store payments.

Bottom line

Consumers are constantly connected to their smartphones, from the early hours in the morning to late at night, when at work, while spending time with family and friends or while commuting. These provide opportunities for converting browsing into purchases with a simplified payment process.

Retailers should educate the market on the existence of touch commerce and encourage first-time usage, perhaps by offering small discounts for doing so. Marketing campaigns should show how fast touch payments are, but also explain how they are also as secure, and possibly more so, than conventional check out processes.

Retailers may need to offer a variety of payment options via a range of third parties.

Touch commerce is likely to tap into consumers' appetite for impulse purchasing. But more mobile commerce and impulse purchases may mean that they will need to be even more responsive and able to cope with unpredicted spikes in demand that may happen at various times of the day and night. The potential impact on sales created by social media influencers should also be considered[79].

A simplified checkout process is not the only prerequisite for mobile commerce. A user-friendly and appealing mobile website or app is also essential.

Some approaches to touch commerce could cause retailers to lose some visibility of customer behavior. Retailers should carefully weigh the benefits of rapid transaction fulfilment with loss of control of customer data.

Retailers should also consider integrating touch payment services with loyalty schemes.

Graphene: research now, reap next decade

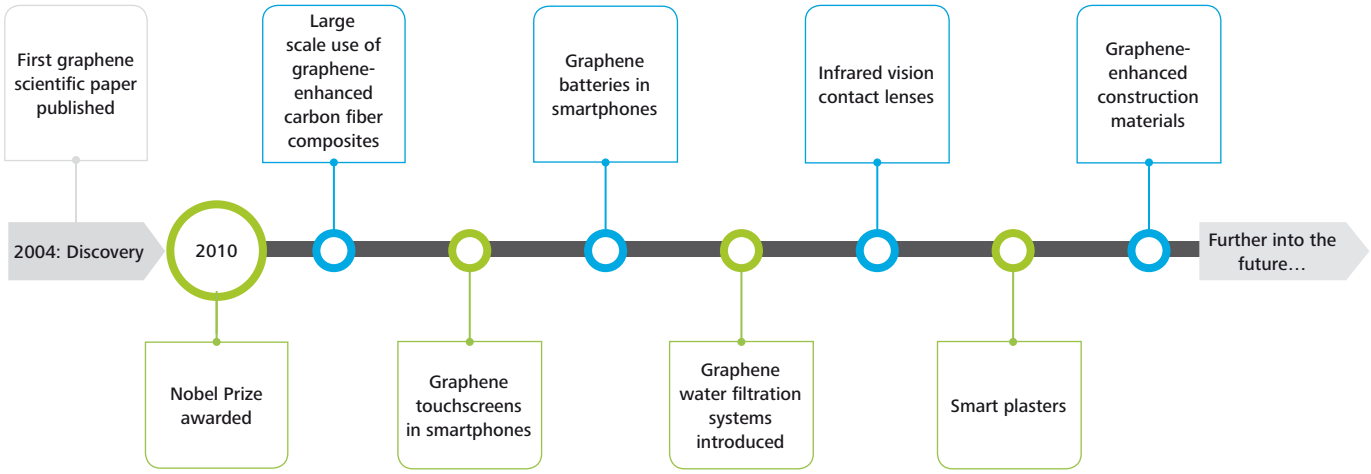
Deloitte Global predicts the total value of the graphene materials market in 2016 is likely to be in the low tens of millions of dollars, equivalent to less than an hour's projected revenues from smartphone sales this year. Research and development spending on graphene is likely to be in the hundreds of millions of dollars in 2016; in the medium term, graphene may be incorporated into products worth many billions of dollars per year, but it may be decades before this material's potential is fully realized.

In 2016, while there are expected to be a few dozen commercially available products that include graphene, the material is likely to be a composite. For example, graphene could be incorporated to improve the strength and weight of the carbon fibers used to manufacture sports equipment[80].

Graphene has been called a 'wonder material'[81], as it offers an unrivalled combination of tensile, electrical, thermal and optical properties. Significant investments have been made in recent years which could hasten the pace at which we start to see more practical applications of graphene and new technologies. For example, the European Union has invested $1.3 billion in 'The Graphene Flagship', a consortium of academic and commercial researchers[82]. The UK Government has provided £235 million ($353 million) to fund a graphene research center[83]. Tech companies are investing in developing their understanding of the material. Samsung for example has already applied for hundreds of graphene-related patents[84].

Graphene is a single atom thick two-dimensional structure, which is a million times thinner than a human hair or a sheet of paper. It is based on graphite, which in turn is a crystallized form of carbon, one of the most abundant elements in the world. A team of scientists from Manchester won the 2010 Nobel Prize for Physics for isolating small amounts of graphene, by applying sticky tape to chunks of graphite and then peeling the layers off one by one[85], leaving a layer of graphene on the tape[86].

Figure 6: Graphene predictions timeline



Source: Deloitte Global, 2015

Graphene is flexible and very strong, and (in one aspect) is tougher than a diamond and stronger than steel. It is currently used as an element within a resin to manufacture solid structures, as is the case with carbon fiber sports equipment[87]. For example, carbon fiber tennis rackets are made using a small amount of graphene[88]. At the 2015 Geneva Motor Show, Spania unveiled the world's first supercar to incorporate graphene into the structure of a car[89]. Going forward, graphene could be increasingly incorporated in manufactured products. For example, it could reduce the weight of vehicles, cutting down both fuel consumption and resulting emissions.

It is transparent: 97 percent of light passes through it. It also an excellent conductor, and can carry heat and electricity more efficiently than gold or copper. This could make it very useful for developing the next generation of electronics such as solar panels and batteries.

Incorporating graphene into batteries could increase their performance enormously. Energy density could be increased up to tenfold, enabling smartphones to last days without recharging, and an electric car's range to equal or surpass that of gasoline vehicles[90].

Memory chips based on graphene have the potential to increase smartphone storage capacities tenfold, and also reduce power consumption and increase memory access speed[91]. Graphene could lead the way in flexible smartphones by providing an alternative to silicon, which is brittle and could break when bent.

It could also be applied to any surface to convert it into a screen; it would be equivalent to applying a layer of high-tech plastic wrap[92].

Graphene is impermeable to gases and liquids, while graphene oxide is permeable to water only. This means that graphene oxide could be used for desalination[93], or the removal of harmful radioactive isotopes[94].

Graphene also has the capability to change the way in which we interact with the world: it could be used to create contact lenses that enable infrared vision[95], and to develop 'smart plasters' that reduce the risk of anti-bacterial infection[96]. However, the toxicity of graphene to humans has yet to be confirmed through scientific studies.

The potential of graphene is phenomenal, but patience is vital: there are several challenges to be addressed before a graphene era can be realized.

The main challenge lies in manufacturing large quantities of graphene, in various formats, and at an affordable price, with effective yields and a purity sufficient so as not to impair graphene's desired chemical properties. Production volumes also need to be scaled up to factory level.

Despite many academic and commercial research groups investigating methods of production, making large quantities of graphene remains a profound challenge. Graphene is currently produced by a variety of methods, which can be summarized as either 'bottom up' or 'top down'. 'Bottom up' methods use chemistry to synthesize layers of graphene, while 'top down' approaches utilize graphite. The Nobel prize-winning 'sticky tape approach' and the 'how to make graphene in your kitchen' approach (described below) are examples of 'top down' production methods that yield high-quality tiny graphene fragments. However, they are micrometers in size, and these methods are not suitable for large scale manufacture[97].

How to make graphene in your kitchen (if you have lab equipment)

As with many emerging technologies, theories abound but practice is a little harder. It is possible to create graphene using a kitchen blender to combine graphite powder with water and dishwashing liquid[98]. A precise quantity of dishwashing liquid is required to make this work, with the volume dependent on the properties of the graphite powder used. Determining this requires advanced and expensive lab equipment[99]. But as of end-2015 this approach, like many others, remained theoretically viable, but not yet proven in a large production run.

The principal example of a 'bottom up' production method is chemical vapor deposition (CVD) which involves creating a graphene layer on another layer (for example copper foil)[100], 'unzipping' carbon nanotubes and the reduction of graphene oxide[101]. While some of these these methods can produce square meters[102] of graphene, they may produce highly defective graphene, or require the use of hazardous materials. As such, there is still some way to go in optimizing the production processes.

As of end-2015, the market price of graphene was about $100 per gram[103]. Once the method of production is optimized and scaled up, the cost of graphene is expected to come down to the cost of the raw materials, which will likely be centered on the existing suppliers for graphite: China and India[104].

While graphene is a 'wonder material', there is another major hurdle to overcome before its use can become widespread in electronics. Semi-conductors, like silicon, are characterized by their ability to turn on and off as their electrons can only move freely within the material in the presence of energy due to the existence of a small band gap. A band gap is the energy range between the valence band (where an electron cannot conduct electricity) and the conduction band (where it can). If material is an insulator, this band is large, and the electrons cannot move from one band into the other and the material has no electrical conductivity. One of the reasons why graphene has such high conductivity is due to the fact that it has no band gap and electrons are free to move between these two bands with no resistence. At the present time, scientists are still developing methods by which to insert a band gap while still maintaining graphene's highly attractive properties.[105]

Other barriers to the development of graphene are the established processes and supply chains for existing materials used in electronics; for example silicon, which is the industry standard in microelectronics, and indium tin oxide which is widely used as transparent electrodes used in touch screens[106]. Until graphene can be produced and supplied at a competitive price to these existing technologies, it is unlikely to become ubiquitous in the market. This means that it will most likely be about a decade before graphene can be used commercially as an alternative to silicon, but this should provide ample time to understand the material and to evaluate its potential performance[107].

While products marketed as 'graphene' may be on the market in 2016, many, if not all, will likely be constructed principally from more traditional materials and incorporate a limited quantity of graphene.

We would expect graphene to continue to be used as a supplementary material in the short term (and through to 2020 at least), until the manufacturing process for graphene is mature enough for it to be used as a key material in products.

Bottom line

It is important to be cognizant both of graphene's potential, as well as the many challenges that need to be overcome before its fantastic properties can be exploited. In 2016, and most likely in the decade to come, graphene will be in a research and prototyping phase. The potential benefits are significant; the challenges are commensurately high.

We predict that sales of materials will likely remain the principal source of revenues in 2016. We expect to see some of the first real graphene-based products entering the market. The number of 'graphene' products on sale in 2016 will likely number in the tens. We anticipate that the graphene market, including material sales, will likely not surpass $30 million in 2016. By the end of the decade material sales may still be a little more than $100 million – which represents growth, but also a continuation of the research phase[108].

We should put graphene's life cycle trajectory in perspective: many of the most impactful materials have taken decades before attaining mainstream adoption. Aluminium was used as a luxury metal in 19th century France. Even when manufacturing costs fell it remained a niche material until the invention of the airplane, which uniquely required aluminium's specific combination of strength and weight to make commercial flight viable. Indeed, it is only now that aluminium is becoming incorporated increasingly into premium passenger cars.

Carbon fiber has similarly had a long gestation: it was first used commercially in the late 1800s as a component in light bulbs[109]. Today it is used only selectively in vehicles, even though its benefits are very well understood.

In 2016, graphene-enhanced products are only going to offer a glimpse of the material's full potential, but a key point to consider is that new materials disrupt existing products and lead to new technologies. So some of the future technologies and benefits of graphene, which could embody the 'graphene era' and change our world, only currently exist within the realms of our imagination.

Cognitive technologies enhance enterprise software

Deloitte Global predicts that by end-2016 more than 80 of the world's 100 largest enterprise software companies by revenues will have integrated cognitive technologies into their products[110], a 25 percent increase on the prior year when 64 of the top 100 had launched products and services which featured one or more cognitive technologies in 2015[111]. By 2020, we expect about 95 percent of the top 100 will have incorporated one or more cognitive technologies.

We expect that the cognitive technologies that will be the most important in the enterprise software market in 2016 will be: machine learning, natural language processing and speech recognition.

What do we mean by cognitive technologies and artificial intelligence (AI)? We distinguish between the field of AI and the technologies that emanate from the field. The popular press portrays AI as the advent of computers as smart as – or smarter than – humans. The individual technologies, by contrast, are getting steadily better at performing specific tasks that were formerly only deliverable by humans. Figure 7 identifies the leading cognitive technologies that business and public sector leaders are likely to benefit from in 2016.

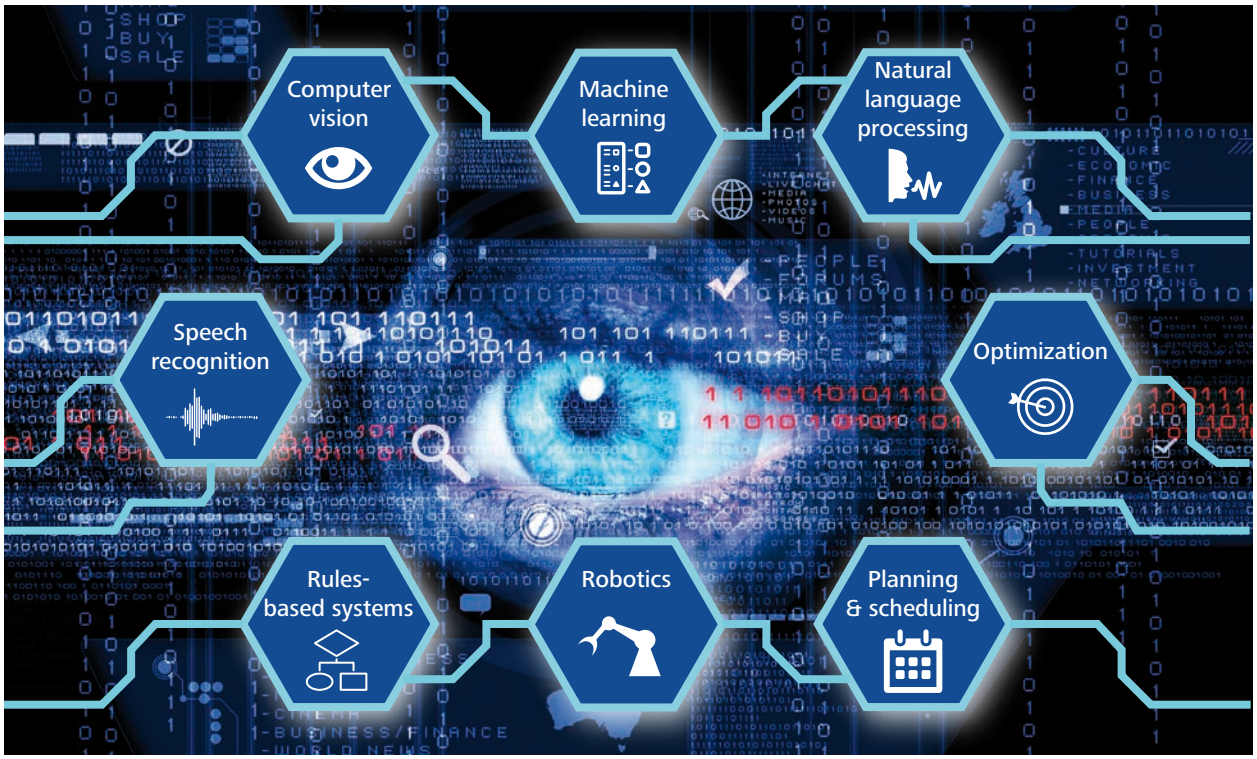
Deloitte Global expects cognitive technologies will be deployed to differing extents by enterprise software companies, but we want to take the time to define what are likely to be the three most widely used in the near-term[112]:

Machine learning – the ability of computer systems to improve their performance by exposure to data but without the need to follow explicitly-programmed instructions – is likely to be the most prevalent. It enhances a large array of applications, from classification to prediction, from anomaly detection to personalization.

Natural language processing (NLP) – whereby computers can process text in the same way as humans, for example extracting meaning from text or even generating text that is readable, stylistically natural, and grammatically correct – has multiple valuable applications when incorporated in software that analyses unstructured text.

Speech recognition – the ability to automatically and accurately transcribe human speech, is useful for applications that may benefit from hands-free modes of operation.

Figure 7: Widely used cognitive technologies



Graphic: Deloitte University Press
Source: Deloitte Development LLC, 2015

Deloitte Global expects the three main benefits for software companies that have integrated cognitive technologies into their products will be:

Improving core functionality – Cognitive technologies will be used to improve the performance of existing software by doing the same things, only better. For example, one US-based company providing retail solutions uses machine learning to reduce false positives when identifying fraudulent transactions[113]. Previous software solutions already identified fraud, but machine learning allows the retailer to do so with greater accuracy, potentially resulting in fewer legitimate transactions being incorrectly flagged. A Silicon Valley networking company uses a cloud-based Cognitive Threat Analytics program that relies on advanced statistical modeling and machine learning to independently identify new web security threats, learn from what it sees, and adapt over time[114].

Generating new insights – Machine learning and other advanced analytical technologies will likely make it possible to uncover previously inaccessible insights that were hidden in large data sets or obscured by the unstructured format of the data. One US database company's cloud service leverages NLP technology to determine and assign an 'emotional' rating to customer survey responses that fit a customer sentiment category, which helps companies take immediate action[115].

Automation – Cognitive technologies make it possible to automate tasks formerly done by people. One medical software company uses an NLP engine to interpret doctors' free-text notes and extracts key data such as allergies, medications and diagnoses[116]. A business services company streamlined a standardized business process: their cross-border e-commerce platform employs a natural language processing engine and machine learning algorithms to accurately deliver and continuously improve product classifications as more transactions are processed[117].

Some business software companies have developed AI capabilities in-house, but many others are acquiring capability through M&A, and we expect this to continue in 2016. Indeed more than 100 mergers and acquisitions involving cognitive technology companies have taken place since 2012[118].

Venture capital (VC) firms are active in this space too. Since 2011, most VC funding of start-ups developing or applying cognitive technologies has benefited companies building applications for traditional enterprise functions such as marketing and sales. US-based start-ups like these have raised nearly $2.5 billion since 2011, suggesting that the biggest near-term opportunity for cognitive technologies is in using them to enhance current business practices[119]. For instance, a company called Convirza raised $25 million to develop and commercialize a call marketing optimization platform that uses speech recognition technology and sophisticated algorithms to gauge lead quality, measure customer conversions, analyze phone performance, and take action with workflow-based marketing automation[120].

Another target for venture investors is vertical specific software vendors. Such companies have received over $2 billion from venture investors since 2011[121]. One example is Wellframe, which received $1.5 million in seed funding for its mobile app that connects healthcare providers and patients once they return home from the hospital, creating a daily to-do list for the patients with items such as medication reminders and questionnaires about symptoms. Wellframe's machine learning engine tailors the app's content based on answers and care regimens prescribed by the patient's healthcare provider[122].

The growth in enterprise software use of cognitive technologies has been partly driven by the shift toward cloud computing. Only a subset of users of enterprise software would historically have had the scale to deploy the on-premise technologies capable of doing advanced machine learning, for example. But the growth in cloud computing could allow enterprise software vendors to provide the benefits of machine learning to all their clients[123]. Further growth in cognitive technologies is likely to be accelerated by the trend toward open source AI: one of the largest players in the space open-sourced the software engine behind their deep learning tools[124], and another open-sourced the designs for the servers that run their AI algorithms[125].

Bottom line

Many top software companies have already discovered the potential for cognitive technologies to enhance their products, create value for customers and improve business operations. Strong support from venture capital investors is helping to further commercialize enterprise applications of cognitive technologies. The potential benefits in terms of ease of use, enhanced performance and improved insights are simply too compelling for software providers to ignore. This is why we expect the trend of embedding cognitive technologies in enterprise software to continue through 2016 and beyond, approaching ubiquity by 2020.

Vendors of enterprise software applications should consider how cognitive technologies can enhance their products. Start-ups may offer models of how to employ these technologies to make products easier to use, automate functions intelligently, and generate greater insight from data.

Corporate IT groups may want to build awareness of and skills in cognitive technologies such as machine learning and natural language processing. They could also begin to assess how to employ cognitive technologies to enhance existing corporate applications to provide greater usability and more valuable insights to users.

Buyers of enterprise software may find it worthwhile to ask their vendors to explain how they plan to take advantage of cognitive technologies to enhance their products' performance and utility.

Software companies should also consider applying cognitive technologies to their internal business operations, such as recruitment. One company integrated predictive analytics to forecast which job applicants were likely to have a good cultural fit and be high performing[126]. The same technology could also predict when a target candidate might start seeking out a new job, and make recruiters aware of this[127].

Another company deployed a virtual support agent, based on NLP, to understand and resolve customer issues. The impact was marked: the average customer support resolution rate rose to 85 percent and the number of call center inquiries and emails fell by 22 percent[128].

Companies could also use cognitive technologies in managing warehouse operations and employees. If an employee uses a new way to accomplish a job more efficiently, that technique can be analyzed and used later on. For one company this delivered an eight percent increase in warehouse productivity[129].

Cognitive technologies should be used across the three types of enterprise software markets:

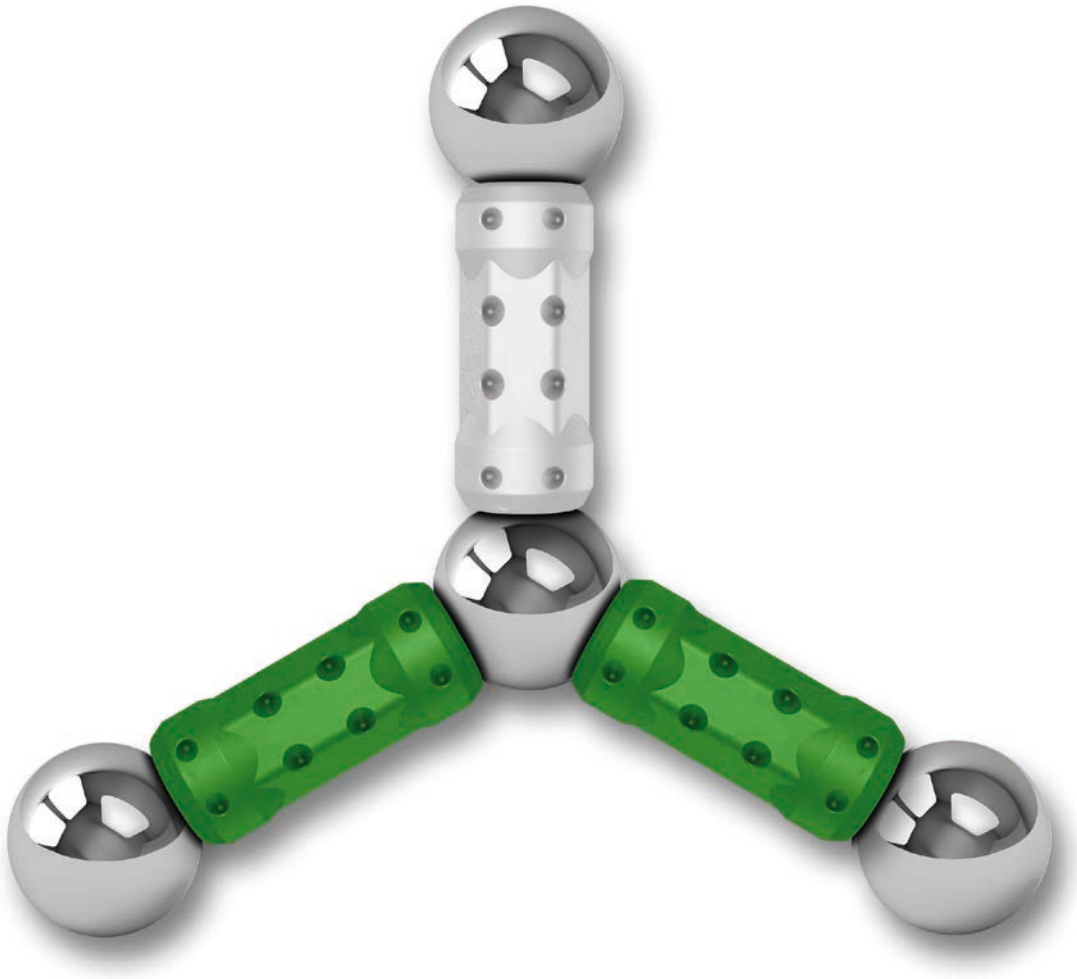
The Enterprise Application Software market focuses on leveraging the power of computers to achieve business, professional or personal goals. One company's cloud solution features a client-targeting tool that aims to solve the difficulty of marketing to large volumes of anonymous online traffic[130]. It uses machine learning to discover associations between the behavior of a new site visitor and the actions taken by previous visitors who behaved similarly. The goal is to make the site experience more engaging and increase conversions to sales.

The Enterprise Infrastructure Software market provides tools that help companies build, run and manage the performance of IT resources. One company has enhanced its logging tool with machine learning capability that groups related server events together to make it easier for an IT manager to identify developing problems or unusual computing trends that should be addressed on a real-time basis[131].

Vertical Specific Software is focused on a narrow scope/industry and is typically a stand-alone software application. In partnership with a major cancer institution, a technology company has developed a standalone oncology offering. Accessible by mobile or desktop, the deep machine learning AI is able to analyze the large volume of patient records and identify potential evidence-based treatment options[132].

The use of cognitive technologies in enterprise software is only part of the overall trend toward increases use of AI in the larger enterprise market. One 2015 study forecasts the sales of enterprise AI will be a cumulative $43.5 billion between 2015 and 2024[133].

Media



Virtual reality: a billion dollar niche

We would expect the majority of spending on VR to be by core rather than casual gamers.

Deloitte Global predicts that virtual reality (VR) will have its first billion dollar year in 2016, with about $700 million in hardware sales, and the remainder from content. We estimate sales of about 2.5 million VR headsets and 10 million game copies sold.

VR is likely to have multiple applications, both consumer and enterprise, in the longer term, but in 2016 we expect the vast majority of commercial activity to focus on video games. We would expect the majority of spending on VR to be by core rather than casual gamers. This implies that while anyone with a smartphone could try out a variant of VR, the majority of VR's revenues in 2016 will likely be driven by a base of tens of millions of core gamers rather than the hundreds of millions of occasional console or PC gamers, or the billions who play casual games.

Virtual reality hardware offers visual (and sometimes audio) immersion via a head-mounted display that shows a stereo image in 3D. Sensors in the headset track the user's movements and change the user's view accordingly. A VR version of scuba diving allows you to feel as if real fish are swimming toward you. If you look up, you see a realistically rendered sky. When you glance down, you are shown the ocean floor. The sound track adjusts accordingly, enhancing the perception of being elsewhere. All other things being equal, the higher the screen resolution, and the faster the screen refresh, the more convincing the simulation[134].

However the illusion remains incomplete, in that not all senses would be catered for. VR could take you into the depths of the rain forest. You could see the forest floor or look up to the canopy. But you would not feel the humidity, experience the smells or touch the vegetation.

VR content can be created using CGI (computer generated images) or filmed using special clusters of cameras that collectively capture a 360-degree field of view. In playback, the user is shown different aspects of the images captured, depending on where he or she is looking[135].

As with many technologies, the notion of virtual reality is decades old, but its commercial realization has been subject to the sometimes slow pace of technological progress. Optimal VR experiences require very high resolution screens (ideally over 500 dots per inch, which have only recently become commercially available), a wide field of view and high refresh rates (ideally at least 75 frames a second[136], requiring powerful processors). More processing power is also necessary so that synchronization between the user moving their head and the picture being adjusted is as near-simultaneous as possible. It is only recently that screen and processor technology have improved in terms of price and performance such that VR is commercially viable, albeit still at high price points for the full featured solution.

There are likely to be two main types of VR device in 2016: 'full feature' and 'mobile'.

The former incorporates high resolution screens and will cost about $350-$500 (with prices at the start of the year likely being higher), and we estimate between 1–1.75 million sales in 2016, with volumes depending heavily on the initial price[137].

Full feature devices will likely be designed for use with either latest generation games consoles or PCs with advanced graphics cards (each costing about $300) capable of driving high refresh rates: the 'average' PC is not powerful enough to support a viable VR experience.

We expect the addressable market for games consoles as of the end of 2016 to be at least 30 million units, and high-end PCs at about seven million units worldwide. We also expect that most users of full feature VR would already own the latest generation console or a high-end PC. Otherwise, a full feature VR experience would require at least $300 additional spending on a console or $1,000 for a suitably equipped PC.

Some VR owners may purchase additional accessories, ranging from controllers to treadmills whose base plate moves in alignment with the view being seen. The floor would tilt, for example, if you were walking uphill[138].

There are hundreds of millions of gamers on consoles and PCs, and many of them buy hardware accessories to improve their game play[139]. However, the vast majority of the top selling peripherals are $30-50[140]. Only a minority of these gamers may want to spend over $300 on additional equipment such as graphics cards, liquid cooling for processors or other special devices.

'Mobile VR' incorporates a high-end smartphone's screen into a special case, enabling the headset to fit more-or-less snugly on the user's head. This is likely to cost from about $100, and we forecast that at least half a million units will be sold in 2016. Mobile VR requires smartphones with large, high resolution screens, ideally with greater than 400 pixels per inch (PPI) resolution, which is higher than that for the average premium smartphone. We expect that VR-ready smartphones will cost from $750 and up but that most purchasers of mobile VR will already be owners of a suitable device.

Both types of VR would provide a high quality VR experience, with the caliber of full feature VR being noticeably superior, at least in 2016 and out to 2020. The processor and pixel density requirements require a lot of power, with plug in power being ideal. A smartphone being used for VR may exhaust its battery after half an hour. Mobile VR will rely on accelerometers for tracking and lacks positional tracking, which may cause a little lag. Furthermore, the field of vision in full feature VR should be slightly superior, at about 100 degrees or wider, while a smartphone tends to offer a field of 96 degrees at most.

VR can be experienced with lower specification PCs, consoles or smartphone, but the quality degrades accordingly. A normal PC would deliver lower screen refresh rates, lessening the efficacy of the simulation. The images shown may lag the pace of a turning head, in turn causing a feeling of nausea, as the image presented would not be what the brain expects. One can also use standard resolution smartphones, but you would likely see pixelated, less convincing images. A smartphone screen that is pixel free at normal viewing distances (10 cm) is likely to appear pixelated when a mere 1-2 cm away from the eye. Smartphone vendors are unlikely to over-specify pixel density unless they can monetize it. Also, mobile graphics chips have to get powerful enough to cope with such high resolutions.

VR cardboard kits are also available. These have the virtue of being low cost, often less than $10 and frequently given away[141]. But they can be fragile as they are self-assembled and because of the material. Low cost variants lack features such as nose supports, causing discomfort with prolonged use. Most of them lack the strap to attach it to your head and require a person to hold it in their hands; this in turn eliminates the motion sickness caused by slow phone refresh rates, but reduces the immersion that the user is experiencing.

As for VR content, we would expect most revenue generated to come from games sales, with titles sold at between $5 and $40, generating over $300 million. Many of the apps created for smartphones are likely to be available for under $10 or free, with the latter serving primarily as marketing tools[142].

We do not expect VR to be used to any great extent in television or movies in 2016. A key reason for VR's minimal impact on TV and movies this year is that little VR content exists, with a fundamental constraint being the lack of broadcast grade or even hobbyist cameras capable of capturing VR content. VR apps will be available, but we expect these typically to offer a view of a virtualized living room which includes a virtual television set, displaying regular TV programs in 2D[143].

By the start of 2016, we anticipate a small range of suitable cameras may have been launched onto the market, but the cost of purchasing or renting professional grade devices may initially be prohibitive for many projects[144].

Furthermore, as was the case with 3D filming for television, there is likely to be a learning curve in determining best practices for shooting for VR[145]. Regular filming places the set in front of the camera, and the production crew to the rear and out of shot. VR filming may require the crew to disappear entirely, which may complicate the directing of the shots. For VR sports, it is not yet certain where best to place the camera: placing it in the center of a field and in the mid-point of the action would likely constrain players' movements.

There are also likely to be challenges in post-production, one of which will be simply how to store the image files. One production level camera features 42 cameras capable of 4K resolution. This captures a gigapixel image (about 500 times the size of a standard smartphone image), and shoots at 30 frames a second[146]. One subsequent challenge of capturing images at this level of resolution will be determining how to store, transmit and edit the files.

VR offers viewers a choice of point of view (POV); some viewers may prefer the director to choose the best viewing angle for them. The first DVDs offered the option of multiple angles, with the viewer choosing the perspective, as a differentiator to video cassettes, but this option was rapidly dropped due to low consumer interest.

As for enterprise adoption of VR, we expect 2016 will be a year of experimentation, with a range of companies dabbling with using VR for sales and marketing purposes. These activities are likely to be commercially insignificant this year. For example:

- Some architects are using VR to create interactive visualizations of construction projects in place of 3D models, or fly-through video[147]. This approach can enable clients to make changes before work starts[148].
- Emergency response workers have used VR to practice how to respond to faults with nuclear reactors[149].
- There are multiple applications for healthcare, with training and education of staff and members of the public being among the most prevalent[150].
- Hotels can provide VR guides to properties[151]. For guests at a property, a VR headset could act as a virtual concierge, showing guests places they could visit.
- As well as teaching via a virtual classroom, VR can additionally be used to provide digitized tours to prospective students[152].
- VR will likely continue to be used in the military where simulators have long been commonplace (see side bar: Simulators and the military).

Simulators and the military

Simulators have been used for flight training as it is much safer and cheaper to learn how to fly in difficult conditions on the ground than in the air. Early simulators were wooden boxes mounted on a Universal Joint and driven by organ bellows in 1930, but were critical to training[153]. By the 1990s, full flight simulators were more mechanically sophisticated and incorporated large, high resolution screens that projected virtual scenes for the pilots-in-training. These cost millions of dollars, and in some cases less expensive solutions were sufficient. By 2007 helmets incorporating projected dual screen images a few inches from the user's eyes were being used for training, both for flight simulation and land combat training[154].

We congratulate VR on what we expect will be its first billion dollar year, and we forecast rising revenues in coming years: it is possible that the industry will generate tens of billions of revenues in the medium term[155]. What appears certain however is that VR's potential is unlikely to be reached imminently; as with all emerging technologies patience is required.

Bottom Line

Virtual reality is a fantastic innovation which can demonstrate the cutting edge of what technology is capable of today. VR's capability is likely to improve further still over the years as processors improve, screen resolution increases yet further, and content creators learn how to create for the format.

That said, as can happen with emerging technologies, there is considerable hype about the impact of VR in the near-term. Any company that is considering VR in any regard should have a careful look at the likely addressable market. Enthusiastic reactions to VR at trade fairs or at industry conferences, based on a few minutes of usage, may not convert into mass market demand. Those who attend trade shows may not be representative of the overall population, and those who are willing to line up for hours to try a new VR headset are likely to be even less representative. Furthermore, not all of those who are willing to line up for a free trial may be willing to spend $300-500 of their own money when the devices become commercially available.

Any company considering marketing via VR imagery should consider the cost of making this content available to consumers. For example travel companies wanting to create VR brochures should assess how much filming and playback in VR may cost relative to current marketing approaches[156]. They should also assess the cost associated with acquiring the hardware needed to display these materials.

Recent breakthrough technologies that required consumers to wear something on their face have not proven to be mass market successes. While VR headsets may sell better than smart glasses or 3D TV glasses, also consider that using the technology may require a set of behavioral changes (the most apparent of which is wearing a large headset) that the majority of people do not want to make. For some people the immersion that VR causes may overwhelm rather than liberate. And wearing a padded headset for a prolonged period of time may cause the user's face to get hot and/or sweaty.

But the dream of being able to teleport anywhere just by donning a pair of goggles might prove enough for some to continue using VR on a daily basis[157]. The ambition to deliver on this dream is likely to keep many companies investing in the goal of making VR a commercial and virtual reality.

As for enterprise adoption of VR, we expect 2016 will be a year of experimentation, with a range of companies dabbling with using VR for sales and marketing purposes.

Mobile games: leading, but less lucrative

The immense number of mobile game titles renders many new titles invisible without substantial marketing spending.

Deloitte Global predicts that in 2016 mobile devices (smartphone and tablet) will become the leading games platform by software revenue, generating $35 billion in revenue, up 20 percent from 2015. This compares to $32 billion for PC games and $28 billion for console games, up only five and six percent respectively from the previous year.

However we expect average revenue per game by platform to vary significantly. We forecast $4.8 million per console game available, $2.9 million per PC game, but only $40,000 per mobile game[158]. We estimate average annual spending on content per mobile games player to be about $20. This compares to $50 per PC games player, and $145 per console player. While many tens of thousands of companies create mobile games, we would expect only about 200 mobile games companies will gross over $1 million in 2016. There are three main reasons explaining the acute differences in revenue per game.

The first is the size of the installed base. We estimate about 1.75 billion smartphones and tablets will be used to play games frequently as of end-2016, out of a total base of 2.7 billion smartphones and 750 million tablets[159]. This compares to the just over 600 million who play games regularly on PCs, and approximately 200 million for games consoles[160].

A second fundamental difference is barriers to entry. A typical latest-generation (also known as AAA) console or PC-based game costs tens of millions of dollars to produce[161], a similar sum to market[162], and can take several years to develop. Mobile games have relatively low barriers to entry, and can be created in mere hours. This has contributed to a profusion of mobile games titles. As of the start of 2016, we estimate app stores will offer more than 800,000 mobile games; this compares to 17,000 titles available for all games consoles and PCs. Every day a further 500 mobile games titles are launched on a single platform[163].

The immense number of mobile game titles renders many new titles invisible without substantial marketing spending. The largest mobile games publishers are spending hundreds of millions of dollars on marketing annually, with a large amount of this spent on broadcast TV[164].

If mobile games publishers cannot afford a TV campaign, they could use outcome-based advertising, such as app-install ads. They would only need to pay for actual downloads of a game or could even choose to pay for apps that are both downloaded and opened several times. However this can be expensive. In the US market, cost per install is $1-2, and can spike far higher on a seasonal basis, such as just after December when there is a surge of new device activations[165]. An install accompanied by usage (known as 'Cost per Loyal User') can incur a charge of over $4 in the US[166].

A mobile games publisher might pay several dollars per download with no resulting revenue, even if the user benefits from hundreds of hours of free usage.

This potential outcome highlights a third fundamental difference: the business model. The predominant sales model for mobile games is freemium, whereby games are downloaded for free and additional content, be this in the form of extra lives, additional characters or special powers, is charged for. Players can (and do) spend tens of hours playing without having to pay a cent. Market data suggests that this is typically less than three percent of all players[167].

Indeed in 2016, it is highly probable that the vast majority of freemium games downloaded to mobile devices will generate no revenue. According to Deloitte member firm research, only about a tenth of smartphone owners make in-app purchases (including games) in a given month[168]. Those that spend on mobile games are lucrative, but they are elusive. About one in 650 mobile games players (known in the industry as "whales") generate about half of all in-app spend in free-to-play games[169]. By contrast, almost all players of console or PC-based games have paid for the game.

One reason why console and PC game players may be more willing to pay is because of the utility derived, with many hours of play frequently taking place. By contrast mobile games are often played to occupy pauses during the day when the user might otherwise be doing little or nothing, such as while commuting on public transport, or waiting for a friend to arrive, or during an advertising break. A mobile game can fill a few minutes and is often a fall-back, whereas someone playing a console or PC-based game may block out hours to do so.

The marketing investment required for mobile games publishers is likely to keep the market stratified in 2016. Deloitte Global expects about 80 percent of mobile games revenue in the top 1,000 titles to be earned by the top 20 publishers in each region: that leaves a fifth of the remaining revenue to be shared among many tens of thousands of developers[170]. We would also expect sizeable rewards to be maintained for the number one game; the best grossing game could generate five times that of the number five game, and 10 times that of the number 10 game[171].

We would expect only a few hundred mobile games companies to gross over $1 million in 2016[172]; this would be sufficient to run a studio with 5-10 developers. One survey of 8,000 developers found that 17 percent generated no revenue; 18 percent made less than $100 a month, and half made less than $1,000 per month[173].

A further difference between mobile games and both console and PC games has been longevity. Movie franchises can be criticized for offering up a mere three sequels to a blockbuster; nine console and PC franchises have launched over 10 editions, of which three *(Madden NFL, FIFA and Mario Brothers)* have had over 20 editions. One 17-year old title, *Counter-Strike,* has on average hundreds of thousands of concurrent users of its latest iteration: *Counter-Strike: Global Offensive*[174]. A major benefit of successful sequels is a lowered marketing cost; the historical inability to launch mobile game sequels further adds to the marketing cost.

Some media properties can diversify across multiple platforms, such as books or plays being turned into movies or TV shows. Console and PC game hits should, arguably, transfer easily to mobile. Yet very few mobile games hits (under 10 percent) were originally console or PC hits.

We predict that in subsequent years mobile games revenues will continue to grow, propelled by both a rising base of mobile devices, and a marked increase in device specification, particularly for smartphones. Better processors and sharper screens will likely enable more sophisticated game play and more complex graphics over time, although game play on a five – or ten-inch screen will be different than on a 15 – or 50-inch screen. Faster connectivity will enable quicker downloads as well as online play.

We would expect games play to remain a principal usage of mobile devices. However, while consumers are likely to continue to enjoy playing mobile games, life may become increasingly arduous for mobile games publishers, potentially leading to some major players exiting the market in 2016 or 2017.

Given these data, we further predict that the rise of mobile games, in terms of revenues, will not 'eat' console and PC games revenues in the medium term: the three platforms will co-exist, with each serving largely distinct needs, underpinned by different business dynamics.

Bottom Line

The mobile games industry as a whole should thrive in 2016, but the outlook for individual mobile games developers is likely to be far more varied. When touchscreen based games first became available for smartphones and tablets, it was relatively easy for an individual or small company to create a game that would then become a major hit.

However success has its consequences, one of which has been to encourage a deluge of developers, and the result has been an increasingly challenging outlook for fledgling mobile games publishers.

The mobile games sector now has the same core challenges as most mainstream media: creating compelling content and making people aware of it.

This may leave three options for small mobile games developers (aside from keeping their day job). A first option would be to hope for a serendipitous hit, such has blessed recent hits such as *Crossy Road, Flappy Bird or Monument Valley*[175]. A second is to align with a major publisher which has the resources to market a new game heavily – but those downloading the game on a freemium basis may not pay for add-ons with sufficient regularity. A third option may simply be to focus on the console or PC market: while the addressable base may be far smaller, gamers in this category have long been accustomed to paying for content.

Mobile ad-blockers: saved by the app?

An ad-blocker is a software file that blocks access to sites that deliver advertising files.

Deloitte Global predicts a mere 0.3 percent of all mobile device owners (comprising smartphones and tablets) will use an ad-blocker by end-2016. This is likely to put less than $100 million (0.1 percent) of the $70 billion mobile advertising market at risk[176].

An ad-blocker is a software file that blocks access to sites that deliver advertising files. These include the visible, such as banner and pop-up ads, and those operating in the background, such as trackers, which log a user's online activity. Data gathered by trackers can be used to determine which ads to serve, and can also be resold to third parties. Without an ad-blocker, a request for a 500-word online article may download these 500 words and additionally a large quantity (up to 20 megabytes, equivalent to 1,000 pages of text) of advertising files (advertising copy and trackers)[177].

For users, the most immediate impact of ad-blockers is page load times: a page that would have taken 10-15 seconds to load over a fast 4G connection can now take 2-3 seconds. Further, pages are presented mostly ad-free and white space replaces the areas reserved for ads; no ads pop up to obscure what you are reading.

A less visible consequence of ad-blockers is that trackers get barred too, inhibiting the reuse and resale of the user's browsing patterns. Some sites install dozens of trackers onto a user's device. Further, each ad, while small in size, can readily feel obtrusive within the minimalist confines of a smartphone screen. All additional ad content can bulk up each web page considerably, potentially increasing load times, consuming data allowances, and depleting the battery.

Despite these benefits, we would expect very few mobile devices to have ad-blockers installed by end-2016.

Only a small minority of the 3.4 billion smartphones and tablets in use by end-2016 are likely to have native ad-blocking capability built into their operating system; of these most usage will be app-based and unaffected by device-level ad-blocking.

A key reason for this is that only a minority (about 20 percent) of the 3.4 billion mobile devices (smartphones and tablets) in use by end-2016 are likely to have native ad-blocking capability built into their operating system. This reduces significantly the addressable market for device-level ad-blocking. These devices are forecast to generate about $6 billion in browser-based ad revenues in 2016.

Additionally, most time spent on mobile devices is app-based, but ad-blockers only filter out browser-based content[178]. In the US for example, about 90 percent of time spent on mobile devices is within an app, and only a tenth in a browser[179]. This means that ad-blocking at the device level is applicable only for a minority of devices, and for a minority of the time.

Mobile ad-blockers do not block all ads: they prevent access to about 50,000 scripts (commands that are executed on a device automatically). The more sites that are added, the more processing power is required to check each site requested against the list. So ad-blockers cannot be fully comprehensive. Some of the companies providing ad-blockers offer to delist (also known as 'white list'), sometimes for ads that are not deemed intrusive, and occasionally for a fee.

An additional barrier to adoption is consumer inertia: for an ad-blocker to be operational, the user needs to select, download, and adjust the settings on their device. We expect most ad-blockers will be paid-for, as free ad-blockers' efficacy may be compromised by their use of 'white lists'.

Given all these factors we expect only a minority – at most two percent (10 million) – of the addressable market to have an ad-blocker installed and active by end-2016.

We would also expect advertisers to redeploy ads to apps or to websites not affected by ad-blocking and as a result may not reduce their spending on mobile. So websites with minimal advertising, and those with fast-loading advertising, may be net beneficiaries of ad-blockers.

We expect the adoption of ad-blockers will follow a different pattern to that for PCs, for which ad-blocking has been available for years. As of mid-2015, there were an estimated 200 million monthly active users of ad-blockers on PCs globally, with 77 million active users in Europe and 45 million in the US alone[180]. The focus on app-based usage on a mobile device is likely to be a key reason why the relatively large-scale adoption of ad-blocking technology that has been experienced on PCs will not be replicated on mobile.

While we do not expect the impact of mobile ad-blocking in 2016 to be significant relative to the overall size of the market, its impact is likely to be felt disproportionately.

Smaller online-only publishers that rely entirely on advertising revenues and lack other forms of income, such as subscription, may be particularly affected. They may not have the resource to be able to optimize their sites to load fast, while still delivering advertising. They may also lack the funding to create an app within which ads could be delivered outside of the reach of ad-blockers.

It may also be the case that the most impacted news outlets are those focused on tech and gaming news, whose audience is most aware of ad-blockers and most likely to have deployed them for their PC-based usage.

Bottom Line

When ad-blockers first went on sale they stormed to the top of the app store charts in the first weekend[181]. Subsequently sales have fallen steadily[182]. However this should not be a cause for complacency. There is the possibility of a further wave of interest in ad-blocking, which could lead to a more significant wave of adoption.

Online publishers that rely on advertising for revenues should use the threat of ad-blocking to consider how best to enable easy payment for their content and not provide a vast array of consumer data as a condition of being able to contribute a dollar, or to insist on subscription.

The mobile advertising industry should also keep an eye on network-level ad-blocking[183]. While in some markets this may be considered a contravention of net neutrality principles, regulation may change to enable this[184].

The industry should also anticipate how prevalent consumer inertia can be. For example, hundreds of millions of mobile users have been able to access an ad-free, text-only mode for reading content for years, but few have chosen to do so[185].

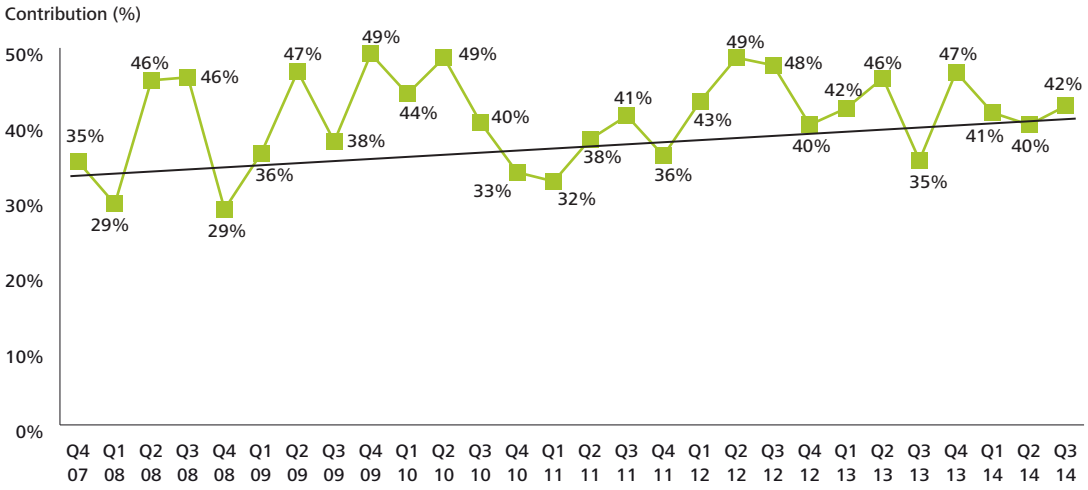
However we also anticipate that many mobile users would deploy their own form of organic ad-blocking by simply ignoring mobile websites with what they consider to be excessive advertising content. So even if ad-blockers are not popular, avoidance of ad-heavy sites may still be common.

The award for stable box office revenues in the face of digital media goes to…

Deloitte Global predicts that the value of movie theater admissions in the US and Canada will fall by about three percent in 2016, to about $10.6 billion, with about 1.3 billion tickets sold. It is impossible to forecast beyond that with any precision: box office is so dependent on the slate of movies released. Between 1996 and 2015, the annual box office revenue change is nearly random, although it has never gone up by more than 10 percent or fallen by more than six percent[186] and the number of tickets sold has never gone up by more than 12 percent or fallen by more than six percent[187]. Given that, we expect average annual revenue growth in the near-term to be about one percent, but within a range of plus or minus 10 percent, and the number of tickets sold to decline about one percent per year. Box office dollars are likely to grow, but at a minimal pace, and are actually likely to decline (also at a minimal pace) if inflation is taken into account[188].

The annual movie box office is driven heavily by the fortunes of the top five blockbusters. The popularity of these films accounts for most of the year-on-year volatility. Since 2007, the trend has been for the five highest-grossing films to generate over 40 percent of the box office[189] (see Figure 8). In 2014 the top five fared poorly and the box office fell five percent[190]. Last year was better, up a forecast eight percent. 2016 may surprise, but at time of writing one industry forecast is for a slightly weaker slate of blockbusters, and therefore a decline, although not as bad as 2014[191].

Figure 8: Contribution (%) from top five films to total box office revenues



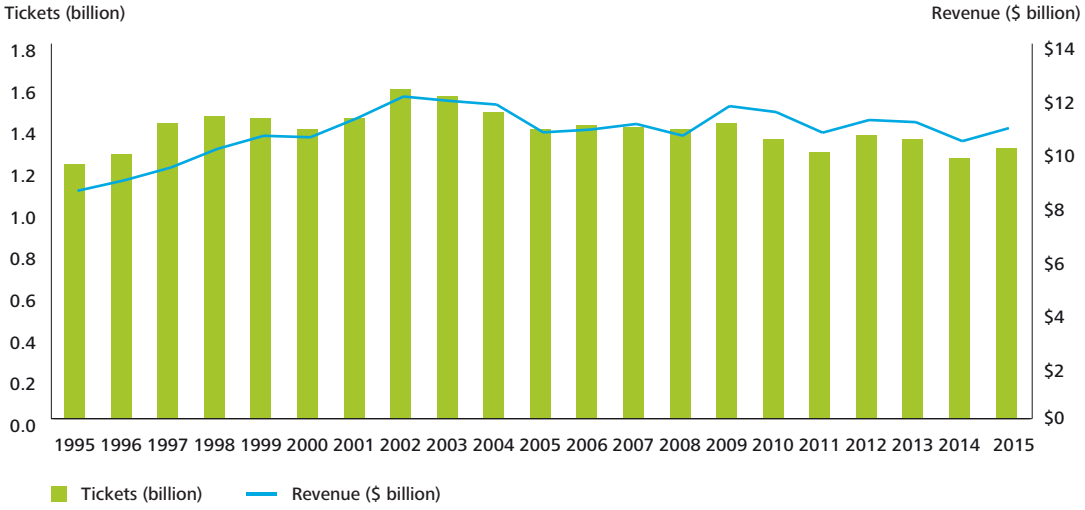
Source: Canaccord Genuity. For further information on the source, see endnotes.

The annual movie box office is driven heavily by the fortunes of the top five blockbusters.

As stated previously, between 1995 and 2015 annual revenues for the US and Canadian box office (called the North American box office by the movie industry, although it does not include Mexico) fluctuated in a relatively narrow range of up 10 percent and down 6 percent. Although the effects of inflation have been small in any given year, the cumulative effect over 20 years is that a box office dollar in 1995 is worth $1.57 in 2015.

A chart of box office revenues in constant dollars and also the number of tickets sold shows a clear picture: both admissions and constant dollar revenues grew from 1995 to 2002, and since then both inflation-adjusted revenues and admissions have fluctuated, but are in slow decline. From 2002 to 2015, admissions have fallen from 1.55 billion to 1.33 billion, or an annual compounded rate of 1.17 percent[192], while revenues declined at a 0.79 percent compound rate in constant 2014 dollars, from $12.03 billion to $10.85 billion[193], see Figure 9.

Figure 9: US and Canada cinema revenues and admissions 1995-2015 in billions of 2014 dollars

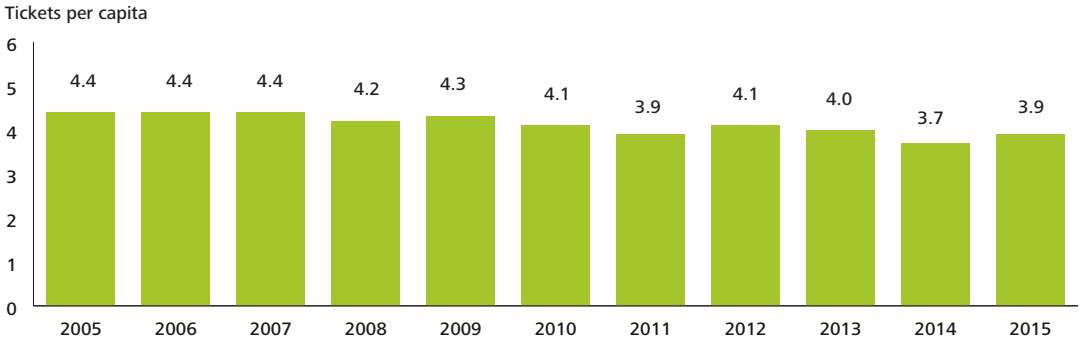


Sources: MPAA, Deloitte Canada analysis. For further information on the sources, see endnotes.

A sub-one percent average annual decline in admission revenues is not indicative of a growth industry, especially considering population growth of 1-2 percent. In fact, Figure 10 shows that per capita admissions in the US and Canada have been declining at a fairly consistent rate since 2005, from 4.4 visits per year to 3.9[194]: an 11 percent decline in total, or a 1.2 percent annual compounded decline.

The revenue impact has been mitigated, even in constant dollar terms, as US movie ticket prices have risen slightly faster than inflation, in part due to a mix with more expensive 3D and large format movies (such as IMAX). The average ticket in 1995 was $4.59 in 1995, and $8.17 in 2014, but in constant 1995 dollars the 2014 number is $5.27, which is annual price growth of almost exactly one percent above inflation[195].

Figure 10: US and Canada tickets per capita for population aged 2+, 2005-2015



Sources: MPAA, Deloitte Canada analysis. For further information on the sources, see endnotes.

But compared to what has happened to the DVD business, the DVD rental business, and other traditional media, cinema is doing better than most.

Charging for feature films has been an industry for over 100 years. Globally the industry is about $40 billion per year[196], and although it is declining in some markets, it is doing so at a very moderate pace compared to other industries that face threats from digital and the Internet.

It seems likely that the greater ease and accessibility of legal and illegal movie streaming or downloading has had an effect on movie box offices. One estimate of the cost of piracy to the US studios was $6.1 billion a year[197]. What was a growth industry to 2002 is now marked by annual fluctuations around a slow decline. And although the dollar value of admissions has been relatively stable, the decline in terms of tickets is steeper: compared to a 0.8 percent decline in constant dollars for 2002-2015, the number of tickets sold has declined about twice as quickly at 1.5 percent annually.

That is still not the kind of erosion seen in many other traditional media, but given that movie theater owners make money from both admissions and concessions, the number of tickets matters a lot. Concession revenues are about 45 percent as the amount of the money from admissions[198], but they are an even larger source of profits, with margins of about 85 percent[199].

It is also worth noting that the number of tickets sold annually in US and Canada since 2002 is down from 1.58 billion to about 1.3 billion in 2015. That 18 percent fall is not bad compared to other traditional media in the same time period, but is also not as serious as the previous decline in the movie business caused by a new technology. In 1947 US box office reached a peak of 4.7 billion tickets sold, but the rise of TV saw ticket sales fall to a billion by 1964 – a 78 percent collapse over only 17 years[200].

Importantly, the stability of movie admissions is not being driven by older audiences, in the way that TV viewing is, where younger viewers watch about half as many hours per day as people aged 65 or over. The average North American aged 2 or over attended just under four movies per year in 2015, while the average 12-24 year old went to 6.3 movies[201]. Yes, they are consuming movies on YouTube, iTunes application program[202], Netflix and illegal streaming/download sites, but they continue to over-index on cinema-going as well, citing the ability to socialize with friends and the big screen experience[203].

… compared to what has happened to the DVD business, the DVD rental business, and other traditional media, cinema is doing better than most.

Bottom Line

Spending on making movies should assume flat-to-down theatrical revenues, but with an ever-increasing focus on franchises and sequels. Seven of the top 10 movies in 2015 were in this category, and the expected outlook for 2016 is for continued dominance[204]. Sequels and franchises tend to be lower risk, and also enjoy better international success than standalone films. As of late 2015, Hollywood had 157 movie sequels in the works[205].

This prediction focuses on domestic box office: the data shows that the number of tickets and dollars from theatrical admissions is more resilient than many think. But the focus on domestic box office is not even close to the full picture for the movie industry. At one time, international box office was almost an afterthought, but these days US studios assume that international will be 60 percent of total box office for any given film, with some films seeing 75 percent of cumulative box office coming from outside North America[206]. Further, even global box office ticket sales are only about half the story. In 2012, nearly half (48 percent) of total revenues for the average film came from ancillary revenues: home video sales, pay-per-view and TV/OTT licensing, syndication fees and merchandising[207].

The US and Canada market is the world's biggest box office at about $11 billion annually, but global box office revenues were about $40 billion in 2015[208]. As of 2013, the five biggest international box office markets after North America were China ($3.6 billion), Japan ($2.4 billion), UK ($1.7 billion) France ($1.6 billion) and India ($1.5 billion)[209]. Between 2009 and 2013, the North American box office was up about three percent in nominal dollars, but the international markets grew by $6.5 billion or 22 percent in the same time frame, representing 70 percent of all ticket sales by 2013.

Certain markets are growing even more strongly than the overall international market: as of December 2015, box office in China was up 49 percent year over year, to $6.7 billion. China is expected to surpass the North American market by 2017 or 2018[210]. The growth in China's box office is being driven in part by expansion in the number of screens: 25,000 additional screens are expected to be added in the next five years[211], which is more than the total number of screens in the country at the end of 2014[212]. This will take China well past the North American market, with its 40,000 screens as of 2014[213]. The number of admissions in 2014 was 830 million[214], and assuming that growth in attendance is in line with the revenue increase at the box office, admissions should be around 1.26 billion for the full year 2015, virtually tied with the 1.3 billion in the North American market.

Although the Chinese and North American market are jockeying for leadership in terms of annual box office revenues, in the number of tickets sold, both are well behind India, which had 2.7 billion admissions in 2013[215]. The rest of the global market is relatively stable: in 2014 Latin America rose two percent, while EMEA fell three percent[216].

The North American market is likely to be typical, at least for English-speaking markets. Admissions and revenues for the UK and Australian markets are roughly in line with US trends across multiple periods, as can be seen in Figure 11, although the revenue measurements are in nominal dollars rather than constant dollars.

Figure 11: Box office and attendance CAGR: North America, UK, and Australia 1993-2013

	North America	UK	Australia
5-yr CAGR till 2013			
Attendance	0.0%	0.2%	-0.6%
Box office revenue	2.6%	4.8%	3.1%
10-yr CAGR till 2013			
Attendance	-1.3%	-0.1%	-0.9%
Box office revenue	1.7%	3.9%	2.4%
15-yr CAGR till 2013			
Attendance	-0.7%	1.3%	0.2%
Box office revenue	3.1%	4.4%	3.8%
20-yr CAGR till 2013			
Attendance	0.4%	1.9%	2.0%
Box office revenue	3.8%	5.6%	5.3%

Source: Canaccord Genuity. For further information on the source, see endnotes

Since movie theaters share ticket revenues with the movie distributors, but keep all of the concession profits for themselves, we expect to see the price of popcorn and other treats continue rising faster than the rate of inflation or ticket prices[217].

Exhibitors can continue to promote premium movie experiences such as 3D and IMAX, although at the risk of pushing some people away due to high prices. The annual growth in ticket prices is only about one percent in real terms, and the industry may want to highlight this fact, since the perception is that ticket prices have grown much faster.

Also exhibitors can drive better use of under-utilized exhibition space, such as by showing live operas[218], renting out meeting rooms to businesses, or as eSports venues[219].

US TV: erosion, not implosion

Deloitte Global predicts that the US traditional television market, the world's largest at about $170 billion in 2016, will see erosion on at least six fronts: the number of pay-TV subscribers; pay-TV penetration as a percent of total population; average pay-TV monthly bill; consumers switching to antennas for watching TV; and live and time-shifted viewing by the overall population, and especially by trailing millennials (18-24 years old).

Although media coverage of these trends is very high in 2015, they have been ongoing since about 2010/2011, which in some ways was 'peak TV' in the US. Despite many forecasts of the imminent collapse of the traditional advertising and subscription-funded TV model, it is likely to erode at a slow, steady and predictable rate. Television is not growing the way it used to: for example, pay-TV penetration in the US rose from over 76 percent in 2000 to nearly 90 percent in 2010, and has fallen slowly since[220]. Traditional TV is not dying, disappearing, or irrelevant. As of May 2015 TV reached 208.5 million Americans over the age of 18, or 87 percent of the adult population; and they watched 468 billion minutes of TV in the average week, which is about four times as many minutes as adult Americans spent on their smartphones, in apps or on the web (but not including talking or SMS texting)[221].

Pay-TV cord cutting. Deloitte Global predicts that the number of US subscribers who cut the cord (completely cancel pay-TV service from a cable, satellite or phone company) is likely to be just over 1 percent in 2016, perhaps 1.5 percent in 2017, and around 2 percent in 2018. By 2020, we predict that there are likely to be around 90 million US homes which are still paying for some version of the traditional bundle which, while down from the peak of 100.9 million subscribers in 2011[222], will be 18 million higher than the 72 million US cable and satellite subscribers in 1997[223]. The rise of cord cutting has been the most discussed trend around traditional TV viewing for years, and is likely to remain so in 2016. In 2010, nearly 90 percent of US consumers watched almost all their TV via a signal provided by a 'distributor', that is a cable, satellite or phone company. Pay-TV is typically sold as part of a bundle, and costs the average subscriber $100 per month for TV only in 2015, with broadband or voice service costing additional amounts[224]. For many years around seven percent of pay-TV consumers have said that they were thinking about cancelling or would cancel their subscriptions within the next 12 months[225].

However intent was rarely matched by action and the decline has been much more muted. The number of pay-TV subscribers has been declining slowly since 2012[226], falling by 8,000 in 2012, 170,000 in 2013, and 164,000 in 2014[227]. The annual incremental change in total subscribers was steady at around 150,000 fewer for most years between 2010 and 2014, but it is accelerating sharply in 2015 with pay-TV subscribers estimated to fall by just under one million[228], on a base of roughly 100 million homes[229] subscribing to a pay-TV package. There is also likely to be some cord shaving, where consumers pay less money for fewer traditional channels, which is discussed further below: in a Deloitte US 2014 survey, just over half of existing US pay-TV customers said they would prefer to pay only for the channels they watch regularly[230]. However, as noted above, there has tended to be a disconnect between stated intention and follow-through.

Pay-TV penetration. Deloitte Global predicts that pay-TV penetration (or reach) will fall more than two percentage points to 81 percent in 2016, to under 79 percent in 2017, and around 70 percent by 2020. That is a 20 percentage point decline in reach from the 89.4 percent in 2010, but the installed base would likely still be markedly higher than for most other countries, and about the same level as US pay-TV penetration of 72 percent in 1997[231].The expected decline in penetration rate is largely due to a steady 1.1-1.3 million forecast increase in the number of US households between 2015 and 2025[232].

But another factor is the growing number of millennials who have never had a pay-TV subscription. These are not cord cutters, but cord nevers, and in one US survey represent 11 percent of 18-34 year-olds[233]. There have always been Americans who have never paid for TV, but the older demographics tended to watch over-the-air broadcast TV with an antenna. They weren't paying for a monthly subscription, but they still watched traditional TV, and usually with all the advertisements. Some of the new generation of cord nevers may be using antennas (one cable company includes an OTA antenna for customers who subscribe to broadband but don't want pay-TV[234]), but many may be using broadband only for their video needs. The exact number of millennials who don't pay for TV and don't have antennas is not known, but as of 2015 the number of households in the US who had broadband only and no antenna or pay-TV subscription was only 3.3 million, although that was up over a million from 2014, or more than 50 percent[235].

Deloitte Global predicts the number of antenna-only homes (or antenna plus Internet TV) to increase by less than one million in 2016, to about 13.5 million homes, and to about 18 million homes by 2020.

Average monthly pay-TV bill. Deloitte Global predicts that the monthly TV bill in 2016 will be about five percent higher than the average $100 per month bill in 2015, or lower than the historical growth rate of over six percent, reflecting the combined effects of small numbers of cord shavers and fewer consumers adding channels. The average US bill for pay-TV grew by 6.1 percent per year[236] between 1995 and 2015. Deloitte Global further predicts that the bill growth is likely to decline by about one percentage point per year so that by 2020 ARPU is likely to be under one percent, and may even have begun to decline, although still at a relatively slow rate.

The number of channels available to the average US pay-TV subscriber has increased by almost 50 percent since 2008, from under 130 channels to nearly 190[237]. Over that period the number of channels watched by the average viewer has declined from 15 channels in 2012 to 11 in 2014[238]. As some 90 percent of channels that are being paid for are unwatched, some subscribers may be thinking about cord shaving: choosing packages with fewer channels, or fewer packages, with the result being lower monthly spend.

A few cord shavers may be substituting a traditional pay-TV package with a lower-cost subscription video on demand (SVOD) service. Were this behavior widespread, we would have likely seen a decline in monthly pay-TV bills, but this has not happened. In fact average bills are still rising, rising from $89 in 2014 to over $99 in 2015, according to one survey[239]. Another 2015 survey shows that over 80 percent of pay-TV subscribers are spending the same or more as in 2014, and that they are remarkably stable in the services they are buying: 64 percent kept the same services as last year, 17.8 percent added services, and 18.6 percent cut services – for a net annual change of only 0.8 percent[240].

Antenna instead of pay-TV. Deloitte Global predicts the number of antenna-only homes (or antenna plus Internet TV) to increase by less than one million in 2016, to about 13.5 million homes, and to about 18 million homes by 2020.

Many North Americans are unaware that many of the channels they would like to watch are available for no monthly charge with the installation of a digital antenna that allows for over-the-air (OTA) TV viewing, either live or time-shifted if they have a recorder. For some Americans, this may require a more expensive roof-mounted antenna, but for the more than 80 percent who live in urban areas[241], the antenna can be indoors near a window or exterior wall and costs less than $20[242]. OTA digital TV is commonplace in Europe, but only about 12.7 million US homes were receiving broadcast as of Q2 2015, or 651,000 higher than the same period in 2014[243]. There are many articles that specifically address cord cutters using antennas[244], and some distributors fear that they will see a surge in OTA homes, as cord-cutters cancel traditional distribution bundles; get some channels from their antenna and buy a small bespoke selection of OTT services.

There is some evidence of this trend, but it is much smaller than most people expect. OTA-only homes in the US were more or less flat at just over 11 million from 2010-2013, but the number has recently begun growing, and at a faster rate: 500,000 additional homes went OTA-only in 2014 and nearly a million in 2015 (although the year-over-year growth was highest in Q1 – in Q2 and Q3 it was less than 700,000)[245]. The modest rise in OTA viewing affects each of the parts of the traditional TV industry differently. Cable, telco and satellite providers of TV packages are likely to see a small effect on subscriber numbers and revenues (although only 53 percent of broadcast-only homes are broadband subscribers, so that partially offsets the decline[246]). However, TV broadcasters and their advertisers are not affected by a move from traditional pay-TV bundle to OTA: as long as viewers are watching their programs (and the ads) then they are largely indifferent to the distribution method.

Average daily TV viewing, live and time-shifted. Deloitte Global predicts that daily TV minutes for the adult population will continue to fall at a slow but steady rate in 2016, to 320 minutes per day in Q1[247]. On average, adults in the US watched over 330 minutes of traditional live and time-shifted TV per day in Q1 2015 on a TV set. This is 14 minutes down from 2014, and 10 minutes lower than in 2013[248].

Deloitte Global further predicts that this moderate decline will continue, but average daily viewing in the US will likely still be over 240 minutes in 2020, that is greater than in most other countries, despite the fall. Four hours would be exactly the same amount of traditional TV as watched in the 1998-99 broadcast season[249].

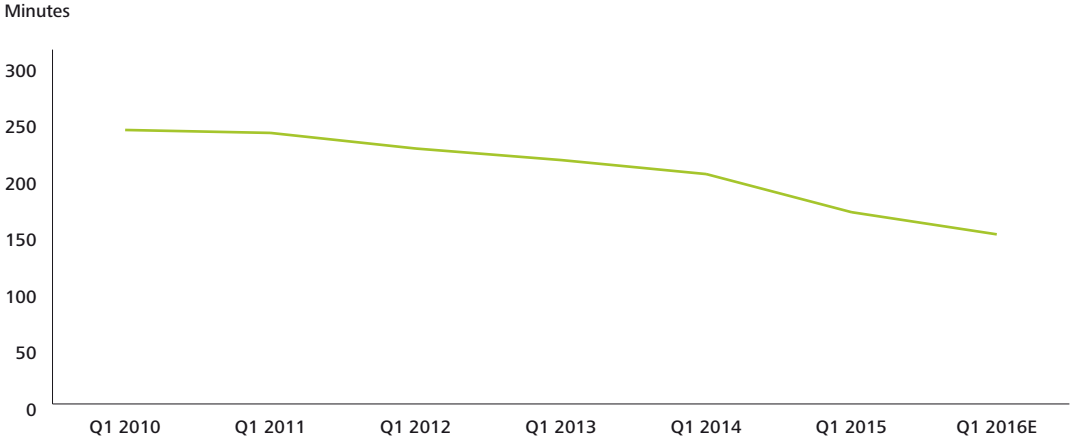
Average daily TV viewing, live and time-shifted trailing millennials. Deloitte Global predicts that 18-24 year-olds will watch about 12 percent less traditional TV in Q1 of the 2016 broadcast year than in the same quarter of the previous year, or about 20 fewer minutes daily, down to an average of 150 minutes, still well over two hours. Deloitte Global further predicts that erosion in viewing time will continue, and that 18-24 year-olds will be watching less than two hours of TV daily by 2020, but more than 90 minutes. Some portion of their video consumption over that time period will likely be shifting from traditional TV on TV sets to other devices, such as multimedia devices (Apple TV digital media extender, Chromecast, etc.) smartphones, computers and tablets[250].

But video consumption on those devices, while it has been growing, has not been offsetting the decline in traditional TV-watching by trailing millennials. In 2015, all video watched on devices other than TV sets was 32 minutes daily, up from 28 minutes in 2014[251]. Those additional four minutes are much less than the 33 minute decline in traditional TV on TV sets that 18-24 year-olds watched over the same two periods[252].

Specific subsets of the US audience are shifting viewing habits faster than the average. Trailing millennials aged 18-24 watched 29 percent fewer minutes of TV daily in 2015 than they did in 2011 (see Figure 12). This is an 8.3 percent compounded annual decline, which is six times faster than the 1.3 percent decline seen for the population aged 2+ in the same period[253].

Younger Americans have always watched considerably less TV than older demographics[254], but the gap is widening: in 2008 18-24 year-olds watched 58 percent as much live and time-shifted TV as those over 65, while by 2015 that age group was watching only 36 percent as many minutes of live and time-shifted TV on TV sets, and about 42 percent as many minutes of all video on all devices as Americans 65+[255]. As TV time for 18-24 year-olds drops to under two hours per day, we may end up nearing a tipping point where TV viewing for that demographic may begin to decline more sharply than for the population as a whole: there may be a threshold or minimum daily viewing time below which media consumption changes more abruptly.

Figure 12: Daily TV minutes (live and time shifted) for US 18-24 year olds in Q1



Source: Nielsen Three Screen Report Q1 2010, Nielsen Cross Platform Reports Q1 2011, 2012, 2013, 2014, Nielsen Total Audience Report Q1 2015, and Deloitte Global estimate for Q1 2016. For further information on the source, see endnotes.

Bottom Line

With the rise of over-the-top (OTT) services offered from non-traditional providers like Netflix, download services like iTunes application program[256], clips from services like YouTube, and the continued usage of pirate sites (streamed or downloaded), talk of the imminent collapse of traditional TV is understandable.

But while the US TV market is not growing, it is not collapsing either. The best way of describing the outlook is gradual erosion: an apocalypse is not around the corner.

An obvious question is: "What do all these various erosions do to the size of the US television industry?" If it is about $170 billion in 2016, (of which $75 billion is advertising and $95 billion is pay-TV) how does that number change thereafter, and by how much?

The outcome is hard to predict with certainty. Putting it all together, the total picture is murky.

If one percent of current pay-TV subscribers discontinues service in 2016 this does not necessarily mean a one percent decline in revenues. Cord cutters are likely to be those on the lowest-priced pay-TV packages. Their departure may cause ARPU to rise and become more resilient: customers that remain may be those least sensitive to further price increases[257]. Cord cutters are likely to include those watching the fewest minutes of TV, and may represent a smaller share of ad dollars to the industry than subscription dollars.

Some cord cutters are moving to OTA antennas, and may therefore end up watching more ads due to the lack of a DVR, and subscription losses may be offset by more effective advertising. Equally, cord shavers who get rid of channels they are not watching will likely have minimal impact on ad revenues.

Millennials aged 18-24 are a desirable demographic, and they are reducing TV minutes at a faster rate than the population as a whole, but are only a tenth of the US population[258]. Further, advertisers often pay to target specific groups: if traditional TV watching becomes concentrated in certain age groups or other demographic slices, advertisers could be willing to pay more for that targeted audience.

As an example, there were concerns over weakness in the TV ad market in the summer of 2015, as the mid-point of the August US upfront estimates fell over two percent from 2014[259]. However by October, total TV ad spend was up 10 percent annually[260].

The US is only one market, albeit the largest in the world, representing about 38 percent of the global TV market of around $450 billion worth of subscriptions, advertising and license fees. What happens in the US may or may not happen in the rest of the world.

Trends in Canada for cord cutting, cord shaving, pay-TV penetration and changes in viewing for the population as a whole, and for millennials, are roughly in line with the US data cited.

If we look at the UK TV market there are some similarities: viewing minutes are expected to fall between 2015 and 2020, but moderately, from 204 daily minutes to 191[261]. The UK data also shows a 27 percent decline in viewing by 16-24 year-olds for the period 2010-H1 2015: from 169 daily live and time-shifted minutes to 123, very much in line with the US decline of 29 percent over (roughly) the same period[262]. However, the forecast is for the peak decline in that youngest demographic to have occurred in 2014/15, and to "flatten out from 2016 onwards"[263]. It is also worth noting that although TV minutes may be declining in the UK, the pay-TV market is growing strongly, both in terms of subscribers and revenues[264], and the UK TV advertising market grew eight percent in 2015, recording its best growth in 20 years[265].

Although pay-TV subscribers are expected to fall slowly in the US, the global picture remains in growth mode. From 950 million subscribers and 58 percent penetration in 2015, estimates for 2020 are for 20 percent growth to 1.14 billion subscribers and 63 percent penetration[266].

Our thesis of gradual erosion is based on recent history and incomplete data. As already mentioned, if there is a tipping point of viewing hours needed to sustain pay-TV subscription rates, we could see the number of millennials who have their own homes and who do not get pay-TV go from current levels of 20-25 percent[267] to a much higher number in a short period of time. That hasn't happened yet, but it could. Another wild card is likely to be the effect of popular channels that had formerly been available only as part of a pay-TV bundle being offered on a stand-alone basis over the top (OTT) through the Internet. One such service has already launched in the US, and has only seen about one percent of its pay-TV subscribers cancel pay-TV and switch to the OTT version[268]. Should that service, or any others, see that substitution accelerate, the fragmenting of the traditional pay-TV bundle model will almost certainly see our predictions on cord cutting, cord shaving, and cord nevers prove too conservative. Finally, although the 18-24 year-old category is currently moving the fastest away from the traditional TV model, it is worth adding that older generations are also exhibiting some of the same shifts, albeit at lower levels. If those older age groups began to resemble millennials more rapidly in their pay-TV habits, our forecasts would again be too cautious.

European football scores $30 billion

Deloitte Global predicts that the European football market may generate $30 billion (€27 billion) in revenues in 2016/2017, an $8 billion (€7 billion) increase relative to 2011/2012, and a compound annual growth rate of seven percent.

Most of this growth will likely be driven by the five largest leagues (England's Premier League, France's Ligue 1, the German Bundesliga, Italy's Serie A and La Liga in Spain) whose share of revenues continues to rise. These leagues are expected to generate approximately $17 billion (58 percent) of total revenues in 2016/17.

Football and pay television have had an increasingly symbiotic relationship over the past two decades, and forecast 2016/2017 revenues attest to this. Football's revenues are predominantly made up of matchday (admissions and hospitality), commercial income and broadcast revenues, and it is this latter source which is forecast to generate both the majority of total revenues and the increase in revenues in 2016/17.

The 2016/2017 season will see new broadcast deals for both the English Premier League (EPL) and Spain's La Liga come into effect. Domestic live broadcast rights is expected to generate an average of $2.6 billion for the EPL for the three seasons from 2016/2017[269], a 71 percent increase on the prior agreement. Spain's La Liga, which has recently moved to a collective broadcast rights selling model, is expected to earn approximately $1.1 billion per season from domestic live rights[270]. These are the two biggest drivers of revenue growth in the European football market.

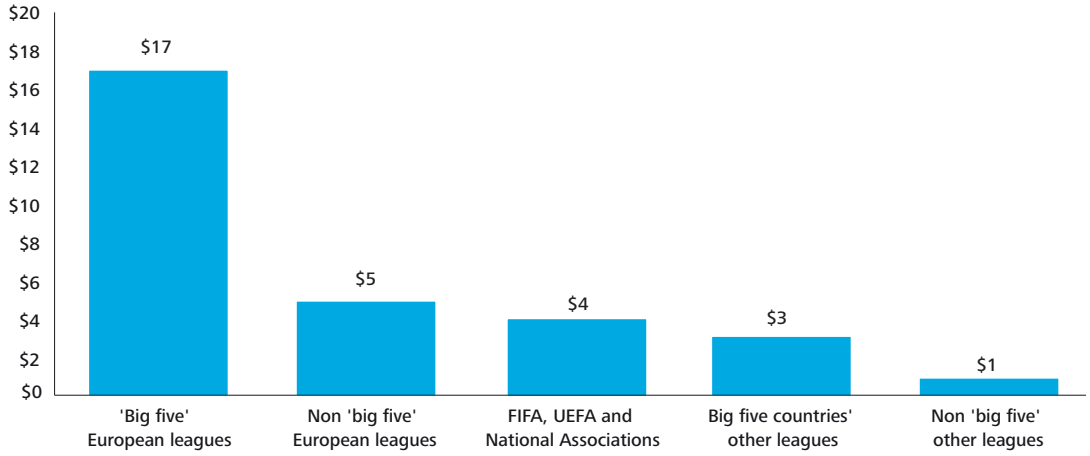
Both the UK and Spain are now relatively mature pay-TV markets for football, with 17.4 million pay-TV homes in the UK (65 percent of all households)[272] and 5.4 million (29 percent) in Spain as of Q2 2015[273]. Live rights to premium content such as top-tier domestic league football provides regular content through most months of the year, and hence is highly attractive to pay-TV operators in driving subscriptions.

It is not just from domestic markets that Europe's top leagues are achieving substantial growth in broadcast rights fees. The EPL and La Liga's international rights fees have been climbing fast too. In the 2016/2017 season the EPL is expected to generate over $1.5 billion from overseas broadcast rights, a gain of at least 40 percent compared to the previous rights cycle. La Liga generates less than half this amount, but has achieved substantial recent growth, and generates the second-highest broadcast revenues from non-domestic markets of any sports league.

There is global interest in football's top leagues and clubs at many levels, from broadcast interest to shirt sponsorship and ownership. In the EPL, over half of the 20 clubs have non-UK owners and the principal sponsor of three-quarters' of the teams is headquartered abroad, with many based in Asia Pacific and the Middle East.

There is global interest in football's top leagues and clubs at many levels, from broadcast interest to shirt sponsorship and ownership.

Figure 13: Predicted European football league revenues in $ billions for 2016/2017



Source: Deloitte Sports Business Group, 2015[271]

The game's rising revenues, and its universal appeal, make it highly attractive to investors.

Combined revenues of the 20 EPL clubs are predicted to surpass $6.5 billion in 2016/17, more than double that of the next-highest European league. The EPL has for many years delivered strong matchday, commercial and broadcast revenues and the core reasons for the EPL's continued revenue leadership are: its substantial broadcast revenue advantage, aided by highly successful centralized sales and marketing; global talent; competitive matches throughout the league; full stadia; and strong history and heritage.

EPL clubs are reaping the returns from heavy investment in venues and facilities over the last 20 years. League attendance averages over 95 percent of stadium capacity. Commercial revenues are now the highest of any European league, driven particularly by lucrative deals secured by the league's largest clubs, which have global appeal and resonance. For example, Manchester United's ten-year kit deal with Adidas is worth a minimum of $114 million (£75 million) per season[274].

While the EPL's financial prowess may not have been matched by its on-pitch success in European club competitions, in recent seasons their widening revenue advantage has given clubs the clout to bid for the top global playing talent, possibly squeezing out other European clubs.

Football has long been about supporters at every level, and owning a football club has to some extent been the ultimate collectable. The game's rising revenues, and its universal appeal, make it highly attractive to investors.

The game changer is the recent trend for top clubs, in the EPL in particular, to be able to generate a profit. Historically, revenue growth has been outstripped by cost increases, with football's greatest challenge being its ability to balance the books. Recent years have seen the development, implementation and subsequent benefits of cost control regulations within the game, indicating that this could be the most significant football business development since the Bosman ruling on player transfers[275].

The early signs are that this is the case, with Premier League clubs returning collective pre-tax profits in 2013/14 for the first time since 1998/99. This has made the sport and its clubs an increasingly attractive investment, both for individuals seeking prestige and for financial buyers looking for a return on their investment.

Further purchases of leading European football teams, in part or whole, are likely in 2016 and beyond. In late 2015, Chinese investors paid $400m for a 13 percent shareholding in City Football Group[276], which owns EPL club Manchester City and football clubs in Melbourne and New York, as well as a shareholding in a club in Yokohama. As of end-2015, only one Premier League club, Leicester City, was majority-owned by Asia Pacific-based investors: we expect this to increase.

Chinese investors have been building their football investments within their home country and abroad. One investor in Manchester City, China Media Capital (CMC) also spent $1.3 billion to secure global broadcasting rights for the Chinese Super League for five years from 2016[277]. Earlier in 2015 Dalian Wanda, a Chinese conglomerate, bought a $50million (€45million) stake in Atlético de Madrid, as well as acquiring global sports marketing company Infront Sports & Media, which holds commercial rights to the Chinese Super League[278, 279]. Full ownership of a Premier League club by a Chinese investor may only be a matter of time.

A quarter of EPL club owners are from North America and the EPL has secured a six-year $1 billion broadcast deal with NBC from 2016/17, highlighting its growing prominence in the US. Further evidence of football's growing value in the US market are the sell-out crowds for pre-season matches involving European clubs, and also the carefully-managed development of the MLS. The US generates the highest individual broadcast rights fee for the World Cup of any territory, and US fans were the largest contingent of travelling fans for the last World Cup[280].

Bottom Line

Football's revenues have been increasing consistently and impressively over the past few decades; but it is only recently that revenue growth has stayed ahead of costs, with improved cost discipline being implemented across the game. This improved cost management, combined with continuing broadcast and commercial growth, looks likely to make football clubs increasingly profitable. They are therefore attractive to investors looking for a consistent financial return, as well as those interested in building profile or business opportunities through acquiring a trophy asset football club.

In the long run, there is a virtuous circle within football. The more revenues a club can generate, the more it has to invest in talent, increasing the chances of on-pitch success, with the associated financial rewards allowing it to reinvest. This creates an imperative for clubs, and the leagues of which they are a part, to maximize their revenues. More revenue should enable clubs to recruit not just the best talent and coaches on the field, but also the best commercial staff, access to the best technology, and the ability to invest for the long term, for example by investing in youth academies. The more popular football becomes, the more brands will likely want to be associated with it.

Europe is currently football's financial powerbase, with leagues and clubs continuing to explore how to capitalize on their global appeal through a variety of strategies – broadcasting and distribution of content, sponsorship, other commercial partnerships, shareholdings, talent development and matches abroad. It is established practice for top European clubs to play pre-season matches in non-European markets. This trend is likely to increase, and it seems only a matter of time before a European League stages regular season matches outside of the continent, in a similar manner to how the NFL has staged matches in London and the NBA in Europe.

As long as imported European content retains popularity, leagues and clubs outside of Europe face the challenge of developing their own competition structures. This challenge should be embraced, with these leagues and clubs building strong governance and administration structures, facilities, youth development and community engagement in their local markets, while leveraging best practice from Europe.

Commentators may question whether football's revenues can continue to grow. We would not expect the 2016/2017 revenue growth rate to continue in 2017/2018: there are no major new broadcast or sponsorship deals likely to start in that period which would generate the same uplift as the new EPL and La Liga deals will do in 2016/2017.

But in the long term, prospects look favorable as long as football maintains its ability to remain a spectacle that can attract a large proportion of the population, almost every week of the year, and which plays out not just on our television screens, but also through online news sites on the web, on social networks, on video games, in the back pages of newspapers, over breakfast, in school break times, and indeed in almost every other medium.

eSports: bigger and smaller than you think

The very idea that people may be willing to watch other people play competitive video games for big money prizes may surprise some.

Deloitte Global predicts that eSports[281] will generate global revenues of $500 million in 2016, up 25 percent from about $400 million in 2015[282], and will likely have an audience of regular and occasional viewers of close to 150 million people.

The very idea that people may be willing to watch other people play competitive video games for big money prizes may surprise some. These people often underestimate the global annual market size at millions of dollars only. Conversely, eSports advocates overestimate the current market size, believing annual revenues are already in the billions, and comparable to major league sports.

In some ways, eSports is comparable. A single event (but not that many per year) may attract 40,000 people watching live, and tens of millions watching over the Web. This could be interpreted as meaning that "eSports is bigger than basketball[283]". That may be true, when measured by audience size for an individual event, but in dollar terms, eSports is not yet playing in the big leagues.

In 2016, eSports revenues will represent a fraction of league revenues in major sports such as European football (soccer), US football, basketball, baseball, or ice hockey which range from $4 billion up to $30 billion (see Figure 14).

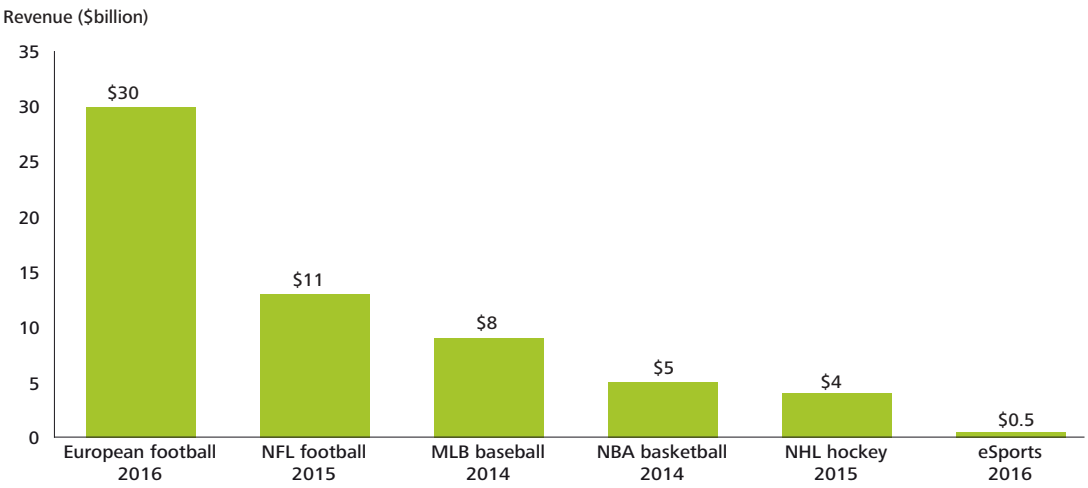
Revenues for eSports are predicted to grow 25 percent in 2016, which is better than most mature sports, many of which have been around for a century or even centuries. Arguably, given its small size, some might ask why eSports' growth rate is not higher.

Some believe that eSports is approaching a tipping point or upward inflection in the market: one American analyst predicts that eSports in the US alone will leap from $85 million in 2014 to $1.2 billion in 2018[284]: a 94 percent compounded growth rate, which is triple the projected 2016 growth over 2015.

Some are linking the popularity of online video game-related content to eSports[285]. The top gaming-related video star is PewDiePie, with 40 million subscribers[286], and number two is VanossGaming, with 15 million subscribers[287]. They may be the biggest stars, but collectively gaming videos make up more than 10 percent of YouTube's top performing channels[288].

However, Deloitte Global does not believe that there is a direct correlation between online video gaming success and eSports and, therefore, that the annual growth rate of eSports revenues is not about to triple. The most popular online content is not about watching elite gamers competing. Instead, the content is about entertainment (both PewDiePie and Vanoss are better known for their humor than being top-ranked players) or is largely instructional in nature: teaching gamers how to find hidden treasures (such as Easter eggs) or surmount difficult in-game challenges.

Figure 14: Major league sports revenues in $ billions



Note: Revenue figures include ticket sales, TV rights, sponsorships and other commercial sources
Source: Forbes and Deloitte Global analysis based on publicly available sources. For further information on the sources, see endnotes.

There is nothing wrong with educating or entertaining tens of millions of gamers (usually for free, except for the ads), but this may not directly lead to tens of millions wanting to either subscribe or pay to attend an eSports tournament. So far, much of the online gaming audience is more comparable to fans of the Harlem Globetrotters (people who are entertainers, who happen to play basketball) rather than to fans of a successful pro basketball team who plays to win a championship.

Tech and media companies are paying attention to eSports, both for growth opportunities and because it appeals to a narrow and desirable demographic: 75 percent are millennials aged 18-34, and 82 percent are men[289]. Amazon acquired Twitch for just under $1 billion in 2014[290], while 2015 saw Swedish media company Modern Times acquire a majority stake in ESL, the oldest eSports company for $87 million[291]. Russian investors have committed $100 million[292]. Canadian motion picture exhibitor Cineplex is spending $15 million to acquire an eSports company and create a new gaming league that will take place in its theatres[293], and the first dedicated eSports venue has been opened in the UK in partnership with a cinema chain[294].

Bottom Line

Even if eSports' revenues were to triple between 2016 and 2020 (to $1.5 billion), they would only be one percent of global sports revenues of over $150 billion[295]. But eSports does reach tens of millions of people on a regular basis, and over a hundred million occasionally. As such, it is comparable to many traditional sports that have large audiences, big sponsors and interesting demographics. One study predicts that eSports will have more viewers than NFL football by 2020[296]. One report describes them as "an advertising goldmine[297]", which is supported by their spending habits: eSports fans are more likely to make in-game purchases, buy more apparel and buy more branded peripherals than other gamers[298].

The assumption tends to be that eSports fans are dominated by those who prefer gaming on their computers. In fact, only 35 percent of US eSports fans were PC gamers, with nearly 80 percent of fans being console gamers[299]. Mobile games have not been a part of eSports, although that may change[300].

Immersive technology like VR goggles may make eSports even more interesting[301]. However, this is unlikely to be an important growth area for eSports in the near-term: our 2016 Prediction on the VR market expects combined hardware and software sales of less than $1 billion (see Prediction: Virtual reality: a billion dollar niche).

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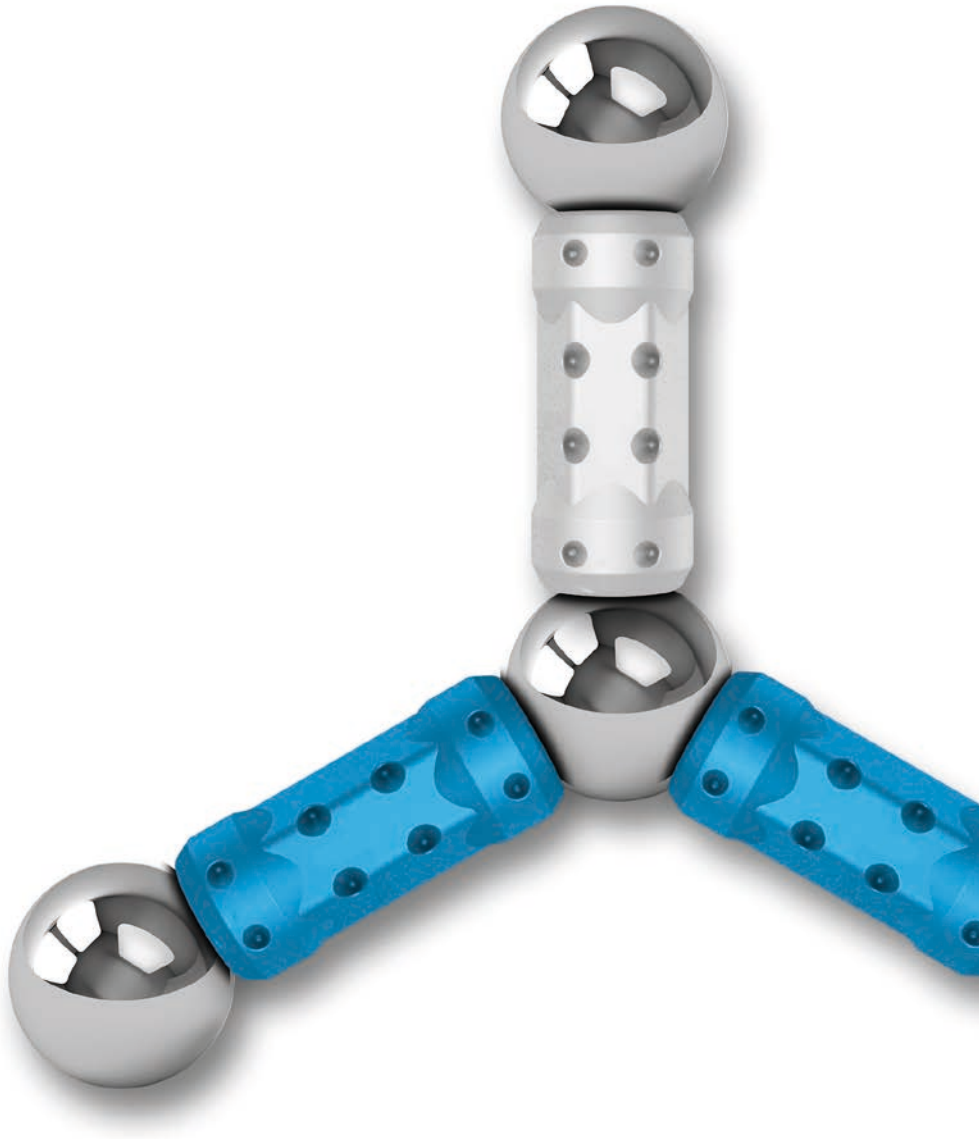
Telecommunications



The dawn of the Gigabit Internet age: every bit counts

Deloitte Global predicts that the number of Gigabit per second (Gbit/s) Internet connections will surge to 10 million by year-end, a tenfold increase, of which about 70 percent will be residential connections. Rising demand is likely to be fueled by falling prices and increasing availability: in 2015, the number of Gbit/s tariffs almost doubled in just three quarters, from just over 80 to over 150 (see Figure 15)[302]. The 10 million subscribers will likely, however, represent a small proportion of the 250 million customers on networks capable of Gbit/s (or 1,000 Mbit/s) connections as of end-2016.

Looking further ahead, we forecast about 600 million subscribers may be on networks that offer a Gigabit tariff as of 2020, representing the majority of connected homes in the world. At this stage between 50 and 100 million broadband connections may be Gbit/s, or marketed as such[303]. This would be between 5 and 10 percent of all broadband connections. Of these about 90 percent would be residential, and the remainder for business.

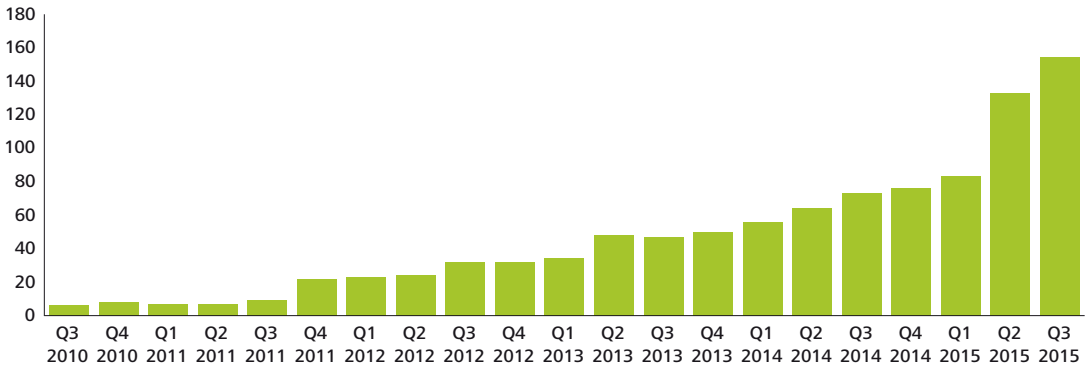
While Gbit/s subscriptions should surge this year (albeit from close to nothing to niche) the sharpest inflection point for the service may be in terms of perception. This would follow a flurry of announcements about the launch of Gbit/s around the world[305].

The perceived reasoning for Gbit/s service will likely evolve from identifying a single application running on a single device that requires a gigantic pipe to meet the aggregate demand from dozens of connected devices in a home.

Over the past 20 years, data connectivity has progressed from serving a single device and a low-speed application, to serving multiple, ever more powerful devices. Demand for connectivity has evolved symbiotically: as faster speeds have become available, the range of applications supported has increased, and the viable number of devices per person has steadily risen.

Small businesses have also experienced a significant increase in bandwidth demand, with the move to cloud-based services for a growing range of applications being a key driver of this.

Figure 15: Global Gigabit tariff count



Source: Point Topic[304], 2015

The number of Gigabit per second (Gbit/s) Internet connections will surge to 10 million by year-end, a tenfold increase, of which about 70 percent will be residential connections.

Advances in data connectivity speeds to the home, 1995-2015

In the mid-1990s, most people used dial-up connections, running typically at 30 Kbit/s. In the following decade, broadband went mass market in developed countries. In 2005, a typical speed offered to the mass market was 1 Mbit/s. In the last five years basic broadband has been complemented by fiber-enhanced connections, which currently offer speeds of 30 Mbit/s and faster. As of summer 2015, FTTx (all types of fiber-based broadband connection) overtook Digital Subscriber Line (DSL) as the most common form of fixed Internet access technology. FTTx offers speeds of 30 Mbit/s and higher. At each point in time much faster speeds have been available, but were only chosen by a minority.

At the start of 2016, upper quartile homes in developed countries may have accumulated a dozen connected devices, each of which may individually 'sip' data, but collectively, at peak time, might 'gulp' data. Through 2020 that dozen may well become dozens.

Furthermore, some subscribers may select a Gbit/s tariff to improve their chances of addressing aggregate demand for 500 Mbit/s at a given time. Advertised broadband speeds are often maxima; they may not be medians or averages. The reality of broadband is that it is a best efforts service. Multiple factors can diminish the actual speed obtained on a device.

Faster connection speeds can also enable more 'bursty' connections, with files downloading or uploading far faster, meaning that each device is connected for less time to the Internet, freeing up capacity for the next request for data[306].

A further driver of Gbit/s demand is likely to be price. At the end of 2012, the average entry level price for service was over $400[307]. By Q3 2015, the average had fallen to under $200, and the cheapest package was priced at under $50[308].

As of 2016, only a limited number of connectivity technologies are likely to be capable of Gbit/s service, namely Fiber to the Home (FTTH), Premise (FTTP), Basement (FTTB) and DOCSIS 3.1. FTTH is relatively rare due to the cost, but FTTP and FTTB are well suited to delivering high speeds to apartment blocks. DOCSIS 3.1 is the upgrade to DOCSIS 3.0 which enables Gbit/s speeds on cable broadband networks.

The other fiber technology, known as Fiber to the Cabinet (FTTC) is unlikely to deliver Gbit/s speeds in 2016, but an evolution of the technology known as G.FAST (also known as Fiber to the Street, or FTTS), in trial phase in 2016, should offer speeds in the hundreds of megabits per second (Mbit/s)[309], and Gbit/s (with the headline speed an aggregate of uplink and downlink speeds) by 2019, if not earlier. For carriers with copper-based networks, FTTS could offer much higher speeds over existing copper connections running into homes, significantly reducing the upgrade costs.

Indeed a relatively modest network upgrade cost is likely to be a key enabler of Gbit/s services. One major cable operator has quantified the cost to upgrade its network to be able to deliver a Gbit/s would be about $22 per home passed[310]. DOCSIS 3.1, the cable network upgrade, is 25 percent more efficient than earlier versions of DOCSIS. Operators can offers speeds that are hundreds of megabits faster without having to change the network[311].

The faster and more ubiquitous that FTTS and other fiber technologies become, the greater the incentive for cable networks to upgrade their networks, and vice-versa[312].

As average data connections get faster, we expect existing services to become steadily more bandwidth consumptive, new formerly unviable data-intensive services to launch, and new 'data-gulping' devices to come to market. Over time many data services have consumed an increasing quantity of bandwidth, rising in line with availability. Video streaming offers the clearest example of this. Its quality has increased steadily along with data connectivity speeds (see side bar: A history of video streaming). Over the past decade, video streaming services have progressed from offering 0.5 Mbit/s streams, which is inferior to standard definition (SD) television, to ultra-high 4K resolution, using 25-50 Mbit/s, or up to 100 times more bandwidth (also see side bar: A history of video streaming)[313].

A history of video streaming: 1995 to 2015

The first Internet-streamed broadcast took place 20 years ago. It barely counted as a video stream: it blended high quality audio with a series of real-time images. Most of the 36,000 online viewers accessed the content from Internet Cafes as home connections were too slow[314].

A decade later, in 2006, a year-old YouTube was receiving 65,000 uploads a day which could then be streamed in low quality (320x240 pixels and mono audio)[315]. In 2008, quality was upgraded to 720p (entry level high definition). A year later full HD, or 1080p became available. In 2010, 4K files (2160p) became available, many years ahead of traditional TV broadcasters. A 4K upload can be at up to 68 Mbit/s[316]. In 2014, 8K was offered, albeit possibly many years ahead of the commercial availability of screens able to display that level of detail.

Video calls have also experienced a significant upgrade in quality. In 2006, video calls were typically made using aftermarket webcams attached to PCs. This year, video calling is supported by billions of smartphones, tablets and PCs, for one-on-one or one-to-many calls. The faster the data connection, the greater the number of possible participants: an eight-way video call would require a dedicated 8 Mbit/s stream.

As available bandwidth increases, we would expect it to change all aspects of communication. Instant messages have already evolved from being predominantly text-based to incorporating photos (in ever higher resolution) and video (at ever higher frame rates). Social networks, which are a variant of instant messaging, are hosting growing volumes of video views. As of November 2015, there were eight billion daily video views on Facebook, double the quantity in April[317].

It is possible that the telephone call may be replaced by a video wall, offering always-on portals to friends, or distant family or remote teams. In 2016 the video wall may be a small screen, such as a tablet, but over time, dedicated video-wall devices might become available, with a commensurate increase in data speed required.

Faster data connections have enabled high definition (HD) video-on-demand to a television set, and are likely to be a factor in encouraging purchases of 4K TV sets. As at end-2015, the majority of 4K services were via streaming.

It is likely that faster bandwidth may also create additional uses of the TV set: it is possible, for example, that the set, when not being used to watch programs or movies, may be used to display images and video, in the same way that screensavers have filled computer screens when idle. We expect it will become increasingly common to download or stream high resolution screensavers for display on TV sets, with imagery ranging from cityscapes to fireplaces, from HD views from the International Space Station[318] to live webcams from tourist hotspots[319].

Gbit/s connections may change the approach to home security solutions. Historically, connected home security relied on a call center making a telephone call to the home. Many home video camera solutions currently record on to hard drives. As uplink speeds increase, cameras are likely to stream video, back-up online, offer better resolution and higher frame rates[320]. A single HD webcam may stream at 1 Mbit/s, and as the cost of security cameras declines, they may well proliferate in homes. As their resolution increases, their network demand will likely grow too.

In addition to the bandwidth usage that is triggered by human activity, from video-on-demand to browsing, there is likely to be a growing volume of background data usage. Every additional device, from smartphones to smart lighting hubs, is likely to require online updates, be this for apps or for operating systems. Over time, these may well grow in size – for example the maximum size of a downloadable app has risen steadily over the years to reach 4GB now; the current limit on downloadable PC files is now 250 GB[321]. Every photo taken may trigger a chain reaction of back-ups to other devices and to remote hosting sites.

The more bandwidth available, the more likely people are to squander it, at least in relative terms. This is similar to the evolution of programming. When processing power was limited, coding was very efficient. As processing power steadily increased, it made less and less sense to spend time refining code such that it 'sipped' power[322]. A similar transition has happened with bandwidth: the more availability of it at the same price, the more consumption.

This prediction has focused on Gbit/s services via fixed lines to homes and premises, but by end-2020 it is possible that such speeds will also be attainable over cellular mobile connections. LTE advanced currently offers up to about 500 Mbit/s in trials, and up to 250 Mbit/s in commercial offerings[323]. Carriers that deploy 5G branded services are likely to offer Gbit/s services, and there is likely to be a mixture of trials and limited commercial launches of service in the run up to 2020[324].

Bottom line

A Gbit/s Internet connection might appear frivolous, but a decade ago some commentators may have questioned the need for a touchscreen-based device capable of transmitting data at 150 Mbit/s, with storage for tens of thousands of HD photos, video quality sufficient for broadcast, a pixel density superior to most TV sets, a secure fingerprint reader, and billions of transistors within a 64-bit eight core processor. Yet modern smartphones with this specification are likely to sell in the hundreds of millions of units this year.

While a Gbit/s connection for a single device and a single application may be overkill, consumers are likely to continue accumulating connected devices in the long term[325].

ISPs should proceed cautiously and be able to respond rapidly. ISPs that launch Gigabit/s too early, and increase speeds on all other service tiers at the same time, may encourage some subscribers to downgrade to a lesser tier. However the offer of Gbit/s service by some ISPs may oblige a rapid response by other players in the same market[326].

Device vendors and application developers should constantly review how the increasing pace of broadband speeds, or response rates, is likely to make previously unviable gadgets or services possible.

As broadband speeds rise, TV broadcasters should consider the extent to which they need to continue using traditional broadcast technologies to deliver content to homes. It may be the case that for some neighborhoods they no longer need to use satellite, cable or terrestrial broadcast to deliver programs into customers' homes.

While this prediction focuses on 2016, and the Gigabit/s era, it is most likely that the speed race will not conclude upon reaching this speed. We would expect Internet speeds to continue rising in the long term; 10 Gbit/s has already been announced, and 50 Gbit/s connections are being contemplated for the future[327].

Used smartphones: the $17 billion market you may never have heard of

Deloitte Global predicts that in 2016 consumers will sell outright or trade in approximately 120 million used smartphones generating more than $17 billion for their owners, at an average value of $140 per device. This is a marked increase from the 80 million smartphones traded in 2015 with a value of $11 billion, or an average value of $135[328].

The value of sold or traded-in smartphones will likely be about twice that of wearables and 25 times the value of the virtual reality (VR) hardware market[329].

Worth $17 billion in 2016, and with 50 percent year-on-year growth in units, the used smartphone market is forecast to grow four-five times faster than the overall smartphone market. A total of 1.6 billion smartphones are expected be sold in 2016, an 11 percent increase on the prior year[330]. Used smartphones represent an increasing share of the market: about seven percent of the total smartphone sales by units in 2016, up from five percent in 2015 and four percent in 2014.

We predict at least 10 percent of premium smartphones ($500 or higher) purchased new in 2016 will end up having three or more owners before being retired, and will still be used actively in 2020 or beyond.

We would expect trade-in value per device to vary by model and market, but across the 120 million used smartphones that are likely to be sold in 2016, we estimate that the average value per device will be about $140.

About half of these devices are expected to be traded in to manufacturers or carriers in exchange for credit toward a new smartphone. The remainder will likely be sold online privately, to retail shops or to second-hand device specialists.

We expect the practice of selling smartphones could well accelerate through 2020 as both consumers and suppliers increasingly embrace the practice of selling or acquiring second-hand smartphones.

For consumers the primary incentives to sell a device – rather than keeping it as a spare, giving it to a family member or throwing it away – will likely be driven by the ease of doing so, the luster of owning a latest model device and the trade-in value on offer.

We expect the market for acquiring second- (or third- or fourth-) hand devices to become steadily more organized. A decade back, those wishing to sell their old phones would often use online auctions or marketplaces, which could be far slower and uncertain relative to being quoted a trade-in value at the point of sale, or simply swapping one phone for another with a leasing plan.

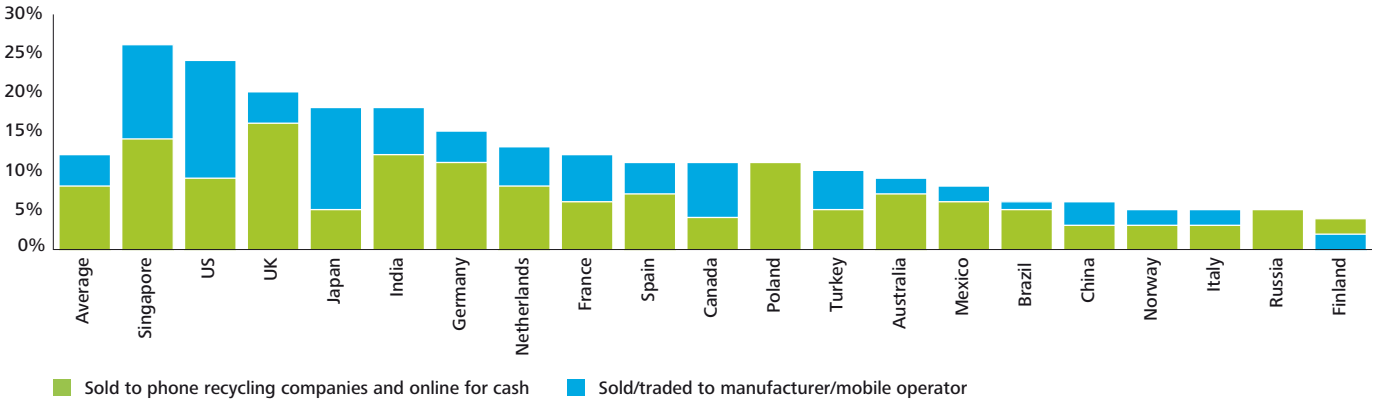
Specialist companies may emerge which forecast trade-in values after one, two or more years of ownership, similar to the equivalent service providers in the automobile industry.

In many developed markets the range of options for selling a device is steadily growing, ranging from companies specializing in acquiring second-hand devices to manufacturers offering leasing options[331].

We expect there to be significant variation in the practice of trading in smartphones by market. Deloitte member firms' research in 20 markets found that as of mid-2015 approximately 12 percent of all consumers sold their smartphones (see Figure 16). Of these two-thirds sold their smartphones outright, and a third traded them in with an operator or device manufacturer. In Singapore, about a quarter of smartphones were traded in; in Norway, Italy, Russia and Finland, only five percent were sold or exchanged. Deloitte Global would expect that over time, most markets should see a steady increase in trade-ins.

Figure 16: Respondents who sell or trade in their previous smartphone

Question: What did you do with your previous smartphone when you last upgraded?



Weighted base: Respondents who own or have access to a smartphone: Australia (1,582), Brazil (1,547), Canada (1,414), China (1,729), Finland (726), France (1,407), Germany (1,491), India (1,729), Italy (1,589), Japan (952), Mexico (1,623), Netherlands (1,639), Norway (846), Poland (1,602), Russia (1,462), Singapore (1,850), Spain (1,755), Turkey (860), UK (3,039), US (1,458)

Source: Deloitte member firms' Global Mobile Consumer Survey, May-July 2015

The US and Canadian markets in particular are seeing a shift from subsidized smartphones on two-year contracts to a one-year lease/upgrade program: one survey found that a fifth of new iPhone device purchasers in the US intended to lease it[332]. The four largest US wireless carriers offer smartphone leasing options that allow for annual trade-ins, which are expected to capture a large part of the post-paid market[333]. In Germany consumers are increasingly being required to purchase devices outright[334]. A trade-in for the old smartphone would reduce the net sum handed over at the point of acquisition of the new device.

We would expect emerging markets to be net acquirers of second-hand smartphones. Some consumers may prefer to buy refurbished, used premium models in lieu of new budget brands, possibly cannibalizing sales of new devices from those budget manufacturers[335].

Rising trade-in values may be a further incentive. In the UK market, the average price of a used handset increased from $30 in 2007 to $165 in 2013[336]. Some models may retain 70 percent of their value nine months post launch[337].

For smartphone vendors the direct benefits of a thriving second-hand market are three fold. First, encouraging an annual replacement cycle among a growing number of users may increase annual sales. Second, the availability of a formal second-hand market could make their devices more affordable to customers with smaller budgets, without having to create less profitable, budget variants of their devices. Used, refurbished premium smartphones may be more appealing than brand new unbranded devices. Third, there would likely be a margin in processing used phones, similar to that earned by car dealers.

A trade-in for the old smartphone would reduce the net sum handed over at the point of acquisition of the new device.

Bottom line

The smartphone is the primary consumer electronics device by revenues and units: over $400 billion in sales and 1.6 billion units expected to sell in 2016. Its second-hand market is a significant market in its own right and likely to grow over the coming years.

The biggest potential implications are for handset vendors, who are likely to become more and more aware of the residual value of their devices. The forecast future value of their products is also likely to become an increasingly important factor in the purchase decision. This may affect not just consumer sales, but also those made by enterprises, for which total cost of ownership should factor in the expected resale value once smartphones are returned.

A possible consequence of a more organized second-hand market is the potential for cannibalization: some consumers may elect to buy second-hand, rather than new, as is the case with the car market. However, some of those that purchase a second-hand device may then decide to purchase new next time round, and they may also purchase new accessories and apps for their used smartphones. Furthermore, familiarity with a used device may act as a brand 'gateway' and encourage the purchase of other devices from the same vendor.

Carriers in developed markets could increase their offer of refurbished premium smartphones. Customers on tight budgets with a refurbished premium device may generate more network traffic, or opt for a large monthly data bundle, than those with a brand new mid-range or budget device. Carriers could offer superior trade-in rates and simple trade-in procedures to lure users from other networks, or to encourage contract extensions. They should consider how best to flex contract length, or offer shorter terms.

Any entity (for example a carrier or an enterprise providing handsets to employees) providing leased handsets should evaluate the tax implications. In some markets, the depreciation in the value of the asset may be tax deductible while in some markets the provision a handset may be treated as a form of income and taxed accordingly.

Carriers in developing markets should also analyze closely the merits of offering a wider range of refurbished, second-hand premium handsets. Consumers across the world aspire to premium brands, and many may well prefer a used aspirational brand, ahead of a new device from a second-tier brand. The ideal $100 handset does not necessarily need to be a new one.

Insurance companies should consider what opportunities this trend may present for them. One of the risks of leasing devices is uncertainty over the condition of the handsets when returned. Vendors or carriers offering leased devices may oblige consumers to take out insurance so as to mitigate risk. Insurance companies should evaluate the robustness of each smartphone model, and also how well each device may be treated.

The growth of a second market could lead to consumer confusion. Some smartphones are locked to specific networks. Customers unaware of this may end up purchasing a device that they cannot use on their current network. Furthermore, there are multiple variants of each device, which may not be obvious to consumers. Each 4G model, for example, supports different frequencies of 4G, with the earliest 4G phones supporting relatively few frequencies. So someone purchasing a 4G phone may find that this phone is not compatible with the 4G frequencies owned by their current operator[338], especially for phones that are being resold in different countries or regions[339].

Consumers selling smartphones should ensure that data stored on their devices is erased before selling on. While professional buyers of phones delete data as part of the service, private buyers would not do so. In one small US study, five of 13 used phones still had customer information on them[340].

The trend to resell old hand-me-down phones may be better for the environment: 140 million mobile devices were thrown away, ending up in landfills in the US in 2012 alone[341]. By 2016, and globally, the number would likely be over 250 million, with some portion of those previously discarded phones now being resold.

One category that may lose from this market is children, seniors and charities, who have become accustomed to receiving hand-me-down phones for free. If trading in becomes lucrative, the flow of gifted devices may become interrupted.

CIOs can now dispose of old smartphones more effectively, or offer refurbished devices to more junior employees. Companies purchasing smartphones for their staff should evaluate how long they should own their phones to optimize the total cost of ownership. It could be that replacing (and trading in phones) after two years is more financially attractive than keeping them for three, for example.

The rise of the data exclusive

Deloitte Global predicts that in 2016, 26 percent of smartphone users in developed markets will not make any traditional phone calls in a given week. We call these individuals 'data exclusives'. They have not stopped communicating, but are rather substituting traditional voice calls for a combination of messaging (including SMS), voice and video services delivered 'over the top'. The data exclusive contingent was 22 percent of all smartphone users in 2015, and 11 percent in 2012 (see Figure 17)[342].

In recent years there have been two contrasting trends with voice. First, mobile voice volumes as measured in minutes have increased by 20 percent between 2012 and 2015[343], likely because of the increased affordability of voice minutes, the rising take-up of unlimited voice packages, an increase in voice minute allowances and an ongoing substitution of fixed to mobile calling.

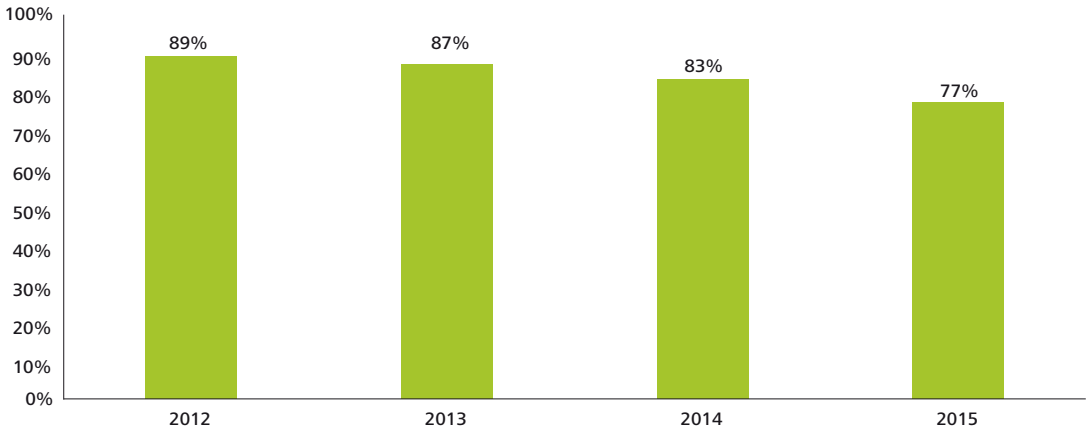
Second, most smartphone owners' usage patterns have become more data-intensive, with the proportion of time spent on non-voice activity increasing considerably; in some markets, such as the UK and the US it has reportedly trebled[344].

What may be happening is a polarization in the usage of voice on mobile: some users are increasing their voice call volumes; at the other end of the scale a growing proportion are not using voice at all.

In 2016, 26 percent of smartphone users in developed markets will not make any traditional phone calls in a given week.

Figure 17: Weekly use of standard voice calling, 2012-2015

Question: In the last seven days, in which of the following ways have you used your smartphone to communicate with others (standard voice calls)?



Note: Respondents who used their smartphone less than once a week have been excluded from this analysis
Weighted base: Respondents who own or have access to a smartphone: 2012 (5,000), 2013 (10,427), 2014 (16,995), 2015 (18,334)
Source: Deloitte member firms' Global Mobile Consumer Survey, selected developed countries, May-July 2012/2013/2014/2015

A key catalyst for the fall in the proportion of people making voice calls on their smartphones has likely been the proliferation of options to communicate without speaking. Phone conversations with friends and family, for example, have been supplanted to an extent by social networks, which offer multiple enhancements to a standard conversation, such as the ability to broadcast to friends and family, incorporate emoji and append photos, videos and hyperlinks. Social networks, IM (instant messaging), email and other forms of messaging also offer control over when to respond: they are asynchronous, while voice conversation obliges a real-time response.

It is not just private conversations that are being usurped. An app can replace the calls we would have formerly made to order a take-away, request a taxi, book an appointment or make a bank transfer.

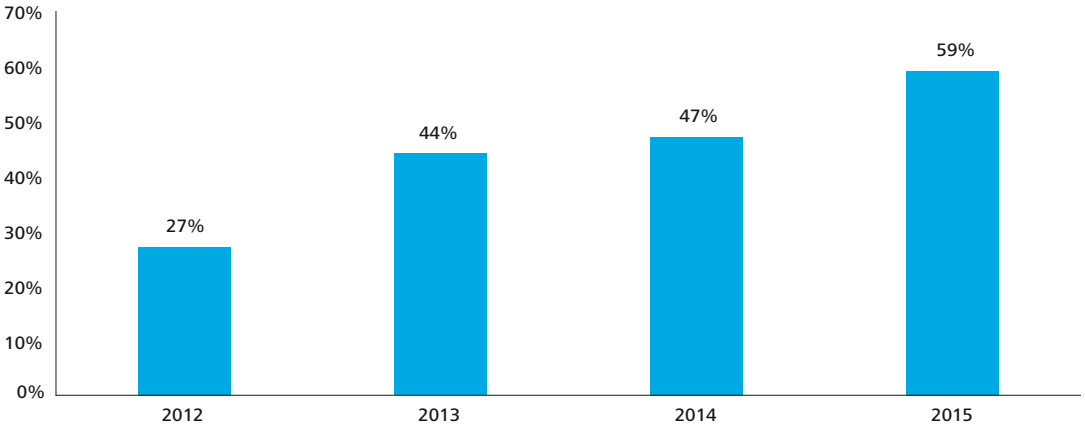
Over the same period of decline in voice calls, most forms of data communication, such as IM, social networks and even the now 'old school' email, have become more popular.

IM has seen the most rapid uptake among consumers since 2012, with the proportion of adults using IM more than doubling from 27 percent in 2012 to 59 percent in 2015 (Figure 18)[345], and volumes escalating from 7 trillion in 2012 to 43 trillion in 2015[346].

Interestingly the text message, a relatively cheap and simple form of data communication, remains widely used among those not making voice calls. As of mid-2015, the most popular data service used was text messaging, with 60 percent usage, closely followed by instant messaging, email and social networks (see Figure 19).

Figure 18: Weekly use of instant messaging, 2012-2015

Question: In the last seven days, in which of the following ways have you used your smartphone to communicate with others (instant messaging)?

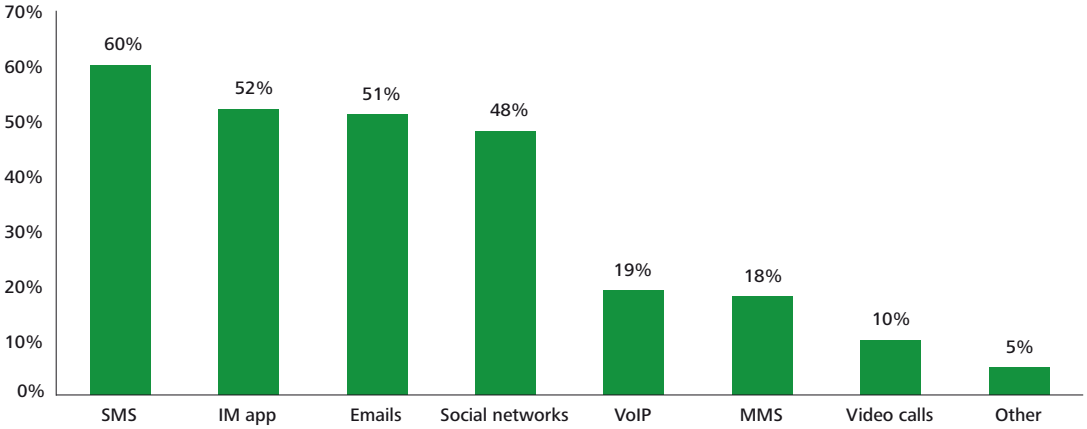


Note: Respondents who used their smartphone less than once a week have been excluded from this analysis
Weighted base: Smartphone owners 2012 (5,000), 2013 (10,427), 2014 (16,995), 2015 (18,334)
Source: Deloitte member firms' Global Mobile Consumer Survey, selected developed countries, May-July 2012/2013/2014/2015

Social networks, IM (instant messaging), email and other forms of messaging also offer control over when to respond: they are asynchronous, while voice conversation obliges a real-time response.

Figure 19: Communication services used in the last week by 'data exclusives', 2015

Question: In the last seven days, in which of the following ways have you used your smartphone to communicate with others (all forms of communication excluding standard voice calls)?



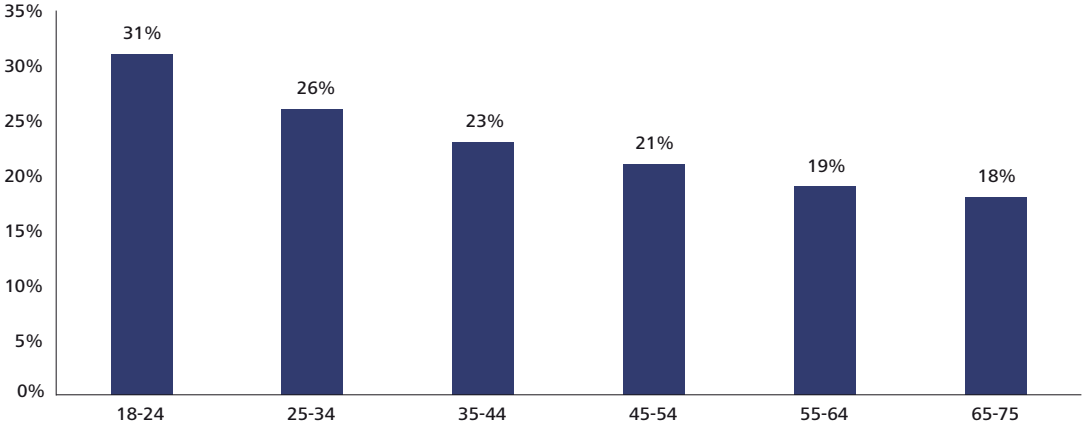
Weighted base: Smartphone owners who did not use their device to make voice calls in the last seven days (4,634)
Source: Deloitte member firms' Global Mobile Consumer Survey. Respondents in the following developed countries: Australia, Canada, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Singapore, Spain, UK, US, May-July 2015

The age group with the largest proportion of data exclusives as of mid-2015 was 18-24 year-olds, 31 percent of whom (in developed countries) reported not making phone calls on a weekly basis, compared to the average for adults of 22 percent.

Figure 20 shows the proportion of data exclusive users by age group.

Figure 20: 'Data exclusive' mobile users, by age group, 2015

Question: In the last seven days, in which of the following ways have you used your smartphone to communicate with others (all forms of communication excluding standard voice calls)?



Weighted base: Smartphone owners who did not use their device for voice calls in the last seven days (4,634)
Source: Deloitte member firms' Global Mobile Consumer Survey. Respondents in the following developed countries: Australia, Canada, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Singapore, Spain, UK, US, May-July 2015

In 2016 and beyond the proportion of data exclusive 18-24 year-old users may rise further still, given that upcoming members of this cohort are likely very accustomed to messaging. Their first communications device as young children may have been a touch-screen MP3 player or a WiFi tablet, which can readily be used for messaging, apps and other types of data functionality, but lacks a cellular modem, and therefore has no capability to make traditional voice calls.

As children progress to their first smartphone, they may not be provided with a voice and data package in order to control costs, and they may use this device exclusively over WiFi, with only occasional use of OTT voice technology. By the time a teen has the funds to pay for a regular mobile phone package that includes voice calls, he or she may regard messaging as the default mode of communication and they may instinctively avoid making voice calls.

Bottom line

The original premise of the smartphone was that it would enable voice *and* data communications via the one device. In the last decade the data capabilities of smartphones have steadily ratcheted up, in the form of bigger screens, faster connectivity, more powerful processors, superior cameras and improved graphics capabilities.

The most obvious implication for carriers is that offering monthly plans with very large or unlimited voice minutes may not be equally attractive for all customers. If 20 percent are talking fewer than 100 minutes per month, they will likely respond only to other inducements, perhaps 'all you can app' messaging plans or simply better data networks. Depending on the alternative to cellular voice, increased use of messaging, especially with pictures or video, may help drive consumers to bigger data plans, enhancing average revenue per user (ARPU).

A decline in voice call traffic could also enable carriers to reduce the quantity of spectrum assigned to voice, and make this available for data.

Smartphone vendors should consider whether a decline in voice usage may encourage a rise in sales of large smartphones (also known as phablets). One of the barriers to large smartphone adoption had been the obtrusiveness of the device when making calls, but if fewer calls are being made, larger screens are arguably preferable for messaging applications.

Any entity communicating with the public should consider how best to adapt to these trends. Government should determine whether to focus on app-based communications rather than call centers; fast food purveyors might want to focus on improving app-based or web-based ordering, on the assumption that customers would rather type than talk when placing orders.

VoLTE/VoWiFi: capacity, reach and capability

Deloitte Global predicts about 100 carriers worldwide will be offering at least one packet-based voice service by the end of 2016, double the amount year-on-year, and six times higher than at the beginning of 2015[347]. We estimate that approximately 300 million customers will be using Voice over LTE (VoLTE) and/or Voice over WiFi (VoWiFi); double the number at the start of the year and five times higher than at the beginning of 2015[348].

For most carriers launching VoLTE or VoWiFi in 2016, the primary motivation is likely to be to increase network capacity and extend the reach of their voice services. While VoLTE or VoWiFi technologies enable a range of value-added services, such as video calling, we expect the majority of carriers to exploit this additional functionality in later years, with the initial focus being on coverage and capacity.

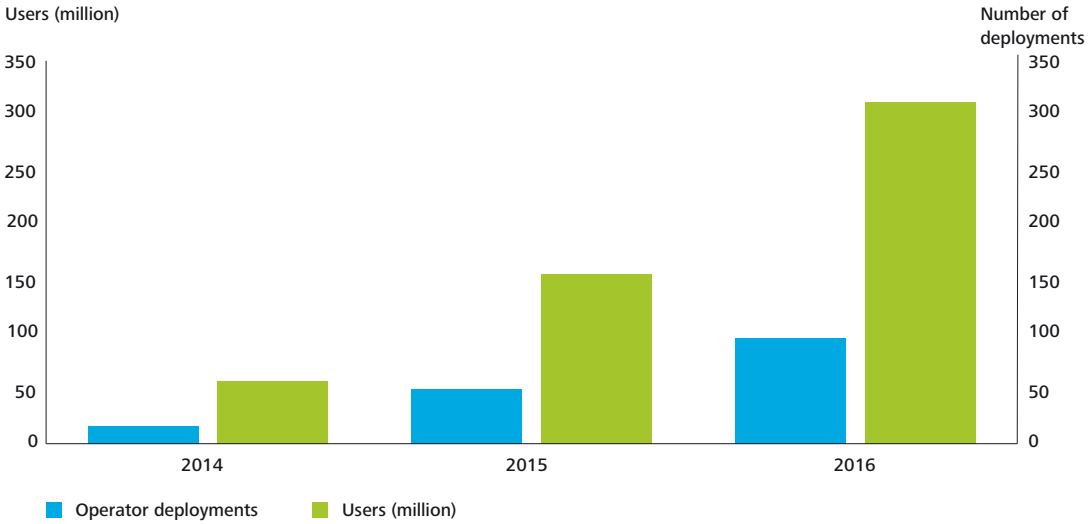
VoLTE increases capacity as it allows operators to move voice calls off 2G and 3G networks and onto the LTE (4G) network. The often lower frequency spectrum that is freed up can be reused for data services. Additionally the LTE interface is more efficient at carrying calls relative to traditional calls: it can support up to twice as many voice users in a given bandwidth (per megahertz). Additional cost savings can be obtained from retiring legacy infrastructure, and not having to run two infrastructures in parallel, one for data and one for voice.

VoLTE also offers a range of enhancements over standard voice. For example it offers the ability to use a data connection while being on a call, superior voice call quality, faster call connection, fewer dropped calls and the ability to switch from a voice call to a video call. However while early adopters in 2016 are likely to be most fervent users of this additional functionality, many users may not notice the variation in voice quality.

Carriers are likely to use VoWiFi to extend coverage, particularly indoors, and as a result help improve customer satisfaction with the operator and lessen the likelihood of churn. The majority of mobile calls are made indoors (at least twice as many smartphone users make voice calls indoors than outdoors)[349], but providing good internal coverage can be technically complex and expensive, particularly for lower floors and internal rooms. One study found that about 40 percent of UK consumers have a mobile blackspot at home and almost a third reported regular issues making or receiving mobile calls from home[350].

One response to blackspots is to deploy additional cellular towers or small cells to increase network reach, but this is complex technically, time-consuming (due for example to required planning consents) and costly[351]. Another approach would be to place femtocells (tiny base stations) in consumers' homes: each of these would cost tens of dollars.

Figure 21: VoLTE and VoWiFi operator deployments and users, 2014-2016



Source: Deloitte Global, 2015

VoWiFi may at first glance appear very similar to VoIP, but there are two critical differences. Firstly it is a network operator managed and controlled service, which, for users, should mean that the call is less likely to be dropped. So other activity on the same network is less likely to disrupt a voice call than would be the case on a VoIP call, which is carried on a best efforts basis. For carriers, being in charge of the service also means that they have more control over the revenue stream. Secondly, VoWiFi offers native calling: there is no need to open an app to make or receive calls. A VoIP call can only be received when that specific app is open.

VoWiFi extends reach at a relatively low marginal cost. Operators need to deploy an IP multimedia subsystem (IMS). If they already have VoLTE, this will already have been paid for. In some regards VoWiFi may even reduce operator costs, as calls placed on a smartphone would be carried over the consumer's broadband network, freeing up some cellular capacity.

Further, VoWiFi can reduce cost for an operator as it enables traffic to be off-loaded to another network. The cost savings could be significant: a US carrier with 15 percent VoWiFi penetration and a national footprint could enjoy spectrum and capacity savings per year of approaching half a billion dollars[352].

Long term, most operators will likely launch both services as a natural evolution towards IP-based-only communication. However, short term some carriers may decide to launch one of the two services first. The decision will likely be influenced by three main factors: the potential cost savings, the need to improve indoor coverage, and the customers' interest in enhanced communication services.

Bottom line

Operators need to weigh up benefits against the cost of deploying an IMS[353]. One analyst firm has calculated that the cost of deploying and operating an IMS solution could be up to $10 million with a VoLTE subscriber base of around 2.5 million. If the base rose to 75 million, there would be significant economies of scale, with the annual operating cost estimated at about $45 million[354].

In the short term, device and network interoperability may be a barrier for uptake. VoWiFi and VoLTE support varies by handset, and each carrier has enabled a different set of these devices. In some cases, VoWiFi may be supported on a consumer all-you-can-eat tariff, but not on the enterprise tariff. Furthermore, packet-based calls may require calling and called devices to have the same software version enabled. For VoLTE, both parties need to have compatible handsets, be in 4G range, be subscribed to 4G (rather than just having 4G capability), and, for a period of time, be on the same network[355].

Carriers should also bear in mind the potential cost implications for incorporating emergency service support (providing a user's location) into VoLTE and VoWiFi. The IMS signaling system needs to support the Emergency IMS subsystem to ensure that the call goes through.

Consumers have high expectations for voice quality: operators should only launch VoLTE and VoWiFi services when the service is stable. The network should be configured so as to prioritize voice packets. Real-time monitoring and auctioning of network performance KPIs such as bit-rate, latency, jitter and packet loss are also recommended. Operators should include a fallback for non-native VoLTE calls, or calls in areas where 4G coverage is lacking or limited[356].

Operators should also advise on some of the quirks of the service at this stage: for example a VoWiFi call cannot roam onto a circuit-based 2G or 3G call when out of WiFi range: it can only move onto a VoLTE network.

Carriers should determine how best to advertise the two services so that consumers value the quality of voice call and perceive the enhancements provided as value added services. This could counteract the declining trend of smartphone users not making phone calls and moving to OTT alternatives.

Photo sharing: trillions and rising

Deloitte Global predicts that in 2016, 2.5 trillion photos will be shared or stored online, a 15 percent increase on the prior year. About three-quarters of this total will likely be shares, and the remainder online back ups[357].

We estimate that over 90 percent of these photos will have been taken over a smartphone; digital SLRs, compact cameras, tablets and laptops will collectively contribute the remainder. This estimate does not include the trillions of photos that remain on devices' memory.

The expected network impact of all this sharing will be about 3.5 exabytes[358], a 20 percent increase over the previous year. We expect the network impact of photographs to continue rising for the foreseeable future, driven by steady increases in the volume of photos taken, shared and backed up, as well as rising average file size.

Photo sharing has been and will likely be enabled and encouraged by improvements in smartphone capabilities, as well as faster fixed and mobile connectivity.

Photography's appeal is partly about capturing and sharing a moment: smartphones enable both to occur almost simultaneously. They remove the lengthy time lag with standard photographic film between taking and sharing a photo.

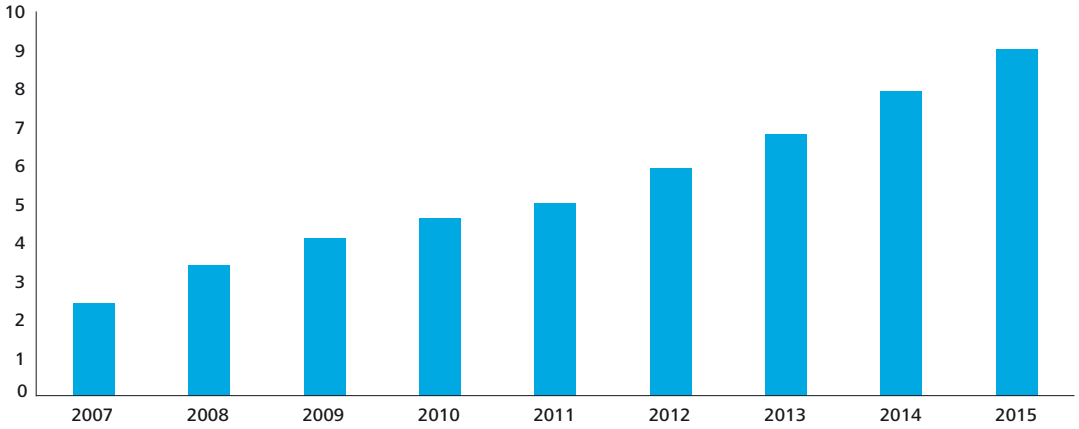
Smartphones can reduce the processes of taking, adjusting and sending a high definition photo to less than a second.

The dominance of the smartphone to photo sharing is due to its ubiquity and the rate at which owners upgrade their devices. We expect 1.6 billion smartphones to be sold in total this year, equivalent to about 23 times peak sales of film cameras (70 million units, 1999), 13 times the peak for digital cameras (120 million SLR and compact digital cameras, 2010) and 40 times 2014 digital camera sales (40 million units)[359]. We forecast about three-quarters of smartphones sold to be upgrades, with most having better cameras, processors, connectivity and storage than their predecessors.

We estimate the number of photos shared online to be about 31 times the volume taken (let alone shared) in the 1990s, when about 80 billion were taken every year[360].

In 2016, we expect the average size of photos taken to increase, thanks to the rising resolution of smartphone cameras. Average resolution, as measured in megapixels (MP), of smartphones on sale increased from 2.4 MP in 2007 to 9 MP last year[361]. We forecast average resolution for smartphones on sale to surpass 10 MP this year (see Figure 22).

Figure 22: Smartphone cameras average resolution (megapixels), 2007-2015



Source: GSM Arena. For more information on the source, see endnote

A core reason for the rise in photos shared online is the widening array of tools that enable and encourage sharing. As of end-2015, there were over 2,000 photo-sharing apps available.

Some tools encourage keeping images for posterity; others emphasize transience, for those who prefer it. Photos can be shared with the whole world, or with selected individuals. Rising network speeds make it easier to send bursts of images, quickly.

Posts with photos get 53 percent more 'likes', 104 percent more comments, and 84 percent more click-throughs than text-only posts[362]. The more fervent reaction to social network posts with photos is likely to encourage yet more posts with images.

The growing ease of creating and sharing images is arguably shaping the way people communicate. The speed and quality with which we can take photos encourages the photos and videos to be substituted for spoken or written words. The message "having a wonderful time on holiday" via a postcard or a phone call is being usurped by photos captured and sent from a phone. The 2013 fashion of posting a photo of a tanned pair of legs – colloquially known as 'hot dog legs' – was a popular way of conveying that you were on vacation and that the sunshine had been abundant[363]. The ability to communicate in this way is driving usage of mobile data while abroad, and accentuating a differentiator for operators that offer low – or zero-cost roaming.

'Hot dog legs' are one type of photographic self-portrait, collectively known as selfies[364]. These may appear a contemporary activity, but demand has existed for almost a century, with the automated photo-booth originally addressing people's needs[365]. The first booth, installed in New York in 1925, had 280,000 customers in its first six months[366].

Increasing volumes of photos are being backed up because of the growing range of tools which enable this, at low or zero cost to the user. A user with multiple back-up services may end up creating a cloud-based copy of the same file multiple times.

The profusion of both sharing and back-up services could lead to one photo being shared and backed-up hundreds of times.

For example parents may share the same photo of their newborn with their individual social networks, as well as send to different groups via a set of instant message services. Some recipients of the image may forward it on to their own networks. If the receiving phone's settings are configured to save each photo viewed, this device would create an online back-up.

The more fervent reaction to social network posts with photos may encourage yet more posts with images.

Bottom line

The desire for photos drives innovation, encourages smartphone upgrades and increases network usage.

Smartphone vendors have long differentiated their models on photographic capability. They should make sure to focus on innovations that are perceptible and appreciated by users, and not be lured into a specification race that only pleases the device's creators. A few years back, some vendors competed on megapixel count. With most photos viewed on small screens by both creators and recipients, incremental resolution soon became imperceptible to all but the best-trained eye. Engineers' ingenuity was thus arguably squandered.

Customers are likely to respond to technology that flatters their ability. Smartphones benefit from exponentially-improving processor and connectivity speed, a progression known as Moore's Law. There is no equivalent law for talent, but technology can (and should) be deployed to lessen user error when taking photos. Software that automatically compensates for photographic mistakes (such as shooting into direct sunlight) can make the owner feel more talented.

Vendors should also consider how to tap into make over technology to enhance the subject. A phone's software can deliver an instant, digital make over by automatically smoothing wrinkles, lessening bags under the eyes, deleting spots and adding a sun-kissed glow. The smartphone is an upgrade to the Evil Queen's magic mirror, as it need not speak the truth.

Software can also differentiate by automation of cataloguing. When one has amassed tens of thousands of photos on a phone, finding a specific portrait becomes tedious. Facial recognition can be deployed to identify individuals automatically, without having to create metadata for each image[367].

Network operators can harness our desire for portraiture and other images to drive network traffic, and to encourage upgrades to larger data packages. Photos (and increasingly video) will likely increase the demand for uplink capacity, and ISPs and mobile operators could differentiate their offerings as optimized for photo/video sharing.

Photo apps and back-up sites should evolve their offerings in line with changing habits. One recent innovation is moving photos, which are a composite of a standard photo accompanied by a few frames of low resolution images that capture the second before and after the main photo was taken[368].

Retailers should consider how best to tap into the growth in communication via images. Catalogues, which have traditionally been shot months before distribution, can be deconstructed into smartphone screen-sized photos accompanied by a 'buy' button. A photo of a celebrity wearing a brand's outfit can be relayed immediately to fans – there is no need to wait for this to appear in a newspaper, magazine or on a website.

Endnotes

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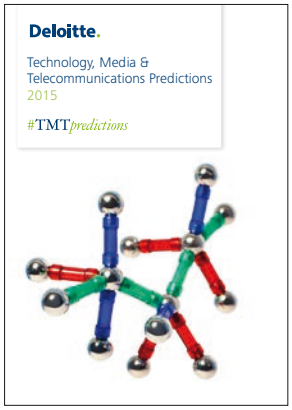

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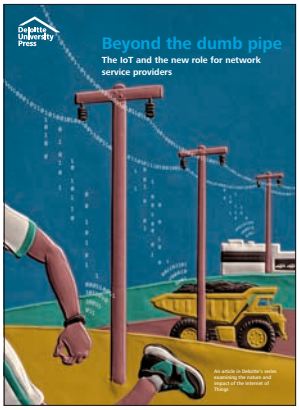

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