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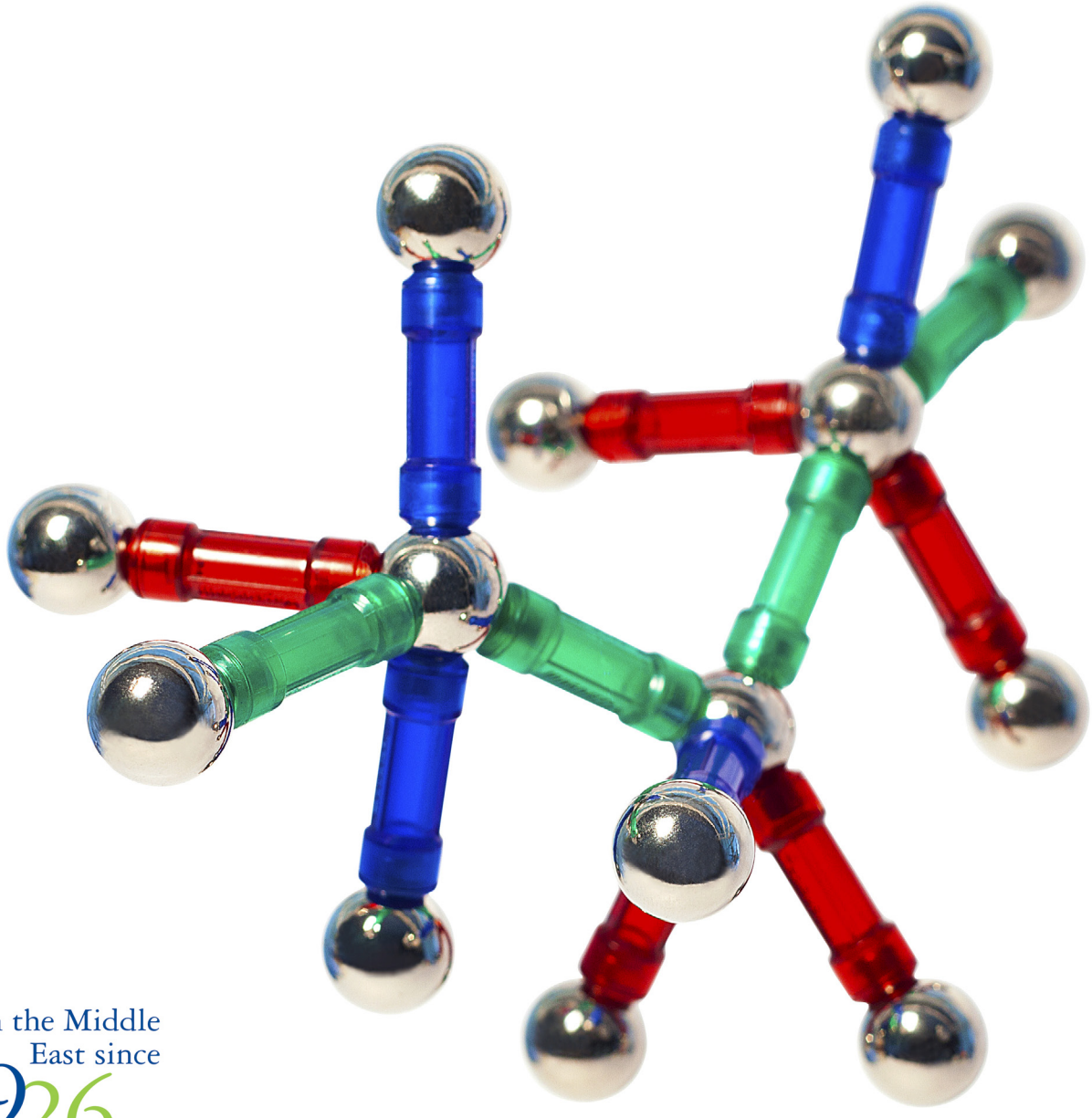
Technology, Media & Telecommunications Predictions 2015

Middle East

#TMT*predictions*



In the Middle East since 1926

Contents

Foreword

Welcome to the 2015 edition of Deloitte's predictions for the technology, media and telecommunications (TMT) sectors.

Our objective with this report is to analyze the key market developments over the next 12-18 months. Our points of view are built around hundreds of meetings with industry executives and commentators from around the world, as well as our proprietary programs of research with tens of thousands of consumers worldwide.

While the Global Predictions are currently in their 14th edition, this year for the 3rd time, Deloitte has launched a version of the predictions with specific relevance to the Middle East region.

Our endeavor is to provide a considered point of view on key industry trends. In some cases we seek to identify the drivers behind major inflection points and milestones, such as the first billion-unit year for the smartphone sector, the take-off of contactless mobile payments or Digital Islamic Services.

In others our intent is to explain why we are not expecting fundamental change, such as in the use of drones for home deliveries, or in smartphone battery technology or the deployment of miniature satellites, known as nanosats.

We also consider it critical to examine sub-trends. For instance, broadband speeds are, on average, increasing at a double-digit pace, but in many markets the average is being lifted by significant performance improvements among the fastest connections, while slower connections remain sluggish.

There are few other industries as 'mercurial' as TMT. It delivers constant, significant change, with the decades of sustained processor power and connectivity speed increases being the best examples. These changes can provoke massive disruption, but can also strengthen existing industries. And this is where predicting gets really interesting.

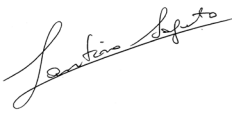
Arguably the bigger challenge in making predictions about the TMT sector is not about forecasting what technologies will emerge or be enhanced, but in how they will be adopted.

Music has gone digital, but consumer demand for physical books remains robust, with millenials at the vanguard. Indeed 18-34 year olds, counter to some perceptions, remain significant consumers of media content.

Technological advance has enabled smart cities, but the soft infrastructure required is not yet in place. 3D printing offers a factory in every home, yet it is enterprise that is driving spend. The Internet of Things (IoT) offers us the capability to remote control multiple aspects of our lives from our smartphones, but we expect companies to reap most of its value in 2015.

We would like to express, once again, our gratitude to Dubai Media City (DMC) for its support in the launch of the TMT Predictions in the Middle East for the third year. The TMT Predictions are a part of DMC's untiring commitment to support the research and study into the future of the sector and its implications for the region in the year ahead and beyond.

We wish you all the best for 2015 and trust that you and your colleagues will find this year's predictions a useful stimulant in your strategic thinking. We look forward to discussing them with you.



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Technology

The Internet of Things really is things, not people

Deloitte predicts that in 2015 one billion wireless Internet of Things (IoT) devices[1] will be shipped, up 60 percent from 2014,[2] and leading to an installed base of 2.8 billion devices.[3] The IoT-specific hardware (which could be a more expensive cellular modem, or a much cheaper Wi-Fi chip) is likely to be worth $10 billion,[4] and the associated services enabled by the devices worth about $70 billion.[5] Services include all of the data plans that may be necessary to connect a device over a network, the professional services (consulting, implementation, or analyzing the data) and then things like an insurance policy discount for a telematics device in a car or a wearable device for health purposes.

IoT hardware and connectivity revenues are growing at about 10-20 percent annually, while the apps, analytics and services are growing even more rapidly at 40-50 percent.[6] While the press may focus on consumers controlling their thermostats, lights and appliances (from washing machines to tea kettles), Deloitte predicts that 60 percent of all wireless IoT devices will be bought, paid for and used by enterprises and industries. And over 90 percent of the services revenue generated will be enterprise, not consumer.[7]

The Internet of Things is also referred to as the Machine-to-Machine (M2M) market, and is often used interchangeably (see: A brief history of Internet of Things terminology). [8]

A brief history of Internet of Things terminology

Many devices and sensors have been able to communicate with each other, normally through wires and using technologies such as SCADA (supervisory control and data acquisition).[9] Occasionally they have been connected through wireless radio signals over certain broadcast frequencies. As cellular phone systems were rolled out in the 1980s at different frequencies, they generally transmitted voice conversations but not data for machines. As 3G was deployed from 2001, it became relatively easy to have a machine or sensor communicate over the now-data-friendly cellular network. Industry analysts needed to distinguish between the two types of traffic, so everything involving voice calls was put in one category, and every data-only device into another, called Machine-to-Machine or M2M. Over time, M2M became a broad category encompassing all telematics over cell networks on trucks, smart utility meters, e-readers, tablets and PC modems, but not smartphones.

Even today, many M2M industry forecasts include e-readers, tablets and PC modems; but this seems inappropriate. Although there is the occasional automatic update or download, most of the traffic via these three devices is human-initiated and human-observed; and they often use cellular for only some of the time, and Wi-Fi (or other short range wireless technologies such as Bluetooth, or ZigBee) for the majority of traffic. Finally, with the advent of Voice-over-IP technology, putting these three devices into a different category from smartphones is not helpful, nor is lumping them together with telematics, machines, or sensors. Following a 2014 Deloitte report on the IoT ecosystem, we are going to "focus more on 'machines' and less on 'people'".[10] The Internet of Humans is an important topic, but a different one.

Modern wireless technology, whether cellular or Wi-Fi, allows a consumer with a smartphone to perform multiple useful tasks remotely: from controlling appliances to home security, climate control and lighting. But Deloitte is forecasting that the total consumer demand in 2015 for this kind of solution will be 90 percent smaller than the enterprise market. Why?

While the press may focus on consumers controlling their thermostats, lights and appliances, Deloitte predicts that 60 percent of all wireless IoT devices will be bought, paid for and used by enterprises and industries.

In the consumer context, M2M usually solves only part of the problem. Turning a washing machine on remotely, being notified when the cycle is finished offers some level of convenience compared to pushing a button on a machine in the basement. But the clothes still need to be sorted, carried to the laundry room, pre-treated, placed in the machine and soap added. In other words, the portion of the task that M2M improves is trivial.[11]

The cost saving from using an appliance during off-peak hours is real but minimal. Starting a clothes dryer in the evening rather than noon takes advantage of lower

electricity rates where offered. But even if a dryer is used daily, this only saves about $50 per year.[12]

Sometimes the cost is prohibitive: one connected home lighting kit, consisting of a controller and two bulbs, costs $150, with each additional bulb costing $60.[13] A connected living room lit up by six IoT bulbs would cost nearly $400; six halogen bulbs and a dimmer switch cost about $50.

Full IoT is sometimes overkill. For example opening a garage door or starting a car remotely is a binary on/off task. A simple radio remote control, costing about $40,[14] accomplishes the same job at a fraction of the price.[15]

Or the task that an M2M device may perform is 'low touch': the majority of homeowners seldom change their climate settings, and their on/off patterns are predictable, as most of us have predictable routines. The conventional programmable thermostat is adequate for most homes, and is already installed, understood, and paid for. In addition, the ecosystem for connecting and controlling devices is highly fragmented, which limits opportunities for higher-value cross-application uses.

Finally, the powerful customization and data analysis that is possible through IoT is not of interest to most consumers: they are not looking for numbers, they are looking for insights. Even then, behavior is a limiting factor: humans are resistant to modifying their behavior to fit with systems; they prefer that systems adapt to meet their needs with minimal change in human behavior. As an example, an electrical utility installed smart meters in millions of homes, expecting that (among other benefits) consumers could look at an online dashboard of their monthly usage, and modify their behavior to save money and benefit the environment. Three years after the meters were deployed, about six percent of households had viewed the dashboard at all, and fewer than two percent had done so more than once.[16]

So if consumers do not need them, should we bother installing M2M smart meters at all?

We should, because enterprises can benefit. For example, deploying smart meters in the UK has been estimated to generate annual savings of just over $40 per household, or $2 billion for households across the whole country.[17] For the electric utilities, the combined savings from the other benefits of IoT could be multiples of this amount. The savings from automated meter reading, short-circuit detection, and better real-time diagnosis/location of power outages comes to over a billion dollars annually, or about the same size as the aggregate consumer savings. But the most significant benefit comes from the analytics about consumer demand for power around peak power periods. This could save billions of dollars annually by obviating the need for between one and three new power plants, each of which could cost up to $37 billion.[18] The total saving for the utilities could be five or even ten times as large as the savings for consumers.

As discussed earlier, the direct benefit to most consumers from remote control of their washing machines is likely to be marginal; but the value to the machine manufacturers is enormous, not just for the information about reliability and advance warning of when a failure is about to occur, but for real-time information on which features are actually being used and how. The insights revealed by this stream of data could be worth hundreds of dollars per machine over its life,[19] recouping the cost of making an IoT-enabled washing machine tens of times over.

In a real-world example, a manufacturer spent millions of dollars and several months building a low-energy automation feature that required customer opt-in. IoT data from users showed that less than one percent of customers actually used it; this prompted the company to change it to a self-learned energy management feature that deployed automatically, translating into customer cost-savings benefits.

Annual sales of cars with embedded telematics are expected to exceed 16 million units in 2015,[20] but it is unclear how many consumers will actually use all those features. As one example, millions of cars have buttons to summon roadside assistance, but in an era of ubiquitous smartphones many drivers never use this service. But insurance companies have interest in the driving data, and offer discounted insurance rates to drivers who opt-in and have after-market devices installed.

Sales of 22 million units including after-market are expected in 2015,[21] and this is likely to save money from discounted insurance and reward safe driving.[22]

Despite all the media excitement around consumer uses for the Internet of Things, most items are selling in their hundreds of thousands as connected devices, sensors or controllers; very few are selling in their millions. Meanwhile enterprises are buying and using tens or even hundreds of millions of IoT devices. Smart meters, smart grids, smart homes, smart cities and smart highways are just some examples. Factories, mHealth, shared transportation solutions (such as car and bike rentals) or resource industries can all benefit too.

Internet of Things in the Middle East: the next big thing…

In the Middle East, IoT adoption is still relatively nascent, but we are already seeing some enterprise applications take hold. We estimate the Middle East region to currently represent about 2-3 percent of the global enterprise IoT market.[23, 24, 25] As such, Deloitte predicts that around 25 million IoT devices will be shipped to the Middle East region in 2015, leading to an installed base of around 70 million IoT devices. This would likely be worth around $250 million in IoT-specific hardware, with revenues of around $1.7 billion in associated IoT services.[26] In terms of growth, we expect the region's IoT market, in line with industry consensus, to continue to outpace global rates, at around 20-30 percent per annum in IoT hardware and connectivity (versus 10-20 percent globally) and around 50-60 percent per annum in associated IoT services (versus 40-50 percent globally).[27] Beyond 2015 we expect the region to accelerate in its adoption of IoT devices and deployment of associated IoT services, as major IoT intensive smart city developments across the region gather momentum and pace.

The vast majority of IoT devices and services will most likely be shipped and deployed across the more technology ready GCC countries. Demand will be driven by telecom operators, enterprises and governments pursuing smart developments across a number of key industry verticals.

Telecom operators: shifting towards a more data-centric strategy, with IoT as the key to thrusting data revenue growth

The largest and most natural driver of IoT adoption and deployment has been and will continue to be through telecom operators, globally as well as regionally. As traditional consumer revenue streams have become increasingly marginal, telecom operators over the years have been expanding their strategic focus towards more data intensive services, particularly with the enterprise segment.

Although IoT is still relatively nascent, the region is picking up fast. Local organizations are increasingly aware and keen to use IoT applications, solutions and services to capture, manage, and analyze data, providing key insights into customers and business processes. This, coupled with the proliferation of connected devices and broadband advancements in the region has led to local organizations and governments generating data at an exponential rate. To put this into context, the Middle East and Africa reportedly generated over 30 Exabytes (30 billion Gigabytes) of cloud data traffic in 2013.[28] With the rising usage of IoT, this is reportedly expected to increase by as much as eight times to over 260 Exabytes (260 billion Gigabytes) in 2018, generating the highest cloud data traffic growth in the world.[29] With IoT fuelling such high growth in data creation and cloud traffic, it is undoubtedly seen as potentially the biggest revenue driver for telecoms companies in the future.[30]

Regional telecoms operators have recognized this. For example, Etisalat has been very proactive in this space, leading regional developments (e.g. international M2M R&D partnerships, establishment of an M2M Control Center providing IoT services such as device management) since 2011.[31] Over the past couple of years, operators across the region have also taken important steps to enter and take advantage of the IoT opportunity.

Enterprises: transformations across many verticals, but at different rates

As mentioned earlier, enterprises benefit far more than consumers in the usage of IoT devices and services. In the region we expect many large enterprises this year to expand or start to embed IoT solutions to improve operational efficiency and effectiveness in terms of time, cost, safety, security and service. Benefits will not only be seen enterprise-wide, but also up and down the supply chain as well as across adjacent industries, for example in inventory management.

However, just as IoT adoption will vary by region across the world, it will also be adopted at very different rates by industry. Industries in the region which already understand IoT applications and its benefits will see the most immediate uptake.[32]

With the region's large car economy, the fastest and most obvious area of IoT uptake is widely expected to be in the automotive, transportation and logistics industries. As explained earlier, regional insurance companies will be able to harness IoT to greatly improve road safety, and regulate driver behavior. In transportation and logistics, connected fleet management can enhance current vehicle tracking mechanisms, and enable more optimal route planning for faster and more reliable delivery. du's partnership with SamTech to create wireless tracking, fleet and asset management solutions, announced in mid-2013, is an example of the industry's relatively quick adoption in the region.[33]

The utilities sector, through smart meter deployments, is another key industry vertical where the region will experience uptake in IoT deployment, with some analysts expecting it to account for almost half of the region's enterprise IoT market.[34] Significant

developments in this vertical are already taking place, for example, the Dubai Water and Electricity Authority (DEWA) has already started a five year project to rollout 250,000 smart meters across the city, and is taking further steps with the Dubai Green Building code.[35] Etisalat's Energy Star (EES), developed in partnership with local M2M solutions provider Pacific Controls, is another successful example. The EES solution involves installing energy monitoring and management sensors on old buildings to reduce the carbon footprint, which generated an impressive 18 percent in energy savings when tested in 2013.[36]

IoT adoption is also likely in local industrial sectors such as manufacturing and oil & gas, for example in automated maintenance and production processes. Reports indicate that more IoT automated and flexible production techniques could increase productivity by as much as 30 percent.[37]

The security and healthcare sectors, for instance through advanced alarm systems, and remote patient monitoring respectively, are also key areas of IoT adoption. However IoT adoption in these sectors at the moment is much lower than the aforementioned verticals, with analysts estimating healthcare to represent only 5 percent of the region's M2M device connections.[38]

Smart government: advancing efficiency and effectiveness

The drive for smart and integrated government is another major driver behind IoT adoption. As with enterprises, the major benefit of IoT here is to maximize operational efficiencies, such as enabling citizens to complete government processes remotely, reducing load on public sector staff and associated costs of providing the service. For example, Oman's Information Technology Authority (ITA) appointed Gemalto, a digital security solutions provider, to secure and implement remote access management of the country's e-government portal with citizens' e-ID cards and their mobile handsets (via mobile authentication). This enabled automatic authentication of citizens and recording of digital signatures whenever citizens used e-government services.[39]

Smart cities: large scale connectivity and enablement

In the mid- to longer-term we expect the development of the region's smart cities to be a real game changer for the region's IoT market, shifting IoT device adoption and solutions services into high-speed. Smart cities are a very IoT intensive development, requiring the deployment of millions of IoT devices to connect the city on a large scale. Smart Dubai for example is planning to use smart sensors and devices across a wide range of areas such as health, education, tourism and public utilities.[40]

With analysts predicting the global smart cities technology market to grow more than two to three times over the next five years in terms of dollar value, and more smart cities developments predicted to arise in the region, we expect corresponding IoT adoption rates to accelerate sharply.[41] A number of other smart city developments such as Masdar, Dubai Design District (d3), King Abdullah Economic City (KAEC) and Qatar's Lusail City are already taking place. Telecom operators such as Etisalat, du and Ooredoo are already working with a number of leading organizations to support the IoT development of smart cities.[42]

Telecom operators are driving the development and adoption of IoT in the Middle East

The region is experiencing a lot of activity in the IoT space. Telecom operators are taking the lead in developing the region's IoT industry, providing the required infrastructure for city and country wide IoT implementations through 5G deployments, regional and international partnerships, industry-wide collaborations as well as joint R&D and innovation efforts.

5G announcements. Previously, upgrades in network speeds were deployed to meet incremental consumer demand for data, stemming from more sophisticated smartphone usage (e.g. video streaming, photo transfers, application downloads). However, with millions of IoT device deployments across industries and entire cities, there is a great need for operators to provide sufficient bandwidth to accommodate much larger levels of M2M data traffic generated and transmitted via IoT devices.

The new 5G network is therefore a significant step up from 4G, with a 100 fold increase in speed to 10 Gbps, reduced latency, improved network coverage, a 30 fold increase in device density per node (for increased spectrum efficiency) and 1000 times reduction in power consumption. Aside from significant advancements, a key feature of 5G is that the network itself is 'smart', capable of understanding the needs of each connected

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device in real time and automatically optimizing bandwidth allocation accordingly.[43] As such, telecom operators across the world and regionally are racing to develop and deploy 5G.[44] For example, Etisalat has recently partnered with Ericsson, aiming to be the first to deploy 5G services in the region.[45]

Partnerships. Both globally and regionally, there has been a flurry of partnerships, as telecoms operators locally and abroad collaborate to develop innovative IoT solutions to take to market.

In UAE, Etisalat partnered with Huawei to commercially launch new IoT connected services in the region, focused on government and enterprise markets.[46] Similarly, Etisalat have also partnered with Telefonica to collaborate on strategic areas such as technological standardization, new global technology initiatives, R&D, and new IoT products and services.[47]

In Qatar, Vodafone Qatar partnered with IoT device vendor NetComm Wireless to bolster the country's IoT infrastructure. The strategic partnership also enables Vodafone Qatar to access a wider portfolio of IoT devices and provide complete end-to-end solutions to its customers.[48] Ooredoo has also partnered with Ericsson to launch a cloud-based IoT platform in Qatar, Algeria and Tunisia this year.[49]

In Saudi Arabia, STC and Cisco have expanded their long-term strategic partnership to create a joint go-to-market strategy, addressing the country's IoT market, with a focus on key verticals including energy, oil & gas, smart & connected city deployments.[50] Similarly, STC has also partnered with SK Telecom to develop IoT solutions for smart cities, digital healthcare, smart learning and building energy management systems (BEMS).[51] Mobily, with Jasper Wireless, a leading IoT connected devices platform, are working together to wirelessly connect IoT devices in Saudi Arabia, covering industry verticals from automotive and healthcare to construction, security systems and utilities.[52]

In Kuwait, Zain is reportedly considering opportunities to partner with or acquire active players in the enterprise IoT and smart cities markets.[53]

A supporting ecosystem needs to be in place for the IoT industry to develop and for IoT technology to sustain continued adoption.

Industry-wide collaboration. In addition to the multitude of strategic partnerships mentioned earlier, regional and global stakeholders at an industry-wide level are also coming together to agree on a common framework to standardize and simplify large-scale IoT deployments.[54] The M2M Multi-Operator Alliance, with the aim of simplifying the process of global IoT deployments for multinational businesses, is an example of this. Through such alliances, common issues with technology deployment such as inter-geographic issues (e.g. limited local coverage of some mobile operators, fragmented network landscapes and multiple SIM management platforms) can be avoided.[55]

The GSMA's introduction of an embedded SIM (eSIM) system, installed within IoT devices at the point of manufacture, where connectivity is not tied to any one operator, is another important development. Telecoms operators must adhere to a single, common and interoperable standard so that IoT devices installed by manufacturers are normalized globally through a variety of operators, in turn accelerating the rapidly growing IoT market not only on a global scale, but also for the long-term development of the IoT industry. This is being implemented for example in automotive vehicles at the point of manufacture. In the region, Etisalat was amongst the first to deploy eSIM compliant M2M services.[56]

A number of regional industry-wide events have also been used as a platform for wider collaboration and development efforts. Example events around IoT include the M2M Middle East Forum, the GSMA Mobile 360 Series - Middle East conference, the IoT Expo (IoTx) and most notably the Internet of Things World Forum (IoTWF), the largest IoT industry conference, which was awarded to Dubai as the host city for 2015.[57]

R&D and innovation. The adoption of IoT will depend upon and be driven heavily by innovations in IoT devices and associated solutions to address real world problems. A supporting ecosystem needs to be in place for the IoT industry to develop and for IoT technology to sustain continued adoption. Efforts in the region have been made towards this. For example, Etisalat and Intel have recently partnered to establish a demonstration environment lab for technology innovations in cloud and IoT services, aiming to develop solutions for several industry verticals.[58] Similarly, Etisalat and Huawei, as part of their strategic partnership, have also announced plans for a new joint R&D programme to develop IoT solutions for various industries. Ooredoo has also signed a strategic alliance with KT Corporation of Korea to introduce new concepts and innovations.[59]

Bottom line

In 2014, the IoT analytics market is primarily descriptive ($800 million), a little bit of predictive ($180 million) and minimally prescriptive ($14 million). Over the next four years, while IoT analytics revenues of all three types is likely to grow by 500 percent, the prescriptive subset is likely to grow over 3,000 percent.[60]

IoT vendors may want to extend cost-reduction and risk management deployments to explore revenue and innovation potential. Often, IoT is seen as a technology that is driven by the CIO. Since CIOs are not typically focused on revenue growth and innovation, providers who sell only to the CIO will usually revert to talking about lowering transaction and maintenance costs. Cost reduction is not bad, but it also is not enough and the potential for adoption and business value may be broadened by reaching out to CMOs, CFOs, major line managers, and even CEOs.[61]

Growing IoT may mean focusing on product and/or customer lifecycle. The retail sector offers examples of how companies can benefit from using real-time data to move beyond transactions and understand their customers and products better. For example, a UK-based retailer used their loyalty club card to track customer visits, buying behavior, payment modes, and inventory. By paying close attention to customers (customer lifecycle) and product sales (product lifecycle), the retailer was able to adjust merchandise dynamically to suit local tastes, customize offers to customers, manage inventory volume based on demand/purchases, and plan inventory refresh as needed. The result? Sales, customer loyalty, and coupon redemption rates all increased.[62]

We expect many firms to target early deployments to maximize impact. This seems counter-intuitive, since the power of IoT grows exponentially as the number of connected devices increases. But in the early days, enterprises may want to find the single biggest pain point or revenue opportunity, and roll out an inexpensive solution, such as a sensor network, which will simplify the ROI justification.

Connecting devices that were unconnected before creates opportunities, but also requires a fundamental shift in business model. A connected product is no longer just a product; it is a service. For example, a connected coffee machine is an insights tool for restocking and usage profiling to optimize coffee pods supply chain and increase customer lifetime value. However, connectivity also introduces new risks, and enterprises need to develop security that is both preventative and responsive in order to lower costs and increase operational efficiency.

Customers have concerns about privacy: what data is an enterprise collecting in M2M, and what are they doing with it? It will be important for companies to maximize transparency in order to enhance user trust: there will likely be a balance between perceived costs and benefits by customers, and the willingness to share information by consumers will vary by application.

Middle East perspective

The acceleration in local IoT developments over the past few years has seen the region undoubtedly gearing up for what is likely to be the next industrial revolution. Although the region is still only a fraction of the global IoT market, GCC countries in particular have big plans: smart telecoms, smart industries, smart government and smart cities all running on smart infrastructure. Regional stakeholders so far are making advance progress, coming together earlier through partnerships, international alliances and taking steps to build an IoT ecosystem together. It is still early days, and a number of hurdles still need to be overcome for the IoT industry's long-term development.

Security and privacy regarding the use of IoT devices and platforms remains a major concern for the end-users and governments, particularly in the Middle East, a more conservative and private society, which has been subject to a rising wave of cyber-attacks in recent years. As M2M platforms worldwide are still evolving, security standards and regulations are still not mature.[63] Each IoT device is a potential network access point which could be exposed to external attacks. Eavesdropping, snooping, tracking, tracing, replaying, counterfeiting and spoofing are described as simple but typical IoT data attacks. Significant research and development is underway to guard against this threat, creating a huge market in the region for ICT security companies and service providers to address.

Beyond the functional, there is also an increasing need to build intellectual human capital to take the local IoT industry forward, on a number of fronts. Knowledge sharing and cross-industry collaboration is essential. This is being done to a large extent amongst telecoms operators internationally, but true industrial transformations in each vertical can only be realized if IoT solutions providers work very closely with vertical specific experts to address vertical specific problems. Educating and training the youth and existing employees is also fundamental to ensuring today's and tomorrow's workforce can understand and apply IoT to its full potential. Without this, local innovation could be inhibited.[64] Some progress is being made. For example, STC and Cisco have announced plans to jointly establish a center of excellence and a training academy.[65]

With so much data being generated by IoT devices and solutions, care also needs to be taken with mobile data pricing, particularly where data throughput is increasing at a faster rate than the revenue generated. While IoT will lead to much greater growth in data usage, operators at the same time need to ensure they are managing this increasing usage profitably. For instance, Etisalat have fixed data packages and per SIM flexible data packages, customizable for any particular sector or business size. A fixed data package can be shared by any number of SIMs, optimum for big long-term projects where all SIMs use a fixed amount of data. Per SIM flexible data packages are best suited for small to medium M2M deployments, where a minimum amount of data is used per SIM, enabling smaller enterprises to keep data costs in control.[66]

In terms of service offering, IoT providers also need to ensure they have the range of capabilities needed to deliver comprehensive IoT solutions. Operators solely providing network connectivity may not make for such a compelling offer to an enterprise customer. Adjacent specialisms such as big data analytics and cloud management also need to be part of the repertoire of what telecoms as IoT providers can offer.

The region is currently a small market compared to more advanced economies, but as with other technologies such as smartphones and social media, has risen much faster than others. Similarly, LTE deployments in the region have progressed far faster in the Middle East than in the UK, with partnerships already forming for 5G.[67] IoT may still seem to be a distant future, but in reality, it may revolutionize the Middle East sooner than we think.

Drones: high-profile and niche

Deloitte predicts that in 2015, the active base of non-military drones costing $200 or more should exceed one million units for the first time. We expect sales of non-military drones (also known as unmanned aerial vehicles or UAVs), to be about 300,000 units in 2015, with the majority being bought by consumers or prosumers. We expect total industry revenues to be $200-$400 million dollars in 2015 (equivalent to the list price of a single, mid-sized passenger jet). In short, while we believe that UAVs have a tremendous range of applications, particularly for enterprise and government, we are not foreseeing a breakthrough year for drones in 2015.

This prediction focuses on three categories of UAV, defined by price and performance (we have excluded toys, due to lesser range and potential impact):[68]

- Entry-level hobbyist models, typically priced at $300 – $500 per kit (including the drone itself, additional batteries, chargers, GPS modules and spares). These have four rotors, a range under direct control of up to fifty meters, and can fly for up to about 20 minutes on an extended battery. Basic models can fly at about 15 kilometers per hour (km/h) horizontally. They weigh less than half a kilogram, are about half a meter in length, incorporate a basic camera, and are typically controlled via smartphone or tablet apps.[69]

- Prosumer devices cost from around $750 per kit.[70] These have four to six rotors and a flying range of up to a kilometer. They can fly at 50 km/h (about 15 meters a second) and can remain airborne for up to 25 minutes. They weigh about a kilogram and usually have a separate controller.

- Enterprise models, costing from $10,000 and up. These usually have six or more rotors, large blades, and multiple motors and are capable of lifting more than three kilograms. Some units have wings and propellers. These units can be designed to maximize payload or range. Some models are capable of an hour's flying time.

The UAV market has benefited over the past decade from the surge in demand for consumer electronics, particularly at hobbyist level. For example, a key appeal of drones is their ability to capture high-definition (HD) video: the billions of sensors and lenses produced for devices such as smartphones each year have enabled better quality and lower prices for applications, such as drones.

Also, a smartphone or tablet can be used to control a drone, removing the cost of a separate controller. Routes can be defined using online maps and GPS positioning. The accelerometers and gyroscopes used in drones are bulk-produced for smartphones. Wi-Fi can be used to control the drone, and also to relay images.[71]

For consumers, UAVs blend the appeal of remote-controlled vehicles, high-definition photography and kite flying. The primary application by consumers of drones seems to be for aerial photography.[72] There are UAVs that are designed for "follow-me" footage: the drone is programmed to track and film from the air the progress of someone skiing down a slope.[73] As smartphone camera quality improves, this will be incorporated into UAVs, enabling ever more spectacular footage.

UAVs are also being deployed in a widening range of professional contexts. Drones provide some of the observational or sometimes transportation functionality of a helicopter from $1,000 a unit, and without the cost of an onboard pilot, or even a pilot at all. They can undertake tasks that were previously too expensive to consider. Farmers can survey crops, without needing to visit their fields.[74] Livestock owners can undertake aerial searches for lost animals or even herd them.[75] Police forces and rescue units can use them to complement search and rescue missions, especially by using infra-red cameras.[76] Geologists can use them to map unchartered territories, or to survey for oil[77]. UAVs can inspect wind turbines, which reach several hundred feet in the air, removing the need for someone to climb up a structure.[78] Off-shore oil rigs can be similarly inspected.[79] Archaeologists have used drones to create 3D images of sites, and also to patrol for looters.[80] Finally, they can be used to distribute medicines, in the absence of viable roads, as part of disaster relief or other humanitarian campaigns.[81]

Aerial news footage no longer requires a helicopter or a trained pilot.[82] Some wedding photographers have used drones to capture the ultimate crowd shot.[83] Drones' newsworthy ability to film footage that would otherwise be hard to reach – from the sides of skyscrapers to the backyards of celebrities to the tops of power stations – has raised their profile significantly.[84]

The UAV market has benefited over the past decade from the surge in demand for consumer electronics, particularly at hobbyist level. For example, A key appeal of drones is their ability to capture high-definition (HD) video.

Drones offer fantastic possibilities for enterprises and consumers, and will be used for an increasingly diverse range of observation applications. But it is unlikely that there will be a surge in demand for UAVs, such that they become a mass-market (multiple millions of units) global market.

Three key factors are likely to constrain demand in the short – and medium-term.

Drones crash

First, flying drones consistently well is challenging and crashes are common. We expect this will dissuade many from spending a few hundred dollars on a fast, hobbyist UAV in 2015.

An individual can fly a drone within minutes of assembly; but even an experienced pilot can suddenly lose control even in everyday conditions, that is with occasional gusts of wind and with cloud.[85] Piloting a drone, which can attain 50 km/h, but which travels in three dimensions, and which is readily buffeted by the elements is tricky. Even flying indoors can be challenging.[86]

Plotting the course for a drone is simple using an online map and GPS. But GPS can readily be lost – for example if a building blocks the signal, or simply due to dense cloud. Once contact is lost the drone would be flying blind. A lost drone might land safely in an unpopulated area; or it could crash into a building, or worse, land on an individual, with rotors still spinning.[87]

Drones' propensity to crash – either due to pilot error or mechanical failure – is reflected in the fact that drone kits often come equipped with a full spare set of rotor blades.

Someone considering what to spend a few hundred dollars on would likely purchase a new smartphone, which could be used every day, ahead of an equally-priced UAV, capable of taking awesome footage, but constrained by a fifteen-minute battery range, and with an odds-on chance of crashing.

A further constraint on consumer UAV usage is that it may be considered anti-social, particularly if used to capture images of areas of outstanding beauty.[88] The sight and noise of a single drone could tarnish a perfect sunset for hundreds sightseers in the vicinity, as well as affect the behavior of wildlife.[89] Some people may consider a camera-equipped drone flying over their heads as an invasion of privacy – even if the camera is not turned on.

Regulation is uncertain

UAV regulation is likely to constrain their use. In some markets, regulation is imminent, while in others, drones come under the same rules as apply to remote controlled aircraft.

In the US, the Federal Aviation Administration has published an initial plan to integrate unmanned vehicles into US airspace.[90] In the European Union, the Commission has set out its views on "how to address civil drones, or remotely piloted aircraft systems (RPAS), operations in a European level policy framework which will enable the progressive development of the commercial drones market while safeguarding the public interest".[91]

Controls can cover a range of UAV actions including the height drones can attain, the distance they can fly from the operator, the required distance between the vehicle and people and the qualifications the pilot needs. For example in the UK, the Civil Aviation Authority permits UAVs of under 20 kilograms in normal airspace so long as they are 150 meters from crowds, 50 meters from a person or a building and within line of sight (defined as within 500 meters' distance and under 122 meters' height). Commercial use of drones requires a license, for which there is a test commensurate with the demands of flying a UAV: as well as a theory test, the practical test requires demonstrating competence in flying figures of eight, or descending at a specific angle.[92]

In the US, there were 25 reported near misses involving UAVs and piloted planes at altitudes of several thousand feet between June and November 2014, some involving large passenger planes.[93] Hobbyist UAVs tend not to have anti-collision systems as these add cost, bulk and weight, reducing the vehicles range.[94] Because of

this potential danger, it is likely that most markets will regulate the use of drones.

A likely outcome in many markets is that UAVs will be integrated into current flight control systems.[95] This will likely require an upgrade of current systems to allow for significantly increased capacity.

The impact of regulation on consumers may well be to dissuade usage. In some cases mishaps occurring from drone usage have been met with fines.[96]

The legality of flying drones has already been the subject of litigation, and this may continue through 2015 and beyond. Some drone manufacturers are responding by incorporating safeguards into their devices. For example, one vendor programmed in no-fly zones near hundreds of airports around the world.[97]

Enterprises will deploy UAVs by the dozen, not the thousand

We expect enterprise and government usage of UAVs to be increasingly widespread, where regulation permits, but for each entity to only use a single or a few drones per task. We do not expect drones to be deployed on a massive scale, for example to replace existing vehicles. Drones are cheaper than helicopters, but more expensive than conventional terrestrial vehicles for many enterprise tasks.

Drones will occasionally be used for transporting goods, but this will not be commonplace. For example a delivery company is using a UAV to deliver urgent packages, such as medication, to Juist, a small island 8 kilometers off the coast of Germany, and which otherwise can only be reached by boat at high tide.[98]

Drone delivery is unlikely ever to be viable for anything aside from high-value, lightweight and compact packages, as the cost of per delivery of up to 10 kilometers would be between $8 and $12. (see: Estimating the cost of drone delivery).[99] These costs are unlikely to decline markedly over the next five years, as there are few forecast technology advances in the medium term that would enable prices to fall significantly.

Estimating the cost of drone delivery

The key capital costs in provisioning a drone suitable for delivery of packages are:

- The UAV, at about $10,000-$50,000 per unit. The $10,000 price-point assumes a bulk order or self-assembly. Each drone can make up to 5,000 round-trips of up to 10 kilometers length. Some drones may get stolen, lost in transit or damaged.[100]
- Rechargeable batteries, at about $200-$400 per pack. At this price, batteries would have a range of ten kilometers with a two kilogram pay load. A battery lasts about 100 charges and its range declines following each charge.
- A system control unit which would control the flotilla of UAVs, provide air traffic control and log flight paths. This unit would cost from $30,000.

These costs exclude operational costs, which could be significant. An autonomous UAV that can rely entirely on satellite navigation for guidance should need no piloting, however if the GPS fails the drone is basically blind. In some markets, this would not be legal, and a pilot would be required to guide the device. Other individuals may be required to perform flight control. One other task that a person would need to do would be to swap out exhausted batteries and replacing them with fresh ones.[101]

Drones can convey a package but cannot deliver it.[102] The package may require a signature; it may need to be re-routed to a neighbor. An unmanned UAV needs a lot of human support around it. The trial of delivery of goods to Juist is only to a reception area.[103] A worker receives the goods, and then delivers it to the recipient. This may seem convoluted, but at present it is the only approach, and may remain so for the foreseeable future.

Bottom line

Individuals have long been fascinated of the possibility of replicating our bustling terrestrial highways above ground: the notion of personal or unmanned vehicles flying around the sky in vast quantities has long been a feature of science fiction. A future in which fully-automated UAVs deliver packages to our homes is a compelling one; however it is not at all likely in 2015.

This is not to say that drones are not useful or compelling. Any invention that counters gravity is a marvel; one that combines flight with other recent innovations, such as lightweight high definition cameras and accelerometers should be lauded.

We expect drones will have multiple industrial and civil government applications, building upon the diverse uses they are already being put to. Any task requiring aerial inspection could be undertaken by a camera equipped drone, transmitting footage to ground staff in real time.

The global aerial imaging market was worth about $1 billion in 2014.[104] Hollywood chase scenes make up a small part of that; the majority is for aerial imaging in construction and development, geospatial technology, and natural resource management. Much of that is from helicopters and drones which will capture a percentage of this market. But some of this market will remain inaccessible as drones are not for purpose for all current aerial imaging work. UAVs have lower ranges, lesser tolerance of adverse weather, and smaller payloads than helicopters: the lightest stabilized camera, for example, weighs around 20 kilograms.[105]

This implies a ceiling for sales of drones for the aerial imaging market, but it is also the case that the lower cost of drones will widen the aerial inspection market. If a drone can do a better job of inspection of building sites than sending a team up with ladders and ropes, then the usage of visual inspection will broaden considerably.

Regulators considering how best to incorporate drones into existing air space will need to balance the many positive contributions they can make, as well as the obvious negative externalities they can inflict. An irresponsibly piloted semi-professional two kilogram drone, whose battery expires in mid-flight above a crowd, may cause serious injury. A drone deployed on search and rescue missions may save lives.

Enterprises should examine every potential application of UAVs while recognizing their limitations: these are lightweight, battery-powered devices, many with modest payloads and short ranges.

3D printing is a revolution: just not the revolution you think

Deloitte predicts, in line with the industry consensus, that in 2015 nearly 220,000 3D printers[106] will be sold worldwide, with a dollar value of $1.6 billion,[107] representing 100 percent unit growth and no more than 80 percent growth in dollars[108] versus 2014. But there won't be a 'factory in every home':[109] although 3D printing can be seen as 'the next Industrial Revolution'[110] the real revolution is for the enterprise market, not the consumer.

By 2017, about 70 percent of units will be sold to consumers,[111] and they are likely to be a majority of units in 2015, but almost all of these will be small units with relatively limited capabilities for producing functional parts.[112] Dollar value and usage will be heavily skewed to the enterprise market. Deloitte estimates that enterprise (rather than consumers) will account for just under 90 percent of the value of all 3D printers;[113] over 95 percent of all printed objects by volume; and 99 percent by economic value.

Deloitte also predicts that rapid prototyping and the production of 3D-printed objects that fit into existing manufacturing processes (such as creating a mold, die, cast or tooling that will be used to make final parts) will represent 90 percent of the 3D objects made by enterprises. Although likely to be the fastest-growing component of 3D printing, final-part manufacturing[114] will still represent less than ten percent of 3D objects printed.

The relative insignificance of the consumer 3D printing market is due to several factors. One is the unit price. Home devices for under $1,000 have now been available for eight years; they print fairly small grapefruit-sized objects out of limited-performance materials and with relatively coarse features. High-end industrial machines are capable of producing finer details, are faster and can print larger objects; but the largest units can cost almost a million dollars, and even smaller machines cost on average hundreds of thousands of dollars each.[115]

But that's only part of the problem holding back the consumer market. In the near term, the less-expensive home devices have some crucial limitations. They can be extremely difficult to calibrate, maintain and use.[116] If the heated bed on which the plastic material is being extruded is even one or two degrees too cold, the object won't form properly; while a degree too hot can cause it to stick to the plate. This deters many consumers from buying a device, and those that do often abandon their machine after producing only a few objects. And this won't be changing soon: according to one forecast, only ten percent of home machines under $1,000 will be 'plug-and-print' by 2016.[117]

3D printers for the home are slow; even objects a few centimeters high can take many hours to print. Printed objects usually require final finishing; materials are expensive at $50 per kilogram or more; the software tools are not easy to learn; and objects tend to be small and have very low-strength properties. The most significant limitation is that most home printers produce objects made from just one or two plastics,[118] and there just aren't that many useful consumer devices made solely out of low-performance plastic.[119]

Many of these limitations will improve over time. Early PCs were hard to use; similar improvements in ease of use are likely for 3D printers. Costs for both machines and materials should continue to decline; printing will get faster; and new materials (different kinds of plastics, or maybe even metals) that currently can only be printed by enterprise-grade machines may make it into the home.[120] But this won't happen in the near term. Even by 2020 home 3D printers will likely be more similar to power tools than PCs: 10-20 percent of homes may have one, or want to have one, but they will be far from ubiquitous; and even owning a 3D printer may be like owning a power drill. Unlike a PC, a 3D printer is a device that most are likely to use only rarely, and not daily.

In contrast a cross-industry survey found that in 2013, one in six enterprises in developed countries owned or were planning to acquire a 3D printer.[121] Deloitte's view is that by the end of 2015 the ratio will be one in four, although it will vary considerably by industry.[122]

Given that 3D printers are now widely used by enterprises, varying by vertical (with manufacturing and medical leading the way) why are we predicting that the finished part share of 3D printer output will not be larger in the next year?

First of all, the manufacture of finished parts is limited by the small number of 3D printers that can actually produce metallic components. Although there are some end uses that may need plastic, glass or other substrate objects, metal remains the most useful 3D-printed end material, but only 348 metal printers were sold worldwide in 2013.[123] The installed base

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at the end of 2014 is likely to be under 1,000 units globally. Even when the right machine is available, and the finished part has suitable materials properties (such as strength and resistance to cracking), 3D printing of these parts seldom makes sense. For the foreseeable future, printing parts will take 10-100 times longer, and cost 10-100 times as much as manufacturing by stamping, casting, or other traditional manufacturing techniques.

In a 2014 survey of industrial manufacturers, 62 percent of respondents were either not implementing 3D printing technology or only experimenting with it. Of those who were actually using 3D printing, two-thirds were using it for prototyping and marketing purposes only; a quarter were using it for a combination of prototyping and production; seven percent were building products that couldn't be made using traditional methods; and only two percent were using their machine only for production of final products or components only (and even then, only for very low volume products).[124]

These trends seem likely to continue in 2015. 3D printing is ideal for prototyping when a fully-functional part is not required. Traditional prototyping requires skilled artisans in machine shops and can take days or even weeks; and each object can cost tens of thousands of dollars – all to create (for example) a plastic rear view mirror housing that a designer looks at and needs to change again. An enterprise-grade 3D printer can take the CAD (Computer Aided Design) file the designer is using and build, layer by layer, a physical sample in eight hours for a materials cost of $100. The designer can then look at the part, tinker with some aspect in the CAD software model, and print out an iterated version by the next morning.

There will be some highly complex parts that are better made through 3D methods (such as certain aerospace components like turbine blades),[125] or unique situations where there is no room for a machine shop and the nearest parts depot is far away (such as the International Space Station).[126] But for many manufacturers, issues around cost, speed, material availability and consistency of outputs remain barriers to using 3D printers; and "customers have yet to put their full trust into these products."[127]

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There is a difference between mass manufacture and producing spare parts. Many enterprises may have a potential need for thousands, or even tens of thousands, of replacement parts, any one of which could be critically important. It is impossible to hold that kind of inventory; and delivery of a part from an overseas manufacturer can take many hours or days, even using air freight. Even when a company that owns a 3D printer can manufacture a part that would normally be ordered from a parts manufacturer or distributor, and that part meets all the required specifications, there are significant legal questions around intellectual property and manufacturers' warranties.[128]

In the near-term however we expect some parts manufacturers to embrace a 3D printing business model, where customers are given the option of downloading an approved file, printing a legal and authenticated part,[129] and installing the part without violating copyright or warranty provisions.

In the long term 3D printing will be used increasingly for making finished goods. Already its use for this purpose appears to be growing faster than the 3D printing market generally.

Even here, adoption may take longer than some of the more optimistic expectations. For example the automobile industry is often cited as an early adopter of 3D printing technology: in 1988 Ford bought the first 3D printer ever made,[130] and the auto industry is the single largest buyer of 3D printers, with over 40 percent share.[131] Virtually all global auto manufacturers and many parts makers[132] have purchased one or more 3D printers; but over 90 percent of them are used for prototyping of non-functional parts, and only about ten percent are used to make functional prototypes or casts or molds to help in conventional manufacturing. As of January 2015, the major North American auto manufacturers and parts makers are not using 3D printing for the direct manufacture of even a single final part for a production vehicle, and are not planning to do so in the next two years.[133]

The medical vertical is about 15 percent of the 3D printer market, and is often discussed as one of the bigger markets for finished part manufacture. Although 3D-printed hips and skulls are getting the most press, the less-glamorous use cases are almost certainly the main drivers of medical 3D printed devices, both in volume of parts and in value. The audiology and

dental markets are often cited as examples where 3D printing is ubiquitous: "Virtually all hearing aid shells and dental copings are made using 3D printing." That is true for the hearing aid market: there are likely to be over 15 million 3D printed hearing aids in circulation today.[134] But although 3D printing is used for some part of the coping manufacture process, in many cases only 15-20 percent of all finished part copings are made exclusively with a 3D printer.[135] Equally, while 3D printers are used occasionally for making temporary teeth, almost all permanent teeth continue to be milled: it's faster, cheaper, and produces better quality objects.

The revolution of 3D printing extends into the Middle East, a much smaller market, but rising to the occasion.

The Middle East region represents a small fraction of the global 3D printing market,[136] as a relatively immature market with a limited design and manufacturing industry, with China and the Unites States driving the growth globally. However, the Middle East is expected to follow the global growth trend with an expected increase of almost 60 percent per annum in 3D printer units and almost 30 percent per annum in 3D printing revenues until 2017, albeit off a low base.[137]

The revolution in the Middle East will also be for the enterprise market, with the potential to provide companies with significant manufacturing savings. Consistent with the global trend, the impact is likely to be focussed on rapid prototyping as opposed to the production of final parts, reducing time and cost for designers that were previously reliant on skilled artisans in machine shops. Experts we interviewed were keen to differentiate between 'hobby printers' and 'production systems', with the former referring largely to rapid prototyping while the latter are used for final parts manufacturing. Only production systems are currently considered to showcase the potential of 3D printing (using additive manufacturing technology to produce a range of manufacturing tooling such as thermo forming, blow moulding tools for plastics, sheet metal tools as well as customized jigs and fixtures),[138] although they also require a more complex understanding of the technology for a customer to submit the quality of files required.[139]

The uptake of rapid prototyping in the region has, to date, largely occurred among a handful of multinationals, including architects and interior designers, such as Godwin Austen Johnson which uses 3D printing in its client work. In terms of suppliers, there are pockets of provider activity within the region, largely concentrated in the UAE, with a number of start-ups seeing an opportunity to accommodate the need for lower-cost manufacturing. Current providers include 3D printing service bureaus, scanning and file conversion, CAD for 3D print, as well as retailers selling 3D printing hardware.

There is evidence of some growth in final parts manufacturing, with the most recent notable newcomer to the market – D2M Solutions – witnessing rapid uptake of its low volume manufacturing services, with customers including regional airlines and government organizations (see mini case study: D2M Solutions). The greatest bottleneck to growth in this segment is the poor quality of files submitted by customers in the region, which limits the quality of the output, and this is unlikely to change until there is greater understanding of the 3D technology.[140]

Whilst 3D printing is likely to play a greater role in final parts manufacturing in the future, its impact on the manufacturing industry is largely restricted to low-volume manufacturing, as traditional methods remain the most effective for high volume manufacturing in terms of cost, speed, material availability and consistency of output.

In line with the global prediction, 3D printing is considered unlikely to revolutionize the consumer market in this region yet, as the products remain fairly basic and are unlikely to transform consumers' lives in the near future. There are nonetheless some interesting examples of 3D printing services targeted at consumers, such as Iris 3D Solutions that offers a range of niche applications including full body and face 3D scanning, and turning 2D photographs of places, people and things into 3D; and Precise Concepts, a kiosk established in three malls in Dubai that offers a service called This Is Me, which sells 3D scanned and 3D printed copies of oneself. Customers that have purchased a 'This is Me' voucher costing $135 to $275 (depending on size)[141] are invited to the studio for a full body scan that takes approximately 30 minutes, and then a 3D prototype that is 10 percent the size of the customer is available for collection within 10 days.[142]

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Mini case study: D2M Solutions

D2M specializes in end-to-end manufacturing, including selling 3D printers and the provision of 3D printing services. It has been active in the Middle East 3D printing market for ten years, and based in Dubai since 2011. D2M has seen rapid growth in the industry since then, with its 3D printing workforce having grown from two staff in 2011 to 25 staff in early 2015.

Paradigm 3D was launched six months ago as D2M's printing services brand, with a view to serving the high-end B2B market with low-volume manufacturing in the Middle East, and has the largest installation of 3D printers in the region, with customers able to request up to 150 copies at relatively good value (compared to traditional manufacturing).

Key customers: American University of Sharjah; Office of H.H. The Crown Prince of Dubai; Al Abbar Group

Customers are primarily large companies with design branches in the region, government entities, airlines, architects, and interior designers. As an example of the value that 3D printing can bring to the low-volume manufacturing market, D2M worked with a customer in Saudi Arabia to replace a part that originally cost over $315,000, reproducing it for just over $50 a piece.

The main challenge faced by Paradigm 3D, and the Middle East market generally, is the poor quality of files submitted by customers. To overcome this, D2M provides informal training to customers to build their understanding of the technology.

Bottom line

Although 3D printers are unlikely to be the 'factory in every home', they may become the factory in every school. Learning how to use 3D printers (and the software tools needed to operate them) will be like learning woodworking or metalworking for past generations of students: enormously useful for those who will end up using 3D printers in their jobs, and still a positive learning experience for the rest. It is still early days, but one study found that hundreds of US primary and secondary schools are already including 3D printers in their annual budgets.[143]

Outside of schools, and for the near term, 3D printing technology may be used best as only part of the manufacturing process: 3D printing dovetails well with many existing production techniques. New technologies that work with existing processes are almost always adopted more rapidly than those that require entirely new ways of doing things.

By lowering the cost and dramatically accelerating the time-to-market for both prototypes and tooling, 3D printing solves particular pain points in some manufacturing chains, and levels the playing field between large manufacturers and the start-up in the garage, just as PC technology narrowed the gap between the mainframe computer makers and the kids in the Silicon Valley garage. Large jewelers used to be the only ones who could maintain in inventory hundreds of mocked-up rings in all the various sizes needed: now small ateliers can produce customized samples at low cost and within hours.

3D printers are used widely in rapid prototyping of mainly non-functional components, but this usage is unlikely to result in material cost savings for the R&D process. Although building traditional prototypes is usually more expensive than using a 3D printer, prototyping is typically only a small fraction of overall R&D costs. The speed and low cost of iteration means that more versions of a given part will be tried; outcomes and timelines will be improved, but dollars won't be saved.

In addition, 3D printing makes the supply chain more flexible and agile. Product life cycles are shortening, which puts a premium on speed to market. Since the initial costs can be lower than those of traditional manufacturing, 3D printing can offer competitive per-unit costs at levels below the scale required by traditional manufacturing.[140]

Deloitte Predictions normally looks at only the next 12-18 months. At the furthest limit of that time frame, there are likely to be new multi-material 3D printers from major manufacturers, targeted at the enterprise market and not the consumer. Full details of these devices are unavailable yet, but they are likely to increase the market for finished parts, due to multi-materials capacity, higher speeds and greater precision.

Middle East perspective

The relevance of 3D printing to the Middle East region could be seen at Downtown Design in October 2014, with an exhibition about what the future might look like that showcased a 3D-printed housing complex made entirely from recycled plastic.[145] The exhibition was produced by Stay Plastic, a project from the Royal College of Art in London, although it has clearly generated interest amongst the design experts in the region. Furthermore, 3D Print Show, the international industry-established show originating in London, with Paris and New York, is now coming to Dubai (as well as California, Madrid and Berlin) in 2015, identifying the city as the 3D printing hub for the region and as one of the upcoming leaders in this field.

Despite the growing presence of 3D printing at conferences and the adoption of the technology by universities, there remains considerable hype and mixed-messaging around the 3D printing industry in the Middle East region, with a relatively limited understanding about the technology. Skills are required to understand the full 3D printing process and to match the technology to the end product requirements. Customers drawn to the low-end printers that are in the market can end up disappointed with the outcome. This lack of awareness presents the greatest challenge to growth in the 3D printing market in the Middle East, particularly relative to more mature markets where customers have a deeper understanding of the technology.

There is already evidence in the Middle East that, as predicted to occur globally, 3D printers are becoming the factory in every school. A number of universities in the region have invested in state-of-the-art 3D printing systems, such as the American University in Sharjah that provides 3D printing systems within its Department of Architecture, and the Texas A&M University in Qatar, which runs an annual 3D printing competition amongst all faculty, researchers, postdocs and students. This is certainly the first step to resolving the challenge of education and awareness in the region, with skilled graduates likely to lead the 3D printing revolution and drive growth in the coming years.

Smartphone batteries: better but no breakthrough

Deloitte predicts that the rechargeable, lithium ion (Li-Ion) battery technology used in all smartphones will improve only modestly in 2015. We expect a 2015 Li-ion battery to have no more than five percent greater unit charge or milliampere hours (mAh) compared to a 2014 model of the same dimensions and voltage. Longer battery life is likely to remain a key factor for those choosing their next smartphone.[146]

However, most new smartphone owners may still get a 15 percent increase in battery life, but this will mostly be due to other factors. New devices will benefit from efficiency improvements in the components that draw power from batteries (principally processors, radio transmitters and screens) as well as from better software. Further, we expect that the mAh of the average battery shipped in smartphones will increase by up to 25 percent in 2015,[147] due to the increase in average size of smartphones sold, with battery capacity rising at a greater pace than screen area.[148] (Battery life will not increase by the full 25 percent: larger screens use more power and newer phones typically offer increased functionality, leading to more intensive usage).

The smartphone has benefited from Moore's Law – the consistent, significant increase in performance at the same price point – with processor and connectivity speeds seeing the biggest increments.[149] Consumers have often yearned for a similar breakthrough for battery. However since the introduction of Li-Ion technology, which predates the arrival of the smartphone, they have continually been disappointed.

Indeed, there is unlikely to be anything more than a modest improvement from Li-Ion in 2015 or at any time in the future. At most it may yield just a further 30 percent performance before hitting a ceiling, with perhaps a 20 percent improvement by 2017.[150]

So any major inflection in battery performance would require the use of different technology. Li-Ion batteries are currently based on a common chemistry, and use a variety of lithium salts, organic solvents and electrodes. New batteries could use different physical structure of an anode or cathode (or both) such as a nanostructure. Alternatively they could vary the material used in the electrode(s), vary the anion that makes up the salt with lithium, or vary the electrolyte chemistry or material. Or they could move away from lithium chemistry completely, perhaps by using graphene.

Across all of these possible innovations, we do not foresee any breakthrough battery technologies being in the market in 2015 – or, regrettably, before the end of this decade.

The challenge of formulating a better battery

The lack of progress in smartphone battery capacity is not for lack of trying, but simply because it is extremely difficult to identify a battery chemistry that is better and suitable for use in the highly diverse operating environments in which the billions of consumer electronic devices we own are used. Many private companies and public organizations are and will likely remain focused on inventing a better battery chemistry – the reward for the inventor is enormous – but the need to optimize the many different characteristics that define what a 'good' battery is makes the task a challenging one (see: Formulating a better battery).

Internal combustion engine vehicles, of which there are currently over a billion in use,[151] still use a 12 volt lead acid battery whose fundamental design is over a century old.

We are not aware of any breakthrough battery chemistry in commercial development in 2015 that offers significant improvements across a sufficient range of these characteristics. But even if there was such a breakthrough, there would be further, time-consuming hurdles to pass: it is highly unlikely that a replacement for current Li-Ion batteries that could be 'dropped in' to existing devices and form factors will be available within the next three years.

Formulating a better battery

A battery suitable for use in everyday consumer-electronics devices needs to balance the following properties:

- Specific energy. It needs to concentrate as much total energy into as little weight as possible (measured in watt hours per kilogram).[152] Low device weight is a key source of competitive advantage among device vendors.[153]

- Energy density. As much total energy should go into as little volume as possible (measured in watt hours per liter).[154] There is a relentless race among vendors to make ever-slimmer devices;[155] bulky devices are typically regarded as being of lower value.

- Specific power: how much peak power (measured in watts per kilogram) can be delivered per unit weight.[156]

- Cost per energy unit. There are some emerging technologies, which have fantastic performance in terms of specific energy, or energy density, but whose cost is currently prohibitive. For example, one very promising field of battery research is graphene, but this nanomaterial currently costs over $100 per gram to manufacture. The price will fall, but as of 2015 a graphene battery in a smartphone would add about $1,500 for the raw material alone. In contrast, a $20 smartphone battery contains less than $0.02 worth of lithium carbonate.[157]

- Self-discharge: the rate at which a battery loses its power with no usage. This can affect the stand-by life of a device.

- Operating temperature. Devices need to function between zero and forty degrees Celsius. There are some battery technologies that only function at very high temperatures, making them unsuitable for use by the public, but which may still have industrial applications, such as large-scale energy storage. Other technologies are badly affected if left in a hot car for only a few minutes.

- Output current. The stated capacity of a battery (in watt hours) is usually dependent on the current (in amps) it is expected to deliver. A battery must be able to satisfy the current requirement of the device in which it is installed and still offer sufficient capacity.

- Safety. There are some battery-like technologies that have existed for many years, such as hydrogen fuel cells which are used to power public transport and are being trialed in passenger vehicles. However they are unsuitable in devices for safety and practical reasons: the fuel for fuel cells is often flammable or even explosive, and therefore may not be allowed on aircraft.

- Durability: the number of charge/discharge cycles that a battery can undergo; both full charge/discharge cycles as well as partial discharges.

- Efficiency. The amount of power needed to charge the battery compared to the amount of power the battery can store is important, because all 'wasted' power is manifested as heat, and heat usually damages batteries. A compact battery must be efficient or it will overheat, especially during fast charging.

- Complexity of the charge system. Current smartphones house the charging circuitry. (What most people refer to as the charger is just a power supply). A battery with a complex charging system requires more electronics, resulting in increased cost and bulk.

A manufacturer would need to run extensive tests on any new battery technology that is being positioned to replace Li-Ion. Will the batteries last as long as expected, when used by consumers, in ways in which the designers may not have anticipated? Is there any risk of the new batteries catching fire if improperly charged, for example through the use of unapproved third-party chargers? Would mistreatment of the device – whether intentional or not – present a potential hazard to the user? Battery engineers can test a product extensively, but may not be able to replicate consumer usage fully. Further, batteries are expected to last a minimum of 2-3 years for almost all consumer devices, and therefore require reliability testing for at least that long, if not longer.

The new battery type would likely require a different charging technology, or may need different packaging, or other system design considerations. An advantage of Li-Ion is that the shape and format of the battery can be varied considerably to meet the needs of the system designer. This would not be the case if, for example, a battery required a metallic container. Similarly, a new chemistry may produce a voltage significantly different from the 3.65 – 3.7 volts of a Li-Ion battery which would require the smartphone to include voltage conversion circuitry, or, perhaps, reengineering the underlying semiconductor technology, which would be non-trivial.

Device component advances will reduce power consumption

While the batteries themselves are unlikely to experience a greater than five percent improvement in 2015, improvements in overall device design can enable – assuming steady state usage – more hours of usage between charges.

The three main drains on battery life for the typical smartphone are: the screen, the processor and the radio. Improvements in processor and radio design are likely to yield the biggest improvements in getting the most minutes out of each milliwatt.

The screen is a key differentiating feature and power drain of devices. Unfortunately we anticipate only modest improvement in display power consumption in 2015, although we do foresee significant change possible by 2020. A smartphone with a four-inch screen might consume about 0.75 watts and its battery would have about 5-6 watt hours' capacity. In real-life conditions, assuming concurrent usage of the screen, processors and radio, this would allow for only about four to five hours of constant usage.

We expect that power consumption by the display is unlikely to improve markedly in 2015: most smartphone displays are transmissive LCDs, which incorporate a backlight.[158] Lower-power display technologies are on the market, the most advanced of which is OLED (Organic Light Emitting Diode).[159] The key constraint on wider adoption of OLED screens in 2015 is cost. We expect OLED displays to displace backlit LCDs over time, but it may be five years before they predominate even in high-end phones.[160]

In the past year, the average size of smartphone screens has increased – and this has indirectly improved battery life. A larger screen drains the battery more and also permits a larger battery to be included, with battery capacity increasing at a greater pace than the screen size. A version of the same phone that has a screen 20 percent larger (with identical components aside from display dimension and battery volume) may last up to 40 percent longer.[161]

The processor used in many 2015 smartphones should be significantly more efficient than 2014 models, delivering a 30-40 percent increase in processing power per watt, in line with Moore's Law. Most processors used in devices – from smartphones to PCs – have experienced annual improvements in power efficiency over the past 40 years.

To illustrate this point, consider that in the mid-1980s, PCs operated at about one MIPS (millions of instructions per second) and consumed about 100 watts.[162] A 2015 PC with a high-end processor such as an Intel Core i7 typically delivers over 100,000 MIPS, but still consumes the same 100 watts. For more information on how processor design can reduce power consumption, see the side bar: Chip design and power efficiency.

Although processors are becoming more energy efficient compared to an equivalent device from last year, smartphones are incorporating ever more powerful processors, which require more energy. It is likely that the first smartphones with 3 GHz processors will launch this year. Software and hardware designers, anticipating consumer demand, will inevitably find applications for increased performance. For example, current leading games designed for smartphones feature far more complex, 3D graphics and video than the 2D games popular with the first smartphones.

The radio, which enables data to be transmitted and received, is the third most significant drain on power.[163] Over the past two decades, the energy required to transmit or receive each bit of data has fallen steadily and significantly, by about 30-40 percent per year.[164] Sending a 100 KB photo using a 4G phone should use less power than using a 3G phone, and significantly less than with a 2.5G phone. This is because 4G phones transmit at a faster rate, meaning that the radio is used for less time. Sending the same photo over 4G may take a quarter of the time it would take over 3G.[165] Further, the technology behind 4G is significantly more efficient in terms of coding, which allows for additional power savings.

However faster transmit rates are likely to change user behavior; the ability to send a photo faster is likely to prompt the sending of more and/or higher resolution photos, or the posting of video in place of photos.

As for voice calls, early analogue mobile phones required a continuous signal at one watt power when making a call: today's 4G phones can deliver up to several hours of continuous talk time for that same single watt.

A further reason for the reduction in the drain by the radio on the battery for every voice minute or megabyte sent is decreasing transmit distance. As the number of cellular network base stations has increased, cells have become smaller, meaning a reduced distance between the phone and the base station, and shorter distances mean that transmitting from the phone to the tower requires much less power. The recent proliferation of private and public Wi-Fi routers has enabled a further decrease in transmit power. Smartphone users who predominantly connect to Wi-Fi, should experience longer battery life than those relying mainly on the mobile network.

Side bar: Chip design and power efficiency

Chip design is a major contributor to greater efficiency. Smartphones are built around a "system on a chip" (SOC), which combine much of the electronics of the mobile device onto a single integrated circuit.[166] One of the benefits of this approach is the ability to shut down parts of the SOC which are not needed at the time. If a user shuts off smartphone display, the graphics and display controller of the SOC may also be shut down and the processor itself put to sleep, only to awaken occasionally to check for user input (via the touchscreen or buttons), receive or transmit via the radio, or use Wi-Fi or Bluetooth. Power consumption of a 'sleeping' processor in a smartphone is a fraction of when it is awake: about 1 mW (0.001 Watts) versus 100 mW. Integrating faster processors reduces power consumption. A slower processor may take 0.5 seconds to complete a task, and consume 50 mW; a faster processor doing the same task in half the time would consume a little over 25 mW.

Smartphone users who predominantly connect to Wi-Fi (presently mostly for data, but increasingly for voice), should experience longer battery life than those relying mainly on the mobile network.

Bottom line

Battery life is becoming an increasingly primal anxiety among digital natives. This anxiety is to an extent self-inflicted: more frequent use of more power-hungry applications on larger devices consumes more power. Our devices would last longer if we used them less, or used them differently. But the rapid progress in smartphone capability looks likely to continue in 2015, which means that the smartphone users will use their phones more frequently, and for a wider range of applications. The gains from new or larger batteries are likely to be balanced out by greater usage.

Phone users who started using mobile telecommunications back in the mid-90s or earlier will be familiar with predecessors to Li-Ion, such as nickel metal hydride, which had markedly inferior performance. These individuals may yearn for a similar step-change increment in performance from batteries. The good news is that one day there is likely to be a new formulation that offers a significant improvement, but that day is unlikely in 2015. In the interim, see our suggestions on how to improve battery life in the side bar.

Frustrations with battery life present many opportunities for vendors.

Smartphone vendors may differentiate their devices in terms of processor design, battery capacity and fast-charging capability.

Network operators with high-density networks and/or a large network of public Wi-Fi hotspots may advertise the fact their network can reduce battery consumption, due to lower transmission drain on their customers' batteries. When a network is overloaded, the phone can spend a lot of time on unproductive tasks, such as waiting for the file to download, or pinging the network to ask whether it can download packets. A congested network can cancel out all the improvements in battery chemistry or semi-conductor efficiency.

Component vendors can offer a range of different external power supplies.

Public venues and public transport facilities can differentiate their facilities through the offer of charging units. There are likely to be ever more locations offering opportunities to recharge, from airport lounges, to planes, trains and automobiles.[167]

Side bar: How to improve smartphone battery life

- Replace the battery with a fresh one, as it will typically have a greater ability to retain power. Over time, with successive recharges, batteries lose their ability to charge.
- Charge frequently and never let the battery drain completely. A Li-Ion battery that is typically discharged by 25 percent before being recharged should last about twice as long as a battery which is half depleted before being recharged.[168]
- Use a phone with a larger screen, as it will likely have a larger battery.
- Keep the display backlight as dim as practicable.
- Use the phone on a relatively uncongested network.

Nanosats take off, but they don't take over

Deloitte predicts that by the end of 2015 over 500 nanosatellites (nanosats) will be in orbit. Nanosats have a mass of between one and ten kilograms,[169] compared to hundreds or even thousands of kilograms for the average commercial satellite. They also tend to be sized in increments of ten centimeters (cm), with a 30 cm x 10 cm x 10 cm configuration being the most common, whereas most commercial satellites measure at least one meter or more in every dimension.[170] Prior to November 2013, only 75 nanosats had ever been launched, and another 94 were put in orbit in the three months ending January 2014, for a total of nearly 170.[171] Our prediction calls for a nearly 300 percent increase in the installed base. Nanosats are attractive for many reasons: they are cheaper than conventional satellites, lighter, easier to build and test, easier to launch, and (as a result of Moore's Law exponentially adding to the functionality of the electronics) increasingly capable of more complex computational tasks.

Students of technology history may wonder whether this is another case of innovative disruption. Although nanosats are currently much less capable than traditional small, medium and heavy satellites, will they follow a similar path to personal computers, MP3 players and camera phones – come in at the low-end, keep improving and eventually dominate the market?

Deloitte predicts that the answer is probably not. Although taking something the size of a small house and replacing it with something that fits on a desktop worked for the PC industry disrupting mainframe computers, nanosats are likely to be additive, and not disruptive for the commercial satellite market, and not just in 2015 and 2016, but in the medium-term. There are specific barriers related to the laws of physics that will likely prevent nanosats from capturing significant parts of the markets that the larger satellites now dominate: in this case, it is 'rocket science'.

The global commercial satellite industry generates about $200 billion in revenues annually.[172] Services (such as satellite pay-TV subscriptions) are the largest part at $115 billion;[173] ground equipment (mobile terminals, dishes, gateways and control stations) $55 billion; launch is 'only' about $7 billion;[174] and the satellites themselves $15 billion.

A $200 billion market should present significant opportunities: that's about the size of the entire US fast food restaurant industry or more than double global tablet sales.[175] If nanosats could capture a significant part of the market from larger satellites, it could be a game-changer. So why is this unlikely to happen, especially when media articles trumpet the potential of nanosats?[176]

Price and processing performance matter a lot, both in space and on the ground. However over 90 percent of the commercial services currently delivered by satellites of any size require certain fundamental characteristics: the ability to stay in their correct position in orbit; the ability to transmit enough power back down to Earth that even small receivers will find usable; and the ability to sense relatively small features.

Staying in their correct position in orbit is a potential problem for nanosats. At less than ten kilograms, and ten centimeters on a side, they have very little internal capacity. Larger satellites use gyroscopes and reaction wheels to make sure they are always pointed in the right direction (altitude control) and have between four and 12 thrusters, powered by propellant (such as hydrazine or xenon) which allows them to maintain a stable orbit (station keeping) given the perturbation effects of gravity or drag from the tenuous upper atmosphere.

Nanosats can use miniature gyroscopes and reaction wheels for attitude control, but they generally have no room for thrusters[177] (or propellant for that matter) for orbital maintenance. This means that some are likely to have usable lives no more than 12-36 months and so require more frequent replacement launches.[178] Most proposed nanosat applications involve Low Earth Orbits (LEO), below 2,000 kilometers; and the inability to stabilize orbits is most severe for LEOs with orbits from 160 to 500 kilometers.[179]

Further, one of the principal potential advantages for nanosats in communications is extremely low latency. Most communications applications involve geostationary (GEO) satellites with an orbital radius of about 36,000 kilometers.[180] Although radio waves travel at the speed of light, the round trip still takes about 250 milliseconds, which can be an unacceptable delay for some communications services. A constellation of nanosats in very low earth orbits would have very low latency, but would also have more severe station keeping needs.

Power is another problem, not so much in terms of processing the data (due to the effect of Moore's Law), but with taking the output of that processing, whatever it might be, and beaming it back down to Earth. Whether a TV satellite is distributing a show, or is one of the GPS constellation of satellites emitting a timing signal that allows a smartphone to determine its location, the signal received by the consumer device on Earth is often only microwatts or even nanowatts in signal power. But as with all radiofrequency transmissions, there is an inverse square law in effect, which means that the satellite needs to transmit down output power of tens, hundreds, or even thousands of watts, even from the nearest Low Earth Orbits, for most home or consumer applications. Depending on footprints, antennas and frequency bands, small receivers on Earth require more power density to come down from space, and even ten watts is a large amount of power to transmit: that's about 40 times as much as the maximum output from a 3G smartphone.

Luckily, there is a free power source in space: the Sun. A few square meters of super-efficient gallium arsenide solar panels provide up to thousands of watts of power,[181] more than enough for GPS, sensing or communication satellite needs. Add another 30-50 kilograms of Lithium Ion batteries for those periods[182] when the Sun is behind the Earth, and all is usually well. But nanosats (which weigh up to ten kilograms) don't have enough room for solar cells or batteries of the requisite capacity. Although both solar and battery technologies are improving, they are doing so slowly. Even a decade from now, although some nanosats should be capable of beaming a signal to Earth that is detectable by the average consumer receiver, they are unlikely to be competitive with larger satellites.

An associated problem is that size also matters for antennas, even assuming equal power. Bigger antennas are better for sending information down to Earth or receiving signals from a ground station. There are various kinds of antennas on satellites: reflectors, horns and phased arrays. Large satellites can use unfurlable mesh reflectors that are up to 12 meters across; solid antennas are up to 3.2 meters in diameter; and even the LEO Iridium constellation of voice and data satellites have phased array antennas that are 188 cm by 86 cm. Nanosats, at least a couple of whose dimensions are no more than ten centimeters, must use antennas that (even if unfurled) are commensurately smaller than for larger satellites resulting in decreases in gain, taper or coverage area, depending on frequency).[183] There are articulated antennas with a 30 cm diameter on satellites today, but this stretches the definition of nanosat.[184]

Many of the commercially useful things that satellites can do require sensitivity. Any kind of observation satellite needs to look down hundreds of kilometers or more, through a turbulent atmosphere, and accurately resolve and image features (optically or with radar) that can be less than a meter across. This is very difficult. Or they need to pick up Earth-originated signals that may be one or two watts in strength on Earth but have attenuated in their journey and are now only picowatts in strength. This is also very difficult.

Either the sensors needs to be ten centimeters or more across, or there need to be optics and filters in front of the sensor that are usually 10-100 cm long. Neither sensor nor optics will fit on a nanosat. There is a useful analogy with cameras on smartphones. Although improvements in semiconductor technologies allow manufacturers to put a ten megapixel sensor chip on a smartphone, it is typically only about 15-25 millimeters square, and the lens is usually no more than four millimeters away from the focal plane.[185] Professional photographers who sell their pictures for money use cameras with physically larger sensor chips that can be up to 2,000 mm square (about 100 times larger) and telephoto lenses that can be 500 mm or more in length (once again, over 100 times longer.) In the same way, any satellite trying to capture Earth Imaging at sub-meter resolutions will likely require devices (lenses, mirrors, and sensors) that won't fit in a cube 10 cm on two of its sides.

Although stability, power and sensitivity are the most important challenges for nanosats, it is worth mentioning some other issues briefly. There are decades of experience with processes and procedures for launching, deploying and even servicing large satellites. There is no similar knowledge base at present for nanosats, especially for some of the proposed large constellations of dozens or even hundreds of them. It is not an insuperable problem, but it isn't trivial either. Next, just like down on Earth, there are only certain slices of the electromagnetic spectrum that are suitable for transmitting information, and that spectrum is finite and needs to be allocated. This constraint is most severe for satellites in LEOs (which will include almost all nanosats) and those using lower frequencies. Finally, there are already concerns about the amount of space debris in orbit: there are nearly 20,000 objects larger than five centimeters being tracked at present.[186] With potentially thousands of nanosats being launched into orbits, with some failing to be deployed and others going out of service over time, the problem will get worse.

It needs to be stressed that nanosats are an important innovation in satellite technology. Their low cost and flexible design will likely make possible many kinds of scientific experiments, or Earth Imaging at more frequent capture rates but lower resolutions. Tracking ships at sea requires neither particularly large sensors nor high power transmission:[187] another ideal market for nanosats.

But if we look at the $200 billion existing satellite market, roughly 80 percent is almost certainly not addressable by any space-based device smaller than ten kilograms – either today, or even by 2025.

Nanosats are an important innovation in satellite technology. Their low cost and flexible design will likely make possible many kinds of scientific experiments.

Bottom Line

In the short or even medium term nanosats may not be able to capture or disrupt many of the market segments currently served by larger satellites but they do lower the cost and challenges of getting a useful object into space; they will likely attract investor attention and get the public more interested in the satellite market. They will almost certainly enable testing of new technologies on low cost and 'disposable' platforms, which in turn may foster the emergence of new applications or services.

It is also worth noting that the many technologies that improve nanosats, and make them feasible in the first place, also make the larger satellites better, lighter and cheaper too.

The price of satellites and associated costs for most applications will not be disrupted downwards. Based on the announced plans for nanosats to date, over half will be technology prototypes or for the science and education markets, and 40 percent will be targeted at the military and commercial Earth Observation market, but with the limitations noted above (power, station keeping and sensitivity.) Only five percent of nanosats are even trying to compete in the communications satellite sector, which generates over 80 percent of the annual $160 billion in the services and ground equipment satellite markets.

Launch or deployment risk will be much the same for nanosats as for larger satellites. Regardless of the size of satellite, an exploding launch vehicle will continue to be a risk, and deploying nanosats once they are in orbit is likely to carry similar risks to larger satellites.

Although this prediction focuses on nanosats, there are microsats (10-100 kilograms) and minisats (also known as small satellites, and weighing 100-500 kilograms) which are bigger than nanosats but smaller than the majority of satellites deployed today. Over time, these categories of small satellite are almost certain to have more disruption potential than nanosats.

Data opens up in the GCC

Monitor Deloitte* predicts that GCC countries in the Middle East will make significant open data advancements in 2015, and within the next three to five years, break into the top half of countries ranked the most 'open' in the world. Although the Gulf countries will take some time to match the level of leading 'open' countries to reap the benefits of open data, and despite the split in their degrees of 'openness' (see Figure 4), 2015 will represent a key milestone of actions implementing major national open data announcements made in 2014.[188] GCC countries that have not yet outlined open data initiatives will begin to do so in 2015, while those that already have will embark on their journey towards open data implementation.

Side bar: Understanding open data

Currently there is no generally agreed upon definition of open data. In the broadest sense, open data generally constitutes seven key characteristics – it is: public, accessible, described, reusable, complete, timely and manageable after release.

Open data should also be relatively easy to use. Although there are gradations of 'openness', there is general consensus that open data should be made available free of charge and redistributable with minimal restriction.

From this, individuals, companies, and governments can launch new ventures, analyze patterns and trends, make data-driven decisions, and solve both day-to-day as well as more complex problems.

All GCC countries have already taken some key steps towards open data development. Oman and Kuwait have allocated webpages to open data[189]. The others, Saudi Arabia, Bahrain, Qatar and the UAE have launched their own dedicated open data portals (see Figure 1).[190]

In particular, notable developments in the UAE include Abu Dhabi's Open Government Data Forum (OGDF) in April 2014 – the first open data event of its kind in the region, aimed at fostering a collective regional-level commitment to open data advancement.[191] The forum was internationally conducted by the Emirates Identity Authority (EIDA), United Nations Public Administration Network (UNPAN), and United Nations Department of Economic and Social Affairs (UNDESA). Neighboring Emirate Dubai, as part of its vision to transform Dubai into a smart city, has also just recently issued a resolution in December 2014 to form an Open Data Committee (ODC). The ODC aims to strike the best balance between making data available and maintaining data security.[192]

Similarly, Qatar has drafted its own Open Data Policy document and launched a public consultation process to solicit feedback from its citizens and residents.[193]

Bahrain has also formulated an Open Government Data Policy, designed to improve transparency, encourage private sector and general public participation, and foster innovation. To this end, Bahrain's Open Data Platform, dedicated to publishing datasets from ministries and government agencies centrally in an open format, makes its data available, downloadable and usable by the general public.

Figure 1. Open data ecosystem in selected GCC countries

Open Data Ecosystem in Selected Countries				
Countries	**Open Dara Policy**	**Portal**	**Launch Date**	**Existing Data Format on the Portal**
UAE	Dubai is in the process of creating a policy	government.ae	2012	XML, Excel, Word, PDF
Bahrain	Open Government Data (OGD) policy exists	data.gov.bh	2011	Excel, PDF
KSA	Open Data Handbook exists	saudi.gov.sa	2011	Excel
Qatar	Open Data Policy exists	www.qix.gov.qa		XML, Excel, Word, PDF

Source: Monitor Deloitte research and analysis

* Monitor Deloitte is Deloitte & Touche (M.E.)'s strategy consulting practice.

Internationally, open data developments are measured, tracked and ranked by an Open Data Barometer (ODB). Designed by the World Wide Web Foundation and the UK's Open Data Institute, the ODB is based on a survey of many countries across the world.

To formulate a barometer reading and ranking, each country surveyed is assessed in depth against three key criteria: its readiness to secure the benefits of open data, its actual level of open data implementation, and the impact of open data initiatives that have been implemented. For each criterion, the country is scored on a percentage scale of 0-100, which is then ranked against all other countries surveyed.

The ODB initiative is a relatively new measure. The survey began in 2013, with an initial 77 countries. Subsequently, the 2014 survey expanded to 86 countries.

Another measure and indicator of open data development is the Global Open Data Index (ODI). Pioneered by the Open Knowledge Foundation, the index assesses the current state of open government data around the world and is also based on a detailed survey of many countries.

The ODI benchmarks open data by assessing ten key datasets in each country including: election results, the national company register, the national map, government spending, government budget, legislation, national statistics office data, the national postcode/ZIP database, public transport timetables and pollutant emissions. The selection of each dataset for benchmarking is based on the G8's definition of key datasets and consultations with the Open Government Community. Scoring is based on weighted criteria including technical and legal openness, also on a percentage scale from 0-100 and ranked against all other countries surveyed.[194]

Similar to the ODB, the ODI is also a new measure, which began in 2013, with an initial 60 countries, and which subsequently expanded to 97 countries in 2014.

So far, ODB reports suggest that open data globally has seen rapid proliferation over the past few years, but notes that global open data development is still in its infancy, since growth in terms of readiness and implementation has not been quite as expected, given developments in the space have been promised by many governments (especially the G7 and G20 countries).

The ODB report also differentiates between leading and lagging countries. Leading open data countries were found to be working on building 'National Data Infrastructures', while developing countries were found to still lack basic open data foundations, such as well-managed government datasets. The absence of 'Rights to Information' laws is also cited as an ongoing issue, which prevents citizens from holding governments responsible for national data.[195]

So where does the Middle East fit into all of this? And how have its countries fared?

The good news is that the ODB survey, although still fairly new, includes most Middle East countries in its rankings. Middle East countries included are: Saudi Arabia, the UAE, Qatar, Bahrain, Yemen, Jordan, Egypt, Tunisia and Morocco. The bad news is that all Middle East countries, even those from the GCC, were ranked in the bottom half of the international ranking, along with many African countries. Although Middle East countries have taken some steps towards open data readiness, they still lack in its implementation, consequently with little or no impact. The Middle East therefore has a long way to go.

As with the ODB measure, the ODI also confirms the same. Middle East countries (Saudi Arabia, Oman, Tunisia, Egypt, Morocco, and Lebanon) also rank in the bottom half of all countries surveyed. Out of the six GCC countries, only two had been part of the 2014 ODI. Both Saudi Arabia and Oman had ranked quite low in 2014, at 74th with a 28 percent score and 93rd with an 18 percent score respectively.

Figure 2. GCC Open Data Barometer rankings (2013, 2014)

	2013 Results and Rankings				2014 Results and Rankings			
Countries		**Readiness**	**Implementation**	**Impact**		**Readiness**	**Implementation**	**Impact**
UAE	**24.59** **Rank 44**	53.88	21.57	12.30	**24.86** **Rank 52**	63	22	8
Bahrain	**18.18** **Rank 54**	42.94	18.04	0	**15.38** **Rank 61**	43	13	0
KSA	**7.09** **Rank 67**	40.82	1.57	5.69	**15.77** **Rank 59**	38	15	0
Qatar	**13.09** **Rank 60**	39.01	11.76	0	**13.97** **Rank 64**	46	9	0

Source: Open Data Barometer Report, World Wide Web Foundation and UK Open Data Institute[196]

Whilst the current state of open data in the region according to the ODB and ODI paints a gloomy picture, we believe that the future is bright.

With open data around the world still at a nascent stage, it is still rather early to assess the GCC's relative open data developments, especially given that open data announcements and policies have only been formulated and revealed last year. That said, the GCC is well known and proven to make fast progress once ICT policies are announced and ready for implementation. With most of the technical ICT and e-government infrastructure underpinning open data and data sharing systems already in place, the GCC has the capability and capacity to support rapid open data implementation, which should make open data advancements far easier and faster than for other countries.

This is demonstrated in the GCC's e-Government Development Index (EGDI), a composite indicator measuring the willingness and capacity of governments to use ICT to deliver public services. A comparative analysis of each region's EGDI illustrates the extent of the GCC's rapid progress in e-government development. Over the past decade from 2003 to 2014, the GCC's EDGI has consistently grown at 10 percent, double the world rate which grew at 5 percent. As a result, the GCC has significantly risen to now become one of the world's leading e-government regions, second only to Europe (see Figure 3).

Individually, Bahrain is the most advanced amongst the GCC countries, ranked as the 18th most electronic government in the world. With an EGDI score between 0.75 and 1.00, Bahrain is classified in the 'very high' EGDI group, which consists of the top 25 (13 percent) most developed e-government countries worldwide. The remaining GCC countries, the UAE, Saudi Arabia, Qatar, Oman and Kuwait, follow with scores between 0.5 and 0.75, classified next under the 'high' EGDI group, in the top 32 percent of e-government countries worldwide.

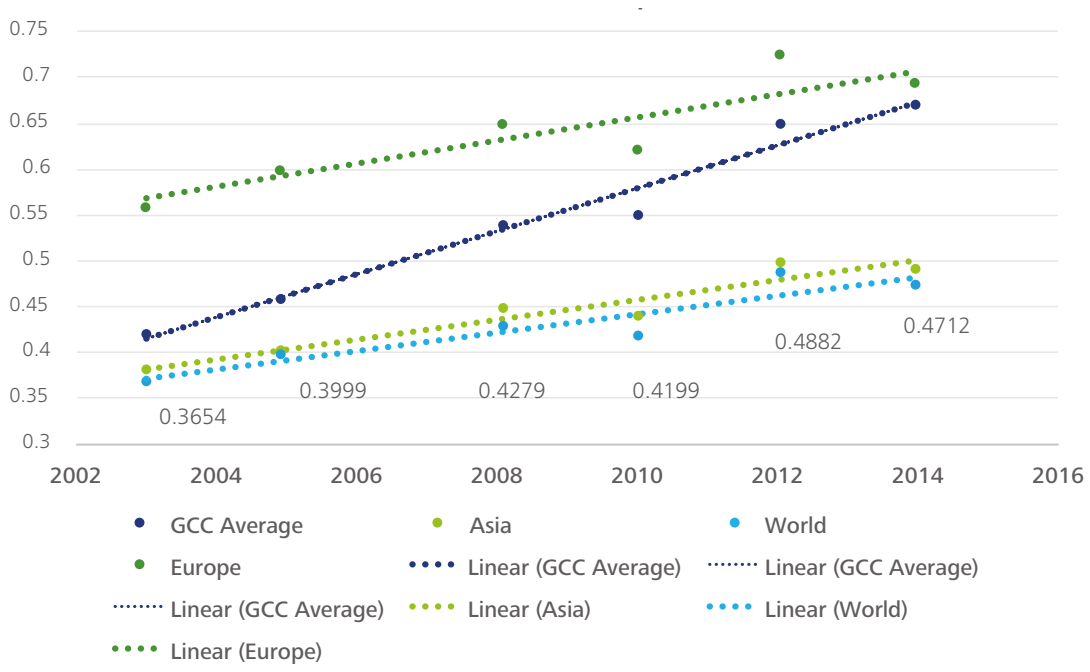
All six GCC governments have individually shown a strong desire to invest in and develop their online national portals, and continue to collectively collaborate closely to advance together. The GCC e-Government Committee is a product of this, set up to enhance each GCC country's e-services, productivity, and efficiency, which improved their international rankings in the UN's Global e-Government Survey. To this end, the committee regularly organizes and holds the GCC e-Government Conference, a forum for sharing experiences, learning and enhancing respective e-transformation processes.

Despite great e-government advancement as well as their willingness, readiness and sparks on many open data fronts, most GCC governments have thus far overlooked the importance of releasing quality datasets (which have high value-add on the welfare of the economy and residents of any country) and are lacking in-depth national open data strategies.

However, following years of exceptional improvements in technical infrastructure and associated e-government services, we expect that the region will naturally make corresponding enhancements in open data, if not in quantity, at least in data quality, format, accessibility, usability, and updating fronts. GCC governments are aware of this, and are set to tackle such issues together with open data featuring prominently in this year's edition of the GCC Smart Government and Smart Services Conference.[197]

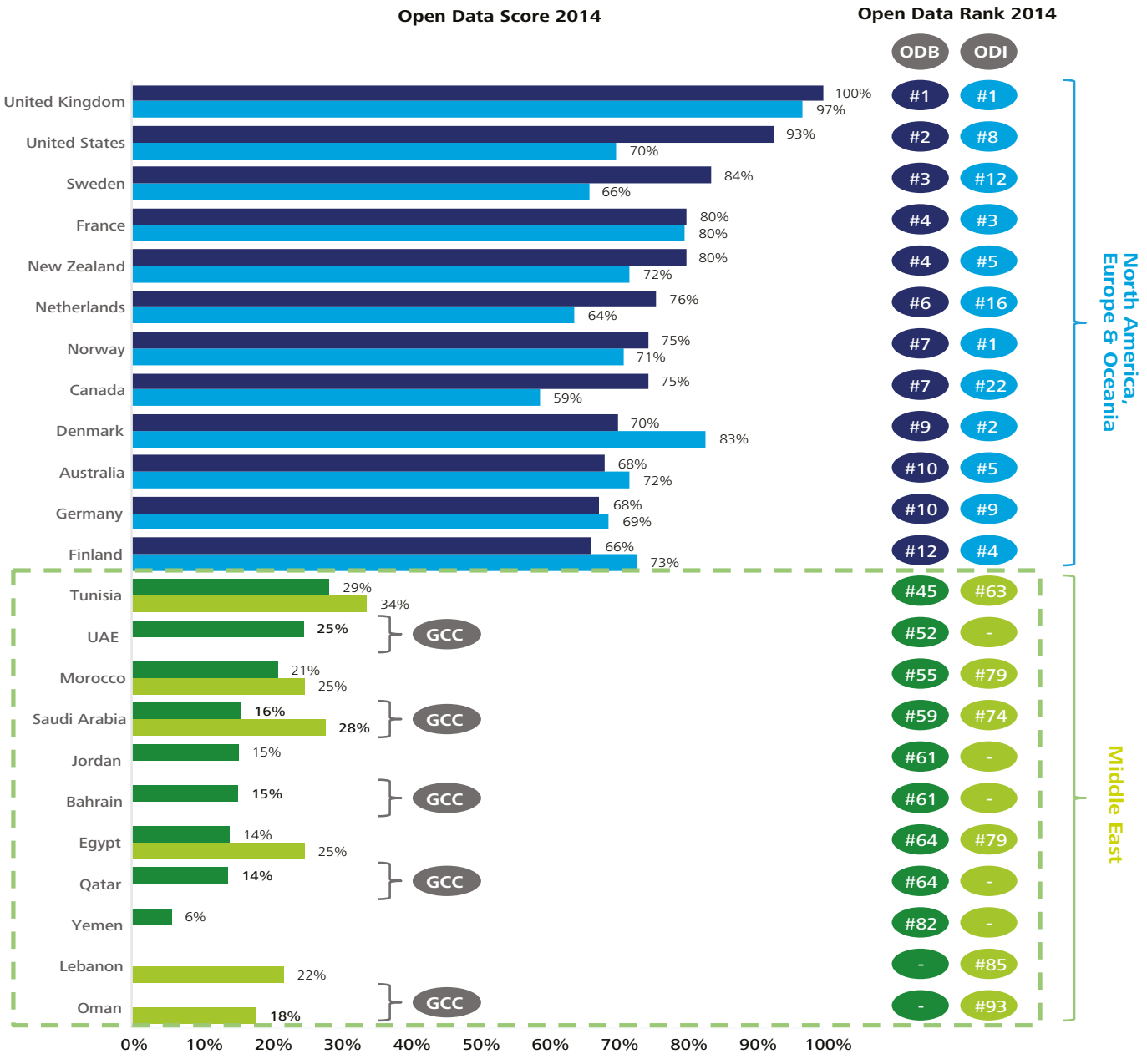
Europe still leads the world in e-government development for now, but recent technology innovations by GCC governments will place them firmly on track to surpass Europe's level of e-government service and improve their path to open data development, making them likely to break into the top half of open data countries within the next three to five years.

Figure 3. GCC EGDI improvement (2003-2014)



Source: United Nations e-Government survey

Figure 4. Open data positioning of top open countries versus Middle East countries, 2014



Source: Open Data Index (ODI), 2014; Open Data Barometer (ODB), 2014

From a GCC-tailored assessment of potential returns from opening up government data to the public, Monitor Deloitte expects open data initiatives to benefit GCC countries foremost by generating cost-savings in public finances, enablement of smart cities and generating growth of small- to medium-sized enterprises (SMEs) in the region.

Cost-efficiency

There are a multitude of international examples where opening up data to the public has led to huge public cost-savings. Notably, The Open Contracting Partnership initiated by the World Wide Web Foundation has been established to fight fraud and waste in public procurement. According to their estimates, around $9.5 trillion is spent by governments on contracts annually worldwide, of which, an alarming $2.3 trillion is estimated to be the fraudulent additional cost of contracts due to corruption.[198]

Another example is in the US city of Albuquerque, through the number of calls to the city's information line. Open data has led to a marked decrease in the number of city information calls by more than 420,000 calls a year, manifesting the significant value of releasing data to more efficiently answer questions, or the reduction thereof.[199]

Globally and in the Middle East, we expect sectors such as healthcare and oil & gas to benefit greatly from new efficiencies through open data.

In healthcare for example, by sharing the treatment data of a large patient population, care providers can better identify practices that could annually save as much as $180 billion globally, much of which we would expect to be in the Middle East, given their large healthcare budgets.[200] With the GCC's total healthcare expenditure forecast by industry analysts to triple between 2011 and 2018, reaching $133 billion,[201] open data technology can help in significantly reducing healthcare costs, while enhancing patients' quality of care. Together with the crucial advents of M2M and IoT in reducing costs, government data, if opened, has the potential to further multiply its effect on the cost reduction process.

The oil & gas industry, with its mass and scale, stands to benefit from even greater cost-savings than healthcare from the use of open data. As much as $450 billion could be saved annually, for example, by sharing anonymized and aggregated data on the management of upstream and downstream facilities globally.[202]

Similarly, we expect a range of other key sectors to benefit from open data, namely utilities, education, and transportation.

The GCC's open data initiatives, once implemented, will therefore lead not only to enormous cost-savings, but also to increased transparency, efficiency and effectiveness.

Enabler of smart cities

Open data is a key enabler of smart city projects both internationally and in GCC.

Internationally, in Canada for example, Montreal identified open data and open & interoperable technological architecture as two of the four key structural components required in the strategic framework to realize its vision to turn into a smart and digital city, in addition to the other two components of high-speed telecommunication services and community development.[203]

Locally, in the UAE for example, Dubai's recently-announced smart city project involves the use of smart sensors and devices to provide open data across three tracks: "Smart Life" for health, education, transport, communications, public utilities, and energy services, "Smart Economy," for developing smart companies, port services, smart stock exchanges, smart jobs, and "Smart Tourism," enabling a smart and convenient environment for visitors to the emirate, including visa, flight, smart gates, and smart hotel services.

Industry analysts are also anticipating open data to inspire the development and innovation in smart cities.[204] Dubai's smart city initiative adds to the existing momentum of smart city initiatives in GCC. This includes Saudi Arabia, which is developing six smart economic cities; three smart city projects in Qatar (The Lusail Smart & Sustainable City, The Pearl Qatar, and The Energy City Qatar), as well as the Masdar City in the UAE.[205] Open data across all of these projects will be a critical component for GCC governments to realize their smart city ambitions.

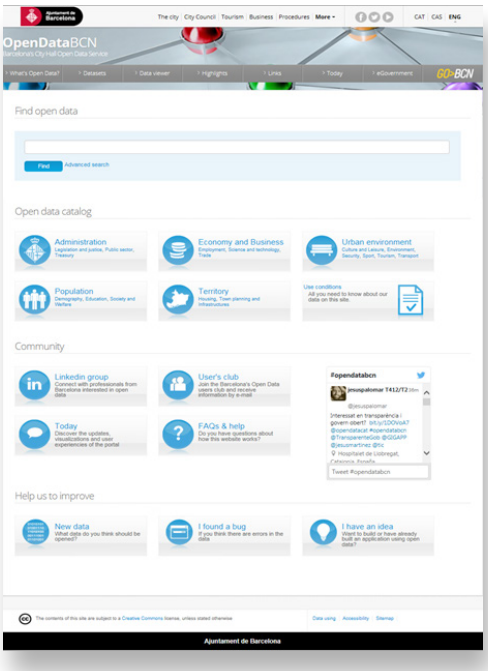
With so much new open data to be generated from smart cities, GCC governments will in parallel need to develop a suite of associated sector-specific big and smart data analytics capabilities. After all, smart cities across the region, connecting millions of sensors in everyday objects to Wi-Fi networks, are generating data that can be used for a wide range of services – including locating the nearest taxi, tracking air quality, and identifying trends in crime and healthcare of their residents, which need to be processed and provided to the public effectively if such services are to perform as intended.[206]

Mini case study: OpenDataBCN – a fundamental enabler of Barcelona Smart City[207]

OpenDataBCN, Barcelona's open data service, is a major 'smart' asset that can help accelerate the city's evolution towards the BCN Smart City.

The platform acts as an enabler for the majority of Barcelona's smart city projects, which include: the integration of municipal ICT networks, installation of one million smart meters (to build a smart grid and upgrade the power supply system), and development of an innovation district, among others.

The platform also supports Barcelona's smart initiatives such as: 22@ Infrastructure Plan (implementation of modern service infrastructure in key districts), bicing (the city's bicycle sharing system), and the Barcelona Urban Lab (fostering innovation through the use of the city as an urban laboratory to test pilot smart city services and programs).



SME Growth

As the next evolution in data access and interaction, open data, supported by government demand and applications is now becoming a key area of inspiration, which we expect to drive the next wave of interest and innovation from entrepreneurs, generating SME growth.

Several start-ups are arising worldwide using open data to create new products and services that will dramatically improve and facilitate public welfare; these start-ups range from healthcare, urban mobility & transportation, weather & geospatial services, to business & trade sectors.

This is already being witnessed in more mature open data markets. For example in the UK, a raft of open-data start-ups are now being incubated at the London-based Open Data Institute (ODI), focused on improving the understanding of corporate ownership, healthcare delivery, energy, finance, transport, and many other areas of public interest.[208]

Across the Atlantic in the US, government announcements have also indicated developing interest and support for open data start-ups.[209]

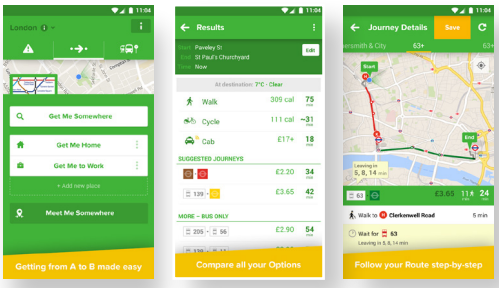
At home in the Middle East, Bahrain's Open Government Data (OGD) policy, for example, clearly states its aim to enhance public and private engagement through the development of web and mobile applications.

SMEs, in addition to citizens, academics, and large businesses, will be users of open government data. If governments of GCC countries ensure that robust engagement models are in place to allow for two-way communication for SMEs to express and get hold of priority/desired datasets, then open data initiatives will ensure fundamental growth for SMEs in the region.

Mini case study: Citymapper – The Ultimate Transport App, created by a London start-up, based on open data[210]

Citymapper is an app, which uses open city maps and related transport data to help users navigate around the largest and most complex cities in the world. It provides a comparative analysis of various transport options, including information such as relative costs and time to help users decide the most optimal way to travel, depending on their travel preferences.

It currently operates in a number of major cities around the world including: London, Washington DC, San Francisco, Mexico City, Philadelphia, New York, Madrid, Chicago, Manchester, Paris, Boston, Milan, Hamburg, Berlin, Barcelona, Rome and Los Angeles.



Middle East perspective

The benefits of open data are many and potentially huge. In addition to cost-efficiencies, enabling smart cities and generating SME growth, open data will generally yield more enhanced government services enabling them to be more efficient, transparent, creative and customized to the individual.[211] Open data will also foster creativity, multiplying the benefits of research and innovation activities across a wide range of economic sectors.

But to gain and realize optimal value in opening up data to the public, GCC countries need to tackle several common yet important challenges faced by almost all open data countries. At the forefront are regulatory issues – security, privacy (personal/consumer), data mining and the ownership/transfer of data. GCC countries need more specific infrastructure requirements as well as standardization policies. Challenges faced specifically by GCC countries include the quality, breadth and granularity of their published datasets. Specific open data frameworks and legislation is also lacking with next to nil user participation in this space.

GCC governments have cooperated particularly well in the development of e-government, and need to carry this momentum forward to translate it effectively into national open data advancements. To ensure implementation is effective, GCC governments need to ensure that sufficient resources are in place, just as they have done in their development of e-government. GCC governments should also seek to collaborate and learn from leading open data governments such as the UK. Active collaboration with the private sector and community building through soliciting citizen participation and feedback are also essential if GCC open data initiatives are to generate a real and meaningful impact.

At the moment, none of the six GCC countries are part of the Open Government Partnership (OGP), which has 65 member countries. The OGP was launched in 2011 to provide an international platform for domestic reformers committed to making their governments more open, accountable, and responsive to citizens. At present, Tunisia and Jordan are the only two Arab countries enlisted as members of the OGP. Open data projects in these countries are at present misunderstood as e-government projects rather than broader-based open government initiatives involving collaboration between governments, the private sector and civil society.[212] GCC countries stand to benefit greatly in recognizing this and in joining the OGP as well.

There is a clear will amongst all GCC countries to open up data to the public. Success will not come easy or overnight, but with the right attention, resources, collaboration and focus, great progress can still be made.

Smart cities…not just the sum of its parts

Monitor Deloitte* predicts that in 2015 and beyond, the number and value of smart city initiatives will expand substantially. The majority of new smart city projects globally will continue to be led by a few European cities. However, as smart city projects developed over the last few years are further tested and scaled up, other cities will adopt pre-tested solutions and drive smart cities growth. Much of the expansion will occur in North American and advanced East Asian cities, followed by cities in the GCC. Although industry estimates as to the market value of smart cities vary greatly, there is no doubt that the smart cities market will increase significantly over the next five years to be anywhere from over $400 billion[213] to over $1.5 trillion[214] by 2020.

Major smart city growth areas

Over the last several years, more and more attention has been paid to how new technological innovations can be used to solve the problems of modern cities. "Smart" solutions have emerged to address a wide range of city infrastructure and services problems. These transformative developments attempt to increase efficiency and lower costs for governments, businesses, and consumers through the adoption of new and improved technology. While the diversity of smart solutions is significant, Monitor Deloitte sees several components of smart city infrastructure and services that will be major areas of growth in the coming years.

Side bar: What exactly are "smart" cities? An international definition for smart cities is lacking, but in the making

As "smart" technology proliferates, there is a growing attempt to apply them to problems of the modern city. This has given rise to the "smart city" – a city, in common parlance, which uses information and communication technology (ICT) to improve its overall sustainability and efficiency, as well as that of its services. However, there is currently no authoritative definition of a "smart city".

From a citizen-consumer standpoint, the lack of definition is problematic as there is no metric against which to hold city authorities accountable. From an analytical perspective, this makes it difficult for businesses and individuals to understand precisely what a smart city is and what the associated opportunities in smart city development are. A key element of building smart city capabilities in the future will therefore be to define exactly what a smart city is.

Leading organizations have started to address this. Both the ISO (International Standards Organization) and ITU (International Telecommunications Union) have recently published definitions and KPIs pertaining to smart cities, although both are still in the process of being developed.

Description: ISO 37120, *Sustainable development of communities — Indicators for city services and quality of life*, is ISO's first set of guidelines about smart cities, only published in May 2014. ISO 37120 provides KPIs for what is to be measured, but at the moment does not provide any thresholds or target numerical values.[215] The full version, ISO 37101, *Sustainable development and resilience of communities*, will be completed in 2016.

Description: ITU has created the Focus Group on Smart Sustainable Cities (FG-SSC) to build a smart city definition. FG-SSC amalgamated over 100 smart city definitions to create one comprehensive definition, published in March 2014:

"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects"
In Dec 2014 FG-SSC decided on 6 KPI dimensions: ICT, environmental sustainability, productivity, quality of life, equity and social inclusion, and physical infrastructure. Numerical targets have not been set for the categories.[216]

* Monitor Deloitte is Deloitte & Touche (M.E.)'s strategy consulting practice.

Transportation. Traffic is a problem, if not a full-blown crisis, in major cities around the world, and attention will increasingly be focused on how to use new and emerging technologies to improve the traffic situation. Examples of smart solutions already developed in this area include the installation of road sensors to measure the flow of traffic and provide real-time traffic reports; sensors in parking areas to help users locate free spaces; and public transportation apps providing real-time information on when the next bus or subway will arrive. A prime example is the congestion charge in London, which uses cameras on traffic lights to take pictures of every license plate going in and out of the city, connected to an online payment system.

Government planning, administration, and operations. City authorities are tapping into the opportunities created by better technology to make municipal services and operations faster, simpler, and more cost-efficient. For example, governments can now create central knowledge systems that amalgamate information and data from all departments, providing residents with quick, easy access to government information and services. In New York City, the Mayor's Office created 311, a centralized system of all government information and non-emergency services that can be accessed online, or through mobile phones, via voice call, SMS, or app.

Big, open data. Multi-trillion-point data sets and the Internet of Things are shifting the possibility frontier forward, and smart cities are a chief beneficiary of this. Building a smart grid, either within a small area or across a whole city, can provide city authorities with a wealth of information on its residents' activities and needs, creating opportunities to improve services or build new ones. Smart grids are still new and few places have them city-wide. However, the installation of sensors in select areas is already delivering huge results, and the adoption of this technology will increase in the coming years, especially as technological advances make the infrastructure more affordable.

Energy and water efficiency. Going green is a huge trend globally, and many smart solutions are, at least in part, designed to positively impact the ecological footprint of the city and its residents. For example, reducing water use and waste through metering systems or pressure sensors in the water supply network to detect leaks, prevent overflow, or more efficiently manage water distribution. Ecological sustainability will continue to be an important topic globally, driving further smart innovation in this area.

As these smart city component areas grow, it is important for governments (and residents) to understand that the adoption of new technology by itself does not necessarily make a city "smart." Because there is a significant amount of integration and interaction between the major smart city growth areas, a single smart solution has the possibility of creating positive outcomes in a variety of ways. It is therefore important going forward to ensure the right systems underpin these technology innovations so that they work together and deliver greater results than would be possible as isolated initiatives.

The 10 drivers of success for smart cities.

Globally, smart cities have had trouble building cohesive, integrated smart city systems; overcoming this will be key to creating the next set of world-leading smart cities. This will mean adopting, over the next several years, the right "soft" infrastructure – underpinning technological solutions by changing the way that governments and organizations operate. Monitor Deloitte has identified 10 important features that drive the success of smart cities, allowing for an integrated, forward-looking, efficient public ecosystem.

A clear vision. City governments should develop a holistic plan for smart city development. This will ensure projects are being rolled out effectively and serve a larger goal. Best practice for this driver is to establish objectives and priorities, with KPIs for each; a funding plan and a realistic estimation of short and long term costs; a clear business case for projects; and a plan to facilitate coordination between public and private stakeholders. To date, there has been mixed success in this area. Many cities have developed some sort of strategic plan, but the comprehensiveness and concreteness varies, as does the length of its future vision and plans for funding sources.

Public-private partnerships (PPPs). Public-private partnerships can provide financing for cash-strapped municipalities to undertake innovative projects that would otherwise be out of reach. They can also give the private sector a guaranteed consumer on which to test new products. Public-private partnerships have become a common feature of many smart cities around the world. Barcelona has had a series of successful PPPs, including for the development of an innovation district, integration of municipal ICT networks, and an upgrade of the power supply system.

Integrated organization. In most city governments today, limited connectivity between each department means that different projects are disjointed and non-cohesive. A successful smart city must build a unified organization with the authority to coordinate, and potentially integrate different city departments and effectively manage the multiple stakeholders involved in the smart city transformation. A good example of a unified structure is the Center of Operations in Rio de Janeiro, which is a central command centre coordinating the city's emergency response resources. It incorporates 30 municipal departments, integrating their activities into a single location in order to respond to needs and anticipate emerging threats efficiently and quickly.

Efficient smart city platform. The utilization of big data is dependent on implementing an effective software platform that can capture, manage, analyze, and display information. It should have a defined rationale for how it sorts and manages data. Otherwise, given the huge quantity of data that will be collected, it will be of no functional use. The Greater London Authority has created an effective data platform in the London Dashboard, a centralized data repository available to Londoners free of charge. The centralized information about public services and city data encourages transparency and better management by city authorities, and allows entrepreneuring individuals to use the data to develop new apps and services.

Strong citizen engagement. Citizens can provide invaluable feedback for the betterment of existing city services and the development of new ones. Smart city authorities should educate and inform citizens about the smart transformation and encourage feedback on pilot programs. Seoul, for example, has developed a very successful online policy suggestion system that enables citizens to contribute ideas for new policies online and discuss them with city officials.

Technology as an enabler. Technology adoption should not be an end in itself, but should be used to address the major pain points of the city, such as mobility, energy, water, public services, etc. While technology has obviously been the central component of smart city development, cities have been less successful at deploying it in an impactful way. A good example of a unified system is Amsterdam's Smart Mobility solutions. From an app that enables a user to book a parking space in advance, to a system linking ambulances to traffic control, to an electric grid allowing electric car owners to store locally produced energy, these individual initiatives work together, improving transportation in the city while delivering positive knock-on effects in other areas, such as environmental sustainability.

Risk management. Extensive collection of personal and business data, and the heavy reliance of governments on technology, creates major risks. Smart city authorities need to implement digital security practices that protect information and prevent interruptions to service provision. This area is generally lacking worldwide. Solutions need to be developed rapidly, and communicated to the population, to increase their trust in the government's ability to protect their information.

Social inclusiveness. Creating a sustainable, economically healthy city is dependent on the engagement of all citizens. Smart services that target disadvantaged groups can make expensive social aid programs better and cheaper. Smart city authorities should make it a focus to improve quality of life and service delivery for all layers of society, and should use technological innovations to increase the accessibility of services to disadvantaged groups in society.

Project upscaling. Cities must be able to successfully bring projects from the pilot to the city-wide scale to build long-term solutions. Many smart cities currently are largely an amalgam of small, limited initiatives. Maintaining efficiencies on a large scale can be challenging, as a project built to fit local demand might not maintain its logic on a larger scale. To solve this, a plan for upscaling should be included in the initial project design phase. One city that has had success is Boston. Its Commonwealth Connect app, which allows citizens to report issues (such as garbage, graffiti, potholes) to the appropriate authority, was successfully scaled up from just one city (Boston) in 2009 to over 60 municipalities in 2014, with funding for its expansion in another 20.

Supportive legal framework. A good smart city regulatory environment will provide the protection that start-ups need while being adaptable enough to allow for the risk-taking and trial-and-error that innovation requires. London, and in some cases the whole UK, have had success with creating an environment conducive to the development of smart city solutions. Tech City UK has numerous initiatives in this area, including: conversation channels between the public and private sectors to ensure policy matches needs (e.g. Tech City Breakfasts at No. 10); a labor policy that ensures London has the best tech talent (e.g. the Entrepreneur Visa and Exceptional Talent Visa); funding support for start-ups (e.g. the Start-up Loan Scheme will provide £110 million over 3 years); and protection for innovation (e.g. The Patent Box program reduces tax on intellectual property developed in the UK to 10 percent).

Middle East: Many governments in the region are interested in developing smarter cities here.

Monitor Deloitte predicts that the number of new smart city greenfield developments in the GCC will double within the next two to three years. This follows the launch of six entirely new, master-planned smart city developments in the GCC over the past decade (see Figure 5). Going forward we also expect the majority of new city sub-developments will incorporate at least some element of "smart" infrastructure. The region's smart city growth will largely be driven by developments in the government planning, administration, and operations area, backed by significant GCC government investments in e-government and mobile services.

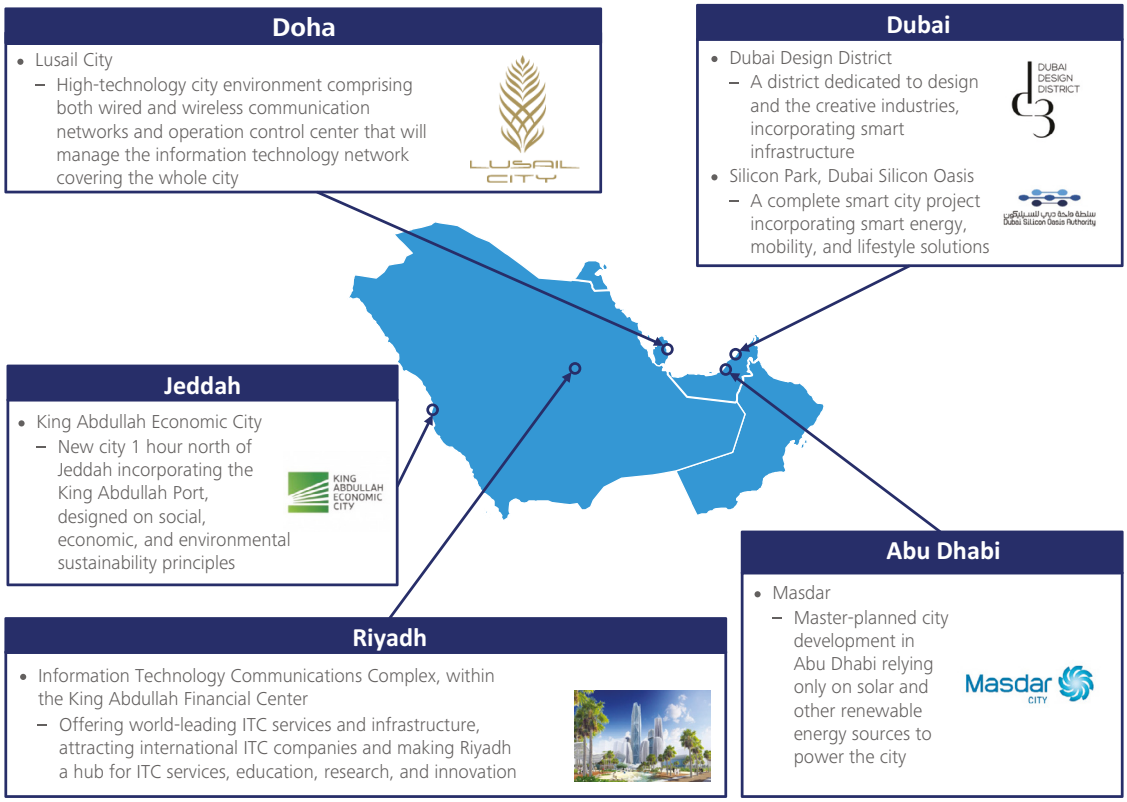
The number of new greenfield developments will increase, providing ripe testing ground for new smart technologies.

One of the most significant opportunities for smart city development in the Middle East is the chance to build a smart city from the ground up. Most global experience in smart cities to date has been in brownfield developments – adding smart solutions to cities that already exist. Cities have to retrofit existing infrastructure with new technologies to make it "smart-compatible," which can be expensive, time-consuming, and complicated.

This isn't the case in the Middle East. Already several projects are taking place. Dubai Design District promises to be a smart district dedicated to design and creative industries. A Memorandum of Understanding (MoU) signed with Cisco in October 2014 will explore potential joint opportunities for smart infrastructure. Dubai Silicon Oasis is building Silicon Park, set to be completed by the end of 2017, an integrated business and residential area that will include smart sustainability, mobility, and lifestyle solutions. In Qatar, in the $45 billion Lusail City, being built for the 2022 World Cup, all energy, communication, and transportation systems will be digitally connected through a main city command center.

These greenfield developments present two major opportunities. First, they present the opportunity to test new innovations at a lower cost, as building in brand new ICT infrastructure is less expensive than retrofitting older infrastructure. Secondly, and perhaps more importantly, they provide the opportunity to further develop already tested innovations, integrating them into the fabric of the city and assessing performance on a large scale.

Figure 5. GCC Smart city greenfield developments



Source: Monitor Deloitte research and analysis

Mini case study: Masdar[218]

Masdar is a master-planned city development in Abu Dhabi relying only on solar and other renewable energy sources to power the city. It is a model for how intelligent design can create an urban environment accommodating dense populations with fewer resources. Masdar, once complete, will cover 6 square kilometers and be home to 40,000 people. Phase 1 is expected to be complete in 2015; the full development is planned for completion in 2020. Smart elements of the city will include:

- Reducing buildings' energy and water consumption by 40 percent through intelligent design
- An integrated smart network of transportation options, including a driverless point-to-point personal rapid transit system, an electric vehicle ride-share program, and a centralized zero-carbon automated public transportation network

Masdar also serves as a testing ground for new renewable energy innovations. The Masdar Institute of Science and Technology acts as a design and innovation center with a focus on the development of new green technology systems. The city then runs pilot projects to test the theories and optimize the engineering. Once the system is perfected, the pilot is upscaled to the whole city, in order to develop a commercialized version.[219]

Governments are increasingly utilizing smart solutions to improve their services

A number of brownfield smart city developments are also taking place throughout the GCC. Stakeholders in the Middle East are paying significant attention to the growing smart city industry, and incorporating solutions into major urban centers. Across all four of the major smart city growth areas, GCC countries present important market opportunities.

By far the largest growth area for the Middle East is in government planning, administration, and operations. Governments in most GCC countries have already developed e-government portals, centralizing information on government services, policies, and regulations into a single portal, enabling citizens to conduct certain procedures online. While the level of effectiveness and impact varies from country to country, there has been and will continue to be a strong drive to use new ICT innovations to make government services more accessible to citizens.

Transportation and big, open data also present important market opportunities specific to the region. Both areas are growing in relevance as cities' populations grow. Given the prevalence of personal vehicles, traffic will increasingly become a pressing issue that big data can help to solve. Big data is also especially critical for Dubai and Qatar, who are both hosting major international events in the next decade. They will need to develop the capacity to deal with the large numbers of visitors, and big data can help develop solutions before these events begin.

Finally, energy and water efficiency present distinct opportunities. Energy and water consumption and waste generation are among the highest in the world for most cities in the GCC, but there is a growing consciousness among citizens and the government that more sustainable ways of life have to be adopted.

Mini case study: Smart Dubai

Smart Dubai was launched in March 2014. Its mission is to make Dubai the smartest city in the world by 2017. There are six main dimensions:

- Economy
- Governance
- People
- Living
- Environment
- Mobility

The processes for the transformation will focus on efficiency (optimized use of city resources), seamlessness (integrating daily life services), safety (anticipating risks and protecting people and information), and impact (enriching life and business experiences). A main point of focus is the integration of systems, both public and private, to increase communication between residents and Dubai's institutions to foster access to information. The government plans to make 1000 government services available electronically through an online window within three years.

Various smart programs will be implemented by Dubai government departments under the Smart Dubai mandate. For example, the Roads and Transport Authority (RTA) will develop a "unified control center" for traffic and transportation control systems. And the Dubai Electricity and Water Authority (DEWA) plans to develop a "smart electrical grid" that encourages homeowners to use solar energy and sell the surplus to the government through the electrical grid.[220]

Mini case study: Dubai Expo 2020[221]

Expo 2020 presents the opportunity to encourage the adoption of smart technology solutions in the public and private sectors in Dubai and across the region. The Expo itself will be an opportunity to showcase the latest innovations in smart tech, while the build-up to the Expo will give stakeholders the opportunity to test pilot projects and engage in the smart technology that will go into the actual development of the Expo. The three themes of the Expo contain elements of the major smart city growth areas, and can serve as a test bed for smart solutions:

- *Sustainability*: Expo will be a monument to the green economy, building partnerships to find lasting sources of energy and water, and successfully managing existing resources.
- *Mobility*: Building efficient logistics and transportation systems to connect people, goods, and services; developing new mobility innovations to create a more integrated world.
- *Opportunity*: Developing new models for sustainable economic development and financial stability, and harnessing those new models to foster entrepreneurship and innovation.

But the soft infrastructure underpinning these developments is lacking.

Despite high levels of interest, smart cities here seem to be falling into the trap of all flash and little substance. Their performance in most of the 10 smart city drivers of success is currently weak compared to their European counterparts, undermining the ability of the reforms they have put in place to deliver substantive change.

For example, while Dubai has taken significant strides to make government services more accessible to the population, the result has not been cohesive. A directive from the government for all departments to create an app for their services has led to a plethora of independent, unintegrated systems. Additionally, the lack of clear KPIs on what is required for the app, or how impactful it is expected to be, has led to substantial variations in the quality and usefulness of those apps (for more information see the prediction: Mobile government: a new mode of public engagement).

In the same vein, Doha launched the Lusail smart city project in anticipation of the 2022 World Cup. This $45 billion development project, which will build a fully integrated smart city from scratch, is not supported by a broad smart city plan for Doha. And despite hosting several smart city conferences, the capital does not have a defined vision for its transformation into a smart city, or deliverables against which its drive to become smarter can be judged.

If governments going forward want to rank among the smartest in the world (as, for example, Dubai has stated), they will have to develop this smart soft infrastructure, in addition to the physical smart solutions.

If governments going forward want to rank among the smartest in the world (as, for example, Dubai has stated), they will have to develop this smart soft infrastructure, in addition to the physical smart solutions.

Bottom line

Smart cities have proliferated around the globe in recent years, providing new solutions to the problems of a modern city. However, the concept of what exactly makes a city "smart" is undefined. Equally, if not more, ambiguous is what city governments need to do to support these smart solutions and increase their impact. It is becoming increasingly important for governments to clearly define the goals, aspirations, systems, and organizations that will guide a city's smart development and help increase the impact of its smart solutions. The danger is that cities will end up with an amalgam of interesting innovations that have limited scope or impact, and which do not interact with each other or help any significant amount of the population.

To address this risk, city governments need to shift their focus to building the soft infrastructure needed to support these and future smart solutions. Monitor Deloitte's 10 drivers of smart city success provide a broad outline of key elements involved in this infrastructure. The development of integrated, efficient, adaptable, truly smart cities will depend on governments adopting these frameworks and systems to support smart city growth in the future.

Middle East perspective

Smart cities have gained increasing attention in the region over the past several years. Both governments and developers have tapped into this trend to engage citizens and develop new solutions. Developers especially are becoming increasingly interested in adopting the ICT infrastructure and master planning that will aid the development of modern smart cities. This presents key opportunities in both the private and public sector to leverage this trend and increase investment in new smart technology.

At the end of the day, though, a greater emphasis must be placed on how to leverage these developments to ignite a shift to better, smarter cities. While greenfield developments allow for a more integrated ICT infrastructure to be developed from the outset, creating the right 'soft' infrastructure to support it is in an even weaker position in the Middle East than it is globally. Governments will need to take an active role in ensuring the 10 smart city drivers outlined are activated if they want to develop truly smart cities and be global leaders in this space.

The re-enterprization of IT

Deloitte predicts that in 2015 the impetus for IT adoption will swing back to the enterprise market following a decade of consumer-led technological change.

From the 1950s until about ten years ago, new technologies and advanced versions of technologies were usually adopted by the enterprise first: the mass-market consumers would then take years or even decades to catch up. Early mainframe computers were only useful or affordable for large companies; they cost $750,000 in 1951 ($7 million in 2014 dollars) and had to be lifted into the building with a crane.[222] Touch-tone phones were in offices long before the average home.[223] Electronic calculators in 1972 were business tools, costing several hundred dollars (thousands of dollars in today's money), so too expensive for the home as for students.[224] Early PCs, aside from tech hobbyists and the curious wealthy, were purchased overwhelmingly by enterprises. Who needed to do word processing or use VisiCalc at home? Early cellular phones cost thousands of dollars – the price of a compact car, or a quarter of the average salary at that time – when they went on sale in 1984. Users would pay $50 a month just to be able to use the service.[225]

When PC manufacturers launched new models, boasting bigger hard drives, more RAM and faster CPUs, they were marketed and branded as 'Pro', 'Office 'or 'Enterprise'. Meanwhile, the lagging edge of technology was marketed as 'Home'. While consumers were buying their first bulky cell phones, businesspeople were lining up for sleek flip-phones, and later for early smartphones incorporating full-sized keyboards and 'giant' 2.0 inch monochrome screens.

But in the last ten years there have been several examples where the exact opposite has been true, and the consumer has led the way.

Large touch-screen smartphones were adopted first by consumers. Enterprises were not only slow in taking to these now-ubiquitous devices; in many cases they tried to ban or restrict their use for work purposes. It was much the same with tablet computers. In the early days, enterprises tried restricting their use, and although they are now common in the work place, this only came about after millions of units had already been bought by consumers.

It isn't just technology that has experienced this trend towards consumerization; it affected telecommunications too. Accessing work functions and email on a smartphone works relatively well at 3G wireless speeds; but consumers wanted to watch high definition video or play games, and wanted the advances provided by 4G LTE networks. Most businesses are only upgrading their wireline ISP provisioning gradually, while it is consumers watching tens of hours of high bitrate over-the-top (OTT) video who are looking into getting fiber-to-the-home services.

There have been a number of other technologies that reflect the consumerization trend. Voice-over IP telephony is common in many large enterprises today, but was largely a consumer-driven product initially. Desktop video conferencing was also consumer-led. Many enterprise laptops had their cameras disabled by the IT department. Storing your emails on a web service was a popular consumer service, while enterprises continued to own dedicated email servers.

From the 1950s until about ten years ago, new technologies and advanced versions of technologies were usually adopted by the enterprise first: the mass-market consumers would then take years or even decades to catch up.

Not surprisingly, observers tend to extrapolate trends based on what has happened in the last couple of years: it's called the 'recency bias'.[226] Since the most recent examples of technological adoption have been 'consumer first; enterprise after' (also known as the consumerization of IT)[227] it is not surprising that many believe this will become the dominant model of technology and telecommunications adoption from now on.

There is strong evidence that the pendulum is swinging back to enterprise-first adoption, or at least a world where the consumer doesn't always lead the way.

Predictions 2014 discussed the wearables market: smart headsets and smart watches such as Google Glass and Samsung Gear, and hundreds of other models from various manufacturers. The media hype in January of that year suggested these would be an enormous consumer success,[228] and our prediction was the same: "Usage of smart glasses in 2014 is likely to focus on consumer applications, with enterprise usage becoming more prevalent later as the product specification improves."[229] Consumer acceptance of these devices has been much lower than the four million units we predicted. Although exact numbers have not been disclosed for many head-mounted devices, the combined total of units sold is almost certainly under 500,000.[230]

Deloitte member firms' ongoing client interactions over the course of 2014 suggest that the enterprise market may be a sweet spot for the wearables industry. The security, medical, materials handling and warehousing industries are all eagerly exploring the potential of devices that offer hands-free use, augmented reality display, and easy-to-use video camera capability.

However, Deloitte member firms' ongoing client interactions over the course of 2014 suggest that the enterprise market may be a sweet spot for the wearables industry. The security, medical, materials handling and warehousing industries are all eagerly exploring the potential of devices that offer hands-free use, augmented reality display, and easy-to-use video camera capability.

Predictions 2015 features three more examples. 3D printing (also known as Additive Manufacturing), drones (also known as Unmanned Aerial Vehicles or UAVs), and the Internet of Things (IoT, also known as Machine-to-Machine communications) seem to be primarily enterprise driven (for the full stories and supporting endnotes, please read each prediction in this report). The consumer market may possibly dominate in terms of units sold, but will be less important in the near term in terms of usage and value.

3D printing has been around since 1988, but more recent media interest has focused on the idea that these devices will become the 'factory in every home'. With a proliferation of sub-$1,000 machines, the concept of widespread home use looks plausible: if many homes have their own laser printers, why not 3D printers too?

The reality is that the home devices are still hard to use, and make small objects out of plastic only. While there is a growing 'Maker' community, the household penetration is well under 0.007 percent,[231] and the total dollar value of all consumer 3D printers is equivalent to less than four hours of smartphone sales.[232]
The media hype is obscuring the more important fact that enterprises are spending ten times more than consumers on 3D printing machines. They buy them and use them frequently: we estimate that the economic value of goods being produced by enterprises is over 100,000 times higher than output by consumers.
In contrast to plastic-only consumer printers, enterprise 3D printers are operated by experts who are good at design, and produce objects from a range of much more useful materials, including metals; and the machines fit into existing production work flows and processes such as the manufacture of molds, forms, jigs, and dies. The most-heralded new 3D printers from large manufacturers are not aimed at the home market, but the enterprise.

Drones (UAVs) have been widely used in military applications since 2001, but the last few years have seen UAVs gaining traction in the consumer and enterprise markets. Although the majority of the 300,000 drones expected to sell in 2015 will be purchased by consumers, we predict they will not be used extensively. Those that are priced for the consumer or even prosumer can't carry much, go very far, or fly even in light winds; and they are suitable only for experimentation and limited aerial photography. They are also becoming more heavily regulated, and are often difficult to fly safely.

In contrast heavier and more expensive enterprise drones, guided by trained, licensed, and insured pilots, will be better able to comply with the new regulations. Drones will not become the norm for delivery or many other mass market uses, but will have growing utility in niche enterprise applications such as crop surveying, finding lost livestock or people, distributing lightweight medicine during disaster relief, surveying for resource extraction, inspecting wind farm turbines, and a variety of professional photography and videography uses.

The media is also focusing on the consumer aspects of the Internet of Things (IoT); but many of these are trivial applications, with low ROIs; and while they are technologically possible, they often do not meet real mass-market consumer needs. Consumers don't need a washing machine that sends a message to a smartphone when the cycle is finished: they already have loud buzzers to do that.

However, washing machine companies do want a connected device, which can provide information about real-world usage. And in the future, predictive analytics from a connected machine could warn of an impending break down, and which parts need to be stocked for the service call. Although consumers will also end up benefiting from connected devices, they will not be the ones pushing for the functionality or paying for it. Enterprises will, and consumers will piggyback.

Deloitte isn't predicting that all tech trends in future will be pioneered by the enterprise. But it seems likely that the consumerization model will not be the only game in town, in 2015 and beyond.

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Consumerization in the Middle East has been rapid, but the scale of re-enterprization will take over

Deloitte predicts that in 2015 the pendulum of IT adoption will not only swing back towards the re-enterprization of IT, but will move faster and deeper than the rest of the world. Consumerization has been rapid, and will coexist with enterprization as a driver to the region's technological development, even leading in certain areas. But the scale of development in the enterprise space, backed by large corporate and government expenditure, will be the region's biggest driver.

Innovations and advancements in IT is a global truth and the Middle East is no exception. There is no doubt that IT adoption, both at the enterprise and consumer level, has had a profound impact on the region's economic and social transformation.[233]

Looking back: the region was always a follower, with enterprises following first

Traditionally, the region has always lagged behind in its adoption of new IT developments, introduced first in more advanced economies. Even in terms of basic connectivity, the 'follower effect' is evident, but was enterprise-led.

When ADSL became commonplace in most US and European households, local enterprises were still in the process of upgrading their connections, while dial-up was still the way to connect from home. Once high-speed fiber optic broadband was widespread in North America and Europe, local enterprises and business districts were the first to benefit from its latent roll out in the region, followed by consumers at the right price.

Similarly, company laptops were issued to enable flexible working anytime and anywhere, but were only implemented in company policies and rolled out by multinationals once they had entered or established themselves in the region.

Mobile also experienced a similar 'follower effect'. Regional GSM, 2G, 3G and relatively recent 4G rollouts all came after their proliferation in more advanced economies.[234] Even in the pre-smartphone era, local executives were the first stage cellular phone adopters, following commonplace usage in the workplace abroad. Mobile enabled them to benefit from the strategic advantage of having a direct mobile connection with colleagues, superiors and clients.

Enterprises always had the technology and connectivity edge by default. They had deeper pockets and naturally much higher demand for data transmission and consumption, versus consumers, who at the time were still buying rather than downloading physical media such as newspapers, books, music CDs and using landlines rather than mobile and VoIP to communicate.

The region has caught up, but so have its consumers

However, in each development, the region has accelerated in its adoption rate, shortening its lag,[235] and over the past decade or so, its consumers have also caught on, and up.

While the proliferation of satellite television, the Internet and computers all played a fundamental and pivotal role in the Middle East's information revolution, mass consumerization of IT really took off with mobile communication, social and digital OTT technologies, informing, educating and connecting people in the region far more effectively than ever before.

Initial signs of this were seen in the early 2000s with Instant Messaging (IM) services such as Yahoo! Messenger and MSN Messenger, but were limited in popularity to local teenagers in schools, those who were fortunate enough to be able to access these services on the one family desktop PC at home.

But following the introduction of mobile phones around 15 years ago, VoIP, social media and smartphones just under a decade ago, and mobile broadband in the last 5-6 years or so, consumer IT services adoption, device consumption and usage have exploded.

Mobile penetration increased rapidly from just 3 percent in 2000 (19 million connections) to 105 percent in 2012 (391 million connections), representing 32 percent per annum growth, the second highest in the world after Sub-Saharan Africa.[236] Of this, smartphones grew even faster, representing just 3 percent of mobile connections in 2008, to just over 20 percent in 2013, over 45 percent per annum growth.[237] Mobile broadband subscriptions soared by over 250 percent from 2008 to 2012, more than ten times the growth in Internet users and fixed line broadband subscribers, which respectively grew around 20 percent over the same period.[238]

Higher smartphone and mobile broadband adoption has grown hand-in-hand with social media, VoIP and other digital over-the-top (OTT) services, which have also grown remarkably over the years. From 2011 to 2013, the user base of Facebook, Twitter and LinkedIn grew by over 40 percent, over 55 percent and over 95 percent per annum respectively.[239] Online daily viewership on YouTube also grew by around 70 to 100 percent per annum[240] and the user base of the most popular VOD (now SVOD) platform, Shahid.net, grew by 40 percent per annum.[241] Both on Facebook and YouTube, the majority of usage is reportedly via mobile and tablet devices.[242] Recent surveys in the largest MENA markets also show high levels of VoIP and mobile instant messaging (MIM), such as WhatsApp, usage with around 45 percent and 70 percent using these services respectively.[243]

Disruption has shaken the enterprises, but they are adapting and looking to regain the front-foot

At first, local enterprises and governments were apprehensive and discouraging. Mass consumerization of IT had led to enormous disruption, which neither enterprises nor governments could control. Naturally this raised security and moral concerns.

First, early phone cameras were banned by some governments.[244] Then a number of VoIP and MIM services were banned by various countries at different points.[245] Social media usage also contributed to rocking the region's political landscape, with regulations and laws introduced to curb its usage.[246] Commercially, enterprises such as telecom operators were also threatened by consumer adoption of smartphones and OTT services, which hit revenues, for example with international call revenues being eroded from higher VoIP usage instead. Piracy also became an issue for pay-TV and IPTV operators, with illegal content downloading and online streaming of sports matches. Increasing incidences of cyber-attacks over the years on governments and corporations has also made consumerization and IT security a board-level issue.[247]

However, whilst the region's consumerization boom and adoption of new IT services over the past ten years has challenged enterprises and governments profoundly, it has also prompted them to adapt and reinvent themselves quickly. Today much of the disruptive consumer-led technologies have been embraced by enterprises and governments in the region. For example they now actively engage and market to customers, citizens and residents on the web, mobile, and social media as well as through traditional channels. Telecom and pay-TV operators have also developed their own OTT services, and even partner with them to drive data usage and subscription revenues. Cyber security and enterprise resource planning (ERP) systems have also seen marked investment and advancement.[248]

Re-enterprization has quickly caught up to the region's rapid consumerization of IT

Since the turn of the decade, we have started to see evidence of local enterprise-led IT re-emerging, harnessing new technologies and driving its use once more.

This is not to say that consumerization will cease, rather, we believe that it is here to stay and that present trends will only continue to gather pace in the years to come, but the scale of enterprization will undoubtedly refocus much of the region's technology developments on local governments and enterprises.

In 2015 and beyond, we foresee re-enterprization of IT occurring across all key enterprise areas of government, the private sector and small- to medium-sized enterprises (SMEs), in different ways.

Governments: driving national modernization via mass IT transformation and ecosystem development

Countless studies reveal how modernization through ICT is widely recognized as a gateway to economic growth, progress and social stability. Whilst most Arab governments are taking the best steps they can towards this, GCC governments in particular are also playing not only to catch up to more advanced economies, but to surpass them, to lead the world. To this effect, many mass government-led IT transformation programs have been taking place as indicated in the remainder of this prediction. Such ambitions may have seemed unrealistic just in the past decade, but in more recent years, great progress has been made and we expect such programs to bring about a new wave of local enterprise-led adoption and innovation.

e-government. The most notable, significant and long-standing of these is the transformation to e-government. For over ten years, the GCC has been digitizing government services and information to be made available online, consolidating them in central web-portals, climbing the UN's world e-government rankings in the process. With its e-government development index growing at twice the rate of the global average, in 2015, the GCC may even overtake Europe as the leading region.

National broadband. Many Arab governments have defined national broadband policies and have embarked on implementing key initiatives to increase broadband penetration levels. Currently broadband access is low with modest regional household penetration levels.[249] However, over the next year or so, plans are to substantially increase this. For example Qatar's National Broadband Plan (NBP) is targeting 95 percent household penetration, including all businesses, schools, hospitals and government institutions. Egypt is aiming to have 75 percent of its population connected to fixed Internet services at two Mbps.

m-government. Only in the past two years, governments have been rapidly expanding public services to mobile platforms, especially in the form of smartphone applications. The past year alone has seen the number of m-government services soar from under 200 to over 400 smartphone apps, more than double global growth. The Middle East is now the second largest region in the world for mobile government services, led by the GCC.

Big data, open data and data analytics. Currently all Arab governments are behind in open data initiatives, for example with relatively limited, lower quality national statistics datasets. However, in recent years national open data portals have sprung up and open data policies are being put in place in the GCC. Most of the foundational e-government infrastructure needed for open data is now there. In 2015 and beyond, we are therefore expecting major leaps to be made in open data in the GCC countries, as some are ready to act on and implement their national open data policies and initiatives.

Smart government. The seamless cross-interaction, information flow and integration of internal operational and external public services between government agencies is an amalgamation of the major government-led initiatives we are seeing. The UAE is leading developments in this area, but as we expect other GCC governments to follow, we expect them in turn to increase their adoption of enabling technologies such as cloud computing and harness them to pioneer smart government IT solutions.[250]

Saudi Arabia and Qatar are amongst the top 40 governments in the world investing in R&D. Qatar's level of investment at 2.8 percent of its GDP makes it comparable to advanced Western economies such as the US and Germany.

Smart cities. A number of smart city projects are emerging across the region in the UAE, Saudi Arabia and Qatar. Dubai, for example, aims to be the smartest city in the world by 2017. With recent reports estimating the smart city technology market to grow more than three times from 2012 to 2020, this is likely to be the region's largest driver for Internet of Things (IoT) devices in the years ahead.[251]

Sector transformations. Governments have been undergoing mass-scale transformations across most economic sectors from utilities, transport, police, customs, oil & gas, to healthcare and education. Examples include digitization of physical records, installation of centralized IT database systems and wearable technologies for cutting-edge solutions. As mentioned earlier, Predictions 2014 had discussed the wearables market. Security, privacy and regulatory issues were anticipated and proven as a key challenge, which ultimately led to the recent cancellation of Google Glass as a consumer product.[252] Even then, we had seen usage emerge in the health sector, with the Saudi Ministry of Health and Philips developing patient monitoring solutions. As such, we alluded to the likelihood that "the public sector could even be one of the primary drivers behind wearable adoption".[253]

IT ecosystem development. Governments have been taking various steps to develop the technology innovation and entrepreneurship ecosystem, from investing in the development of tech-hubs to research and development (R&D) and incubator/accelerator initiatives. For example, Saudi Arabia and Qatar are amongst the top 40 governments in the world investing in R&D. Qatar's level of investment at 2.8 percent of its GDP makes it comparable to advanced Western economies such as the US and Germany. This is followed by Saudi Arabia at 0.3 percent of its GDP.[254] Other reports mention UAE at around 0.5 percent of its GDP.[255] In Dubai alone, the number of tech incubators/accelerators increased from three in 2008 to more than ten in 2014.[256]

Private Sector: partnering with governments and applying new tech to develop innovative solutions

The region's private sector used to be followers, like government, but now are also being proactive in developing innovative IT solutions not only to support national government modernization programs, but also to increase internal efficiencies and bring new products to market. This is seen in recent notable enterprization trends in the private sector.

ICT solutions for governments. In all government-led IT initiatives, public-private partnerships (PPPs) and collaborations have been essential, such as in big data and smart cities.[257] Telecom operators and ICT solutions providers have been leading developments across all government verticals from oil & gas, to education and health. For example in 2014, telecom operators du and Etisalat partnered with the UAE Ministry of Health to develop and implement the country's mobile Health (m-health) program.[258] Similarly, GE has signed a number of MOUs with the UAE government to develop the country's IT advancement in the healthcare sector (see mini case study). STC Advanced Solutions, STC's enterprise ICT solutions business, launched last year, has also been working with Saudi government entities including the Ministry of Interior, the King Abdullah Financial District (KAFD), among others.[259]

Wearables. Similarly, business-to-business (B2B) partnerships have sprung up to develop new solutions across industries to gain from operational efficiencies. For example Etisalat and MasterCard Labs partnered to develop a novel payment solution using smart glasses.[260] Ooredoo has also been working with ICT solutions providers from the UK to develop enterprise applications based on wearable technologies.[261]

Digital solutions. Large enterprises have also been catching up in their adoption of digital solutions, which has been lagging compared to international markets. Whether in energy, banking or other sectors, large firms in the region are heavily involved in catching up with IT solutions and standards of developed economies.[262] For example, many regional players are implementing state-of-the-art banking technology solutions to meet the rise in Islamic banking needs, namely, business analytics, mobility, disaster recovery, and risk management,[263] where IT investments are considered as essential to the competitive advantage that differentiates one bank from its peers.[264]

3D Printing. 3D printing has also entered and remained in the region's B2B domain, for example in final parts manufacturing. New 3D printing companies such as D2M Solutions print final parts for aviation and government clients.

Other enabling technologies and solutions. Cloud computing, software-defined applications and infrastructure, risk-based security and self-protection are also just some of the current concerns of large corporations.[265, 266]

SMEs: the next wave of enterprise IT adoption and innovation

The region's re-enterprization trends are not only driven by the latest technologies, but also more basic and fundamental ones too. Last year's predictions highlighted that local SME adoption of ICT services is gaining momentum, enabling them to accelerate their economic development and competitiveness. Although regional SME usage of ICT services were found to lag behind local consumers and the rest of the world, sizeable increases in the number of SMEs, and their demand for ICT services, is generating world-leading growth in their expenditure (supported by more incubators and venture capital investments) on ICT.[267] We expect expenditure across the three fundamental areas of web presence, e-commerce and cloud computing to continue, and SMEs to lead the growth in adoption in these areas, which is likely to accelerate.

In addition to the adoption of fundamental ICT services, we also expect the rise we are seeing in homegrown SMEs and incubation efforts to accelerate new enterprise-led IT innovations throughout the region.

STC's freshly launched InspireU, an incubator and accelerator for startups does precisely this. The new initiative is focused on ICT and digital innovation in the Kingdom, especially in the development of smart technologies and solutions.[268] Similarly, Mobily has launched its own new venture capital fund for technology start-ups, with interests in a range of B2B services including retail innovation, mobile financial services and payments, digital advertising, IT and cloud services.[269]

Investors are also arising from other industries. For example Alkhabeer Capital, in the financial services industry, has also recently announced a new venture capital fund for technology start-ups with interests in new disruptive technologies such as wearables, IoT, and 3D imaging.[270] Even at the national level, the UAE government has formally launched its National Innovation Strategy, annually investing over $3.8 billion in innovation and R&D, to be amongst the most innovative nations in the world.[271]

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Mini case study: Predix software platform from GE[270]

GE Software

Predix®
From GE. To Everyone.

GE's Predix software platform can connect industrial assets from any vintage or vendor to the cloud and to each other. It can also be used as a platform to build apps for any industry or sector—by customers, OEMs, developers, anyone. GE states that businesses ranging from automotive to agriculture to buildings can run smarter and more profitably with Predix Asset Performance Management system.

From the healthcare perspective, and in line with the country's Vision for 2021, the United Arab Emirates is considered one of the leading adopters of digital health services and technology not just in the region but all over the world. The UAE is also investing heavily in Big Data applications, and has signed multiple MOUs, namely with GE, to enhance the use of big data, mHealth, remote monitoring and other digital health services by, local and regional, public and private entities. An expected sector worth $60bn by 2025.

Sample stakeholders

مدينة دبي الطبية
Dubai Healthcare City

Healthcare organizations

VISION 2021

Government

digital health LIVE

Private sector / events

Bottom Line

The 're-enterprization of IT' may be an inelegant term, but it is likely to be a boon for the CIO, who tolerated consumerization, but largely found it posed significant challenges. Consumerization and the associated 'Bring Your Own Device' trend offered some benefits for the enterprise, but attempting to procure, pay for, provision and secure tens or even hundreds of millions of consumer devices has been a nightmare for most corporate IT departments. The sheer diversity of operating systems and form factors has been a challenge, and if enterprise use of wearables, 3D printers, drones or the Internet of Things were being primarily driven by consumers the headaches would only be worse.

As an example, head-mounted wearables aimed primarily at the consumer market would be unlikely to be secure enough from an intellectual property perspective for many enterprises. It is too easy for employees to intentionally or inadvertently record trade secrets or other proprietary information. But a device that was enterprise-oriented from inception can have 'IP integrity by design' built in: the pharmaceutical industry would almost certainly be interested in secure enterprise wearables, and not interested in a consumer version of the technology. Equally, consumer wearables are not usually rugged enough, or safe enough (they can emit sparks) to use on an oil drilling rig; but an enterprise version would have to go through the Mil-Std safety tests, and pose lower risks.

The Internet of Things offers significant promise: but the billions of widely-dispersed sensors and various networking standards also pose a security risk that is potentially even larger than with PCs or mobile phones. If IoT were primarily consumer-led, it seems unlikely that security would have been the most important feature. Enterprise-grade IoT seems more likely to protect corporate networks and data, and is likely to do a better job on privacy too.

New technologies – whether adopted first by consumers or enterprises – do not sit in splendid isolation: they need to fit into an ecosystem. Consumerized devices were designed to be inter-operable with consumer networks, software, connectivity and services. In some cases the technology worked adequately with enterprise software, supply chains and networks. But, as an example, where smartphones and tablets work nearly perfectly in synching music libraries or sharing photos on social networks, they are not nearly so perfect in synching ERP workflows or sharing spreadsheet versions.

Middle East perspective

Consumerization and enterprization of IT have been and will continue to be the two common models in the Middle East. In 2015 and beyond we expect enterprization, in terms of scale, usage and scope, to only grow further and take the lead. Despite a lag compared to global trends, consumer-led developments, such as digital OTT services, are still gaining momentum with new products coming into the region. At the same time, governments and large enterprises are eager to materialize the benefits of initiatives such as big data, smart government and smart cities, guiding them towards becoming global leaders in technology and innovation.

Nevertheless, it is worth mentioning that the GCC is the focal point in the region's IT infrastructure and ecosystem development. Saudi Arabia, the UAE and Qatar are spearheading the development of big data at a national level. The region is witnessing a large number of events and deals that are shaping the future of industries. For example in the healthcare sector, partnerships between governments, telecom operators and technology leaders such as Siemens and GE are paving the way for locally induced innovation.

Large enterprises are also enhancing their IT systems and infrastructure to improve operations and become prepared for the future requirements of the global workplace. With some reports expecting ICT spend across Middle East and Africa to break $270 billion in 2015,[273] the region certainly earns its focus on enterprise-led IT.

Media

Digital Islamic Services: set for take off

Deloitte predicts that 2015 will be the year that Digital Islamic Services start to take off across the Middle East region and the world. If global and regional online benchmarks are used, we estimate within the next three to four years the region's Digital Islamic Economy to nearly double in size in terms of Muslim consumer spend on lifestyle products and services, from around $15 billion currently to touching and probably crossing $30 billion by 2018.[274] Muslim consumer spend on Digital Islamic Services in the region, driven by already high digital media consumption, will likely expand by as much as 25 to 30 percent across most areas of the Islamic economy in 2015 and beyond (see Figure 6).[275]

The anticipated surge in growth is a combination of a number of factors which have converged to synergize demand.

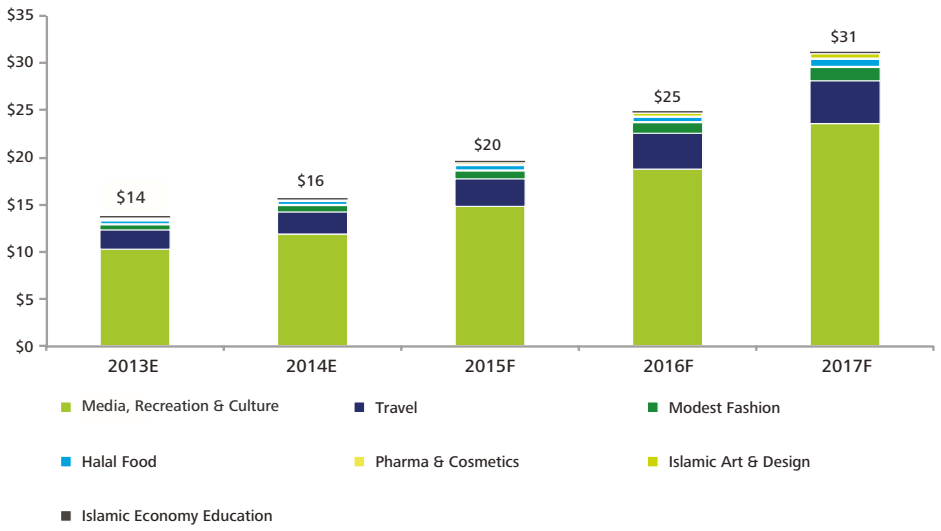
The Middle East, home to the cradle of Islam and around 15-20 percent of the world's Muslim population,[276] has the highest, youngest and wealthiest domestic concentration of Muslim consumers, growing rapidly in number and in technology readiness.[277] In 2013, Muslim consumers from the region have spent over $700 billion on all Halal lifestyle products and services, 35 percent of the $2 trillion global Muslim lifestyle spend (excluding Islamic Finance), more than any other region in the world.[278]

Geographically, the GCC has accelerated and modernized to become one of the most technology ready sub-regions, with more populated North African countries such as Egypt and Morocco advancing fast. With over 100 million users, regional Internet penetration is 35-40 percent and mobile at over 100 percent, has become ubiquitous.[279] Smartphone penetration at about 20-30 percent[280] and national broadband development across a number of Arab countries has also fuelled demand for online.

Ripe market conditions have already led to the widespread adoption of some Digital Services, such as social media and mobile gaming. Core Digital Services such as e-commerce have now also became established in the region with as many as 30 million online buyers.[281] However, at only two percent of the offline retail market (including travel),[282] less than half the worldwide online retail average,[283] such services are still massively underpenetrated in the region. The region's overall digital economy is therefore still in its infancy, but set to grow rapidly off a low base, for example in e-commerce sales, expected to outpace international rates at over 21 percent per annum.[284]

At the same time, the Islamic economy has also been growing and developing at an increasing pace. Key economic growth drivers include regional initiatives, for example Dubai's stated ambition to be the capital of the global Islamic economy,[285] developments in Halal infrastructure (e.g. dedicated Halal zones),[286] multinationals seeking growth markets and segments

Figure 6. Combined Muslim consumer spend online on lifestyle and digital products and services, 2013-2017



Source: Deloitte research, analysis and estimates, 2015, based on various industry sources

(e.g. Nestle in Halal Food),[288] and general advancements in Digital Services, which has enabled the Islamic economy lifestyle sectors to achieve a wider global reach and exposure.

Digital Services in particular over the past two years has resulted in the rising significance and popularity of Digital Islamic Services, exhibited through the rise and multiplication for example in online Islamic lifestyle magazines, Modest Fashion blogs and Islamic lifestyle app solutions.

Deloitte's recent Digital Services Maturity Cycle assessment, developed to assess the relative maturity and prospects of Digital Services in the Middle East over the next three to five years, identified a number Digital Services: Hobbies, Healthcare, Education and Religion (i.e. Islamic services), as unique emerging niches for the Arab world. Of these, Religion (i.e. Islamic services) was identified as the Digital Services category with the greatest prospects, closest to the peaking stage, which would take off with continued activity and development (see Figure 7).[289]

The past ten years has seen great advancements in the region's social and technology development. Coupled with its growth in the Islamic economy, the stars have naturally aligned.

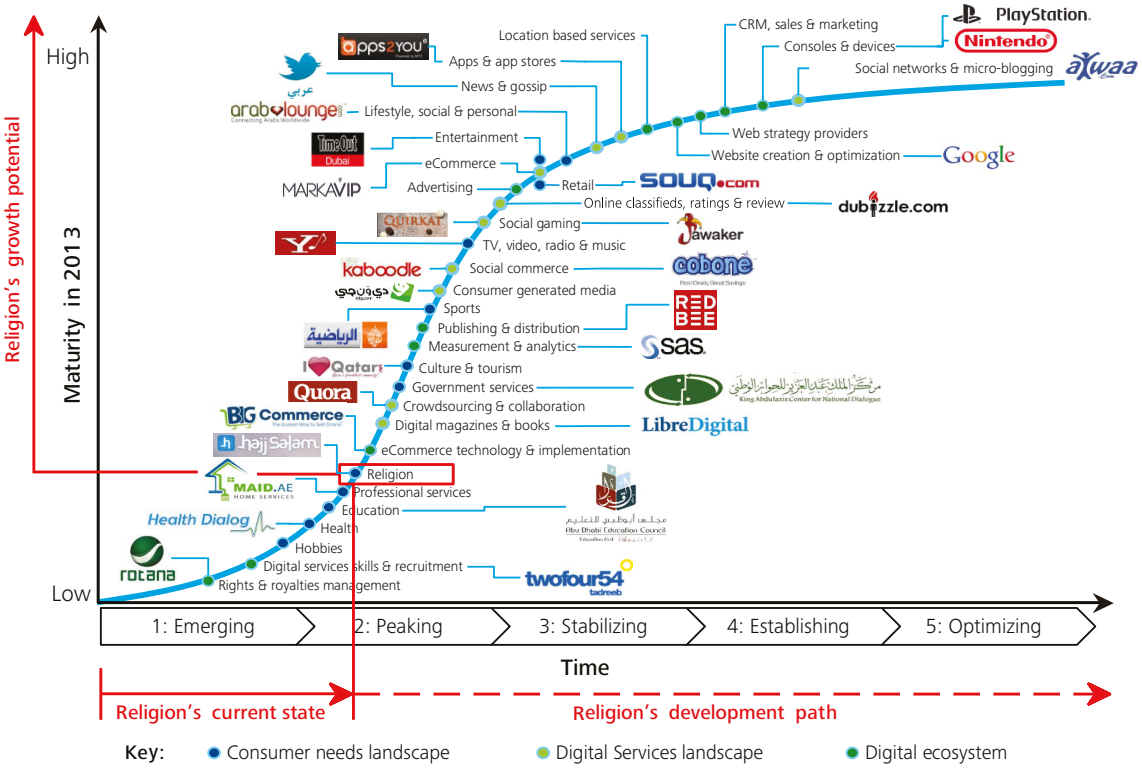
Side bar: The Islamic economy and Digital Islamic Services[290]

Islamic economy: The Islamic economy was first defined by the Dubai Islamic Economy Development Centre (DIEDC) in collaboration with Thomson Reuters, Dinar Standard and the Dubai Chamber of Commerce and Industry (DCCI).[291] Their widely accepted definition focuses on core sectors of the global Islamic economy and their ecosystem that have through Islamic values structurally impacted consumer lifestyles and business practices. Core sectors include: Halal Food, Halal Travel, Fashion, Islamic Finance, Media, Recreation and Culture (MRC), Pharmaceuticals and Cosmetics.[292] Deloitte's analysis of the Islamic economy also includes other emerging sectors such as Islamic Art & Design and Islamic Economy Education.

Digital Islamic Economy: The Digital Islamic Economy encompasses the entire online Islamic market. This includes the B2C market, such as consumer spend on Halal products and services via e-commerce, as well as B2B services, such as digital advertising for Halal or Sharia-compliant organizations. Our analysis of Digital Islamic Services also identified another two areas with digital activity: Smart Mosques and Standards & Certification, which are typically managed and controlled by governing and religious authorities.

Digital Islamic Services: Any technology, media, online product or service which addresses the needs of a Muslim consumer in the Islamic economy, facilitating their observance and practice of Islam. This can include both B2C and B2B services. In our prediction, estimates are focused on core B2C services.

Figure 7. Middle East Digital Services Maturity Cycle



Source: Defining the Digital Services Landscape for the Middle East, Deloitte, 2014

Sizing the Digital Islamic Economy

Our estimates and forecasts encompass multiple market assessments and growth factors. This includes the:

- Global Islamic economy: The total size of the world's Muslim population, 1.7 billion people,[293] and the size of the global Islamic economy in terms of Muslim consumer spend, currently estimated at over $1.8 trillion and forecast to be over $3.4 trillion (excluding Islamic Finance and non-Modest Fashion spend) by the end of 2019 (i.e. by 2020).[294]

- Regional Islamic economy: The size of the region's Muslim population, around 15-20 percent of the global population,[295] and each country's individual population levels (for per capita analysis), including its share of global Muslim consumer spending, 35 percent, of the total global Islamic economy.[296]

- Offline market (by sector): Muslim consumers' overall spend in the region, both offline and online, on Halal, Islamic or Sharia-compliant products and services in each Islamic economy sector (e.g. Halal Food) or in general as given by existing Muslim market reports (e.g. Media). The total market, herein referred to as the 'offline' market (as it is predominantly offline), for most Islamic economy sectors has already been defined, quantified and forecasted in the "State of the Global Islamic Economy" reports.[297, 298] Other sectors such as Islamic Economy Education and Islamic Art & Design are also based on authoritative industry reports and proprietary Deloitte research, analysis and estimates (e.g. Islamic Art & Design).[299] Our online market estimates, both current and forecasted, are therefore based on the current and future size of the offline market in each sector.

- Online market (by sector): Muslim consumers' usage of e-commerce and paid online services (e.g. online media streaming, content downloads). In addition to raw offline market size, each Islamic economy sector has an inherently unique level of online activity and penetration amongst Muslim consumers in the region. Each sector also has its own outlook for online growth, driving its share of online versus offline consumer spend.

- Industry benchmarks (by sector, regional and global): Each sector's Islamic offline and online market size and growth are analyzed against total regional and global industry benchmarks (i.e. Islamic and non-Islamic). For example, the region's online Halal Travel market is analyzed in line with the overall Middle East and global online travel market's penetration and growth. For sectors with fast moving consumer goods (FMCG) including pharmaceuticals and cosmetics, e-commerce globally has an average penetration of 4.7 percent of total retail sales, forecast to become 8.1 percent in 2019.[300] Regionally, penetration of retail e-commerce for FMCG is less than 1 percent of retail sales,[301] but forecasted to grow at over 21 percent through to 2017,[302] and most likely beyond. Penetration and growth in penetration is estimated for each sector, and applied to the forecasted offline market figures.

- Digital Services maturity assessment: Growth in Digital Islamic Services is not linear and analyzed in line with our assessment of the relative maturity of Digital Services in the region. The Religion (i.e. Islamic services) category is still emerging, but closest to the peaking stage (see Figure 7).[303]

In the years ahead, we expect the impending growth in Digital Islamic Services to widely proliferate across all areas of the region's Islamic economy. Key trends and developments we are seeing both in the offline and online markets in each sector verify strong growth in demand for Digital Islamic Services. In terms of size, the four largest growth areas of the Digital Islamic Economy (aside from Islamic Finance) are in Islamic Media, Halal Travel, Modest Fashion and Halal Food.

Islamic Media. Although media is not the largest in offline market size, it is certainly the most well developed online, as global industry reports indicate digital to make up a third of all media and entertainment consumption.[304] Accordingly, Muslim consumers in the region were estimated to have spent over $10 billion on digital media in 2013.[305] With the region's offline market growing at twice the pace of the rest of the world,[306] and the online market growing at double the rate of the offline market,[307] Deloitte predicts that regional Muslim consumer spend on digital media will jump to over $23 billion in 2017.[308]

This is echoed by many developments specifically in the Islamic Media space, such as through the rise in Islamic Media entrepreneurship. Notable examples include Kuwait's The 99, a Muslim comic book series which rapidly expanded into gaming and television across the region and to over 70 countries across the world. Sharjah Media Corporation's Munshid Al Sharjah, a popular reality talent show similar in format to Arab Idol, but dedicated towards finding the next Nasheed (Islamic inspired music) star from across the Muslim world, is another example.

Halal Travel. Online travel over the past 20 years has evolved to become one of the most core components of any travel, hotel, airline or tourism business. About a quarter of online travel sector revenues globally are made through online bookings.[309] However, in the region, e-commerce is still in its infancy, with online travel bookings only representing about 3.4 percent of total revenues.[310, 311] This may strike as an oddly low percentage, but still generated over $2 billion from Muslim travelers in the region, over a fifth of the region's e-commerce revenues in 2013,[312, 313] not such a small amount. With healthy double digit growth in the region's offline travel market and the region's e-commerce revenues set to grow by over 21 percent,[314] Deloitte predicts that regional Muslim consumer spend on travel will double in size, crossing $4 billion in 2017.[315, 316]

Naturally, the most pervasive of Digital Islamic Services seen in this vertical are online bookings services, ratings and accreditation platforms. In particular, Islamic friendly travel apps have also proved to be very popular, helping users to practice on-the-go (e.g. in-flight prayers, mobile travel guides).

Modest Fashion. Unlike travel, the online fashion business is still very small in comparison to the offline market, contributing only 4 percent in clothing and footwear sales globally,[317] and only 1-2 percent in the region.[318] Assuming that 40-50 percent of all Muslim consumer fashion spend is on Modest Fashion items,[319] this suggests a plus $0.6 billion online market in 2013.[320] However, Modest Fashion is growing quite fast at 13-14 percent offline[321] and almost double at 31 percent online.[322] Deloitte therefore predicts Modest Fashion revenues generated from Muslim consumer spend in the region to more than double, crossing $1.4 billion in 2017.[323]

Interestingly, it is important to note that the growth in Modest Fashion over the past decade has also coincided with the growth of Digital Services. This has helped many local Modest Fashion designers to start-up low-cost shops online (e.g. the region's world leading designers Rabiz Z and Balqees), engage with consumers directly through social media (e.g. Jordan's Hijabik, established online following astounding feedback of sample designer items posted on Facebook), market themselves through online blogs and magazines (e.g. Kuwait based Ascia AKF's plus 1 million Instagram followers after only a year of Modest Fashion blogging) as well as to build their own business network and knowledge base online.[324]

Halal Food. Fundamentally, Halal Food is by far the largest sector, with its offline market representing over 70 percent of the overall Islamic economy (excluding Islamic Finance and non-Modest Fashion spend), but with online sales at most only 0.1 percent of the region's offline market,[325] over $368 million in 2013,[326] and few dedicated homegrown Halal Food online and e-commerce services, it is also one of the most digitally immature. That said, offline market and e-commerce growth is strong, together providing plenty of opportunity to grow off a low base in this sector. We therefore expect regional online Halal Food services to grow by as much as 35 percent over the next few years[327] to surpass $840 million in 2017.[328]

Interestingly, it is important to note that the growth in Modest Fashion over the past decade has also coincided with the growth of Digital Services. This has helped many local Modest Fashion designers to start-up low-cost shops online.

Other sectors. Although the four sectors above are the most significant in offline and online consumer market size, the growth story does not end there.

The combined online Muslim consumer market for remaining sectors is estimated at about $246 million in 2013, out of which over $241 million is on **Pharma & Cosmetics**,[329] $3.4 million is on **Islamic Economy Education**[330] and $0.7 million is on **Islamic Art & Design**.[331] Although these are more niche areas, they have all shown strong historical growth, and signs to accelerate going forward. For example Islamic Economy Education, mainly focused on Islamic Finance courses, has experienced more than 20 percent growth in online learning platforms globally over the past five years, 30 percent of which are estimated to be in the UAE.[332] Global Islamic Art sales, mainly from the region, have also expanded on average at 22 percent per annum over the past decade from 2001 to 2011.[333] With such strong and consistent growth, Deloitte predicts online Muslim consumer spend on Pharma & Cosmetics, Islamic Economy Education and Islamic Art & Design to cross $552 million,[334] $7.8 million[335] and $1.6 million[336] respectively in 2017 respectively.

Overall growth in the offline market is also spurring developments in the digital domain. For example Sharia-compliant crowdfunding and online incubators such as Yomken and Shekra in Egypt are exemplar platforms which have only sprung up within the past few years and experienced rapid success in a short-time.

Beyond Muslim consumer markets, further areas of Digital Islamic Economy growth also lie in other areas.

Islamic Finance, with an offline market of over $1.6 trillion in 2013 (in total asset base),[337] is effectively another economy on its own, experiencing high growth at an industry-wide level. The Middle East region alone represents around half of this, with at least $743 billion in commercial Islamic bank assets.[338] Overall growth in the offline market is also spurring developments in the digital domain. For example Sharia-compliant crowdfunding and online incubators such as Yomken and Shekra in Egypt are exemplar platforms which have only sprung up within the past few years and experienced rapid success in a short-time.

Smart Mosques. Although still at a concept and experimental stage; greenfield Smart Mosques are also being introduced and piloted by GCC countries, namely in the UAE and Saudi Arabia.[339] Earlier last year, Dubai unveiled its first smart mosque, enabling and encouraging worshippers to interact, for example, using their mobile devices and quick response (QR) codes to access services such as mosque information.[340]

The unification and cohesion of **Standards & Certifications** in the Islamic economy is another development area, with very few online players across the world. With over 300 different standards for the Halal Food sector alone,[341] there is confusion around Sharia-compliant standards. The largest and most obvious need is for online platforms which can be used to facilitate accreditation, certification and verification processes. Currently, the focus is on the implementation of technology ensuring Halal-compliant food preservation and packaging technologies. The use of technology for Halal traceability is limited.

Middle East perspective

Muslim consumers; sometimes referred to as the 'next billion',[342] represent one of the most powerful consumer groups in the world. The Middle East region, with the highest share of Muslim consumer spend, some of the fastest rates of technology development and adoption, and its desire to lead the world in Islamic economy development, creates an ideal environment for the Digital Islamic Economy, and in turn Digital Islamic Services, to flourish. The growing value of online Muslim consumer spend in the region is testament to this.

Opportunity is not limited to only consumer e-commerce (B2C). Across all industry verticals, there is also a clear underutilization of other B2B services such as digital marketing, which could help many existing service providers maximize their Muslim consumer reach and penetration. 'Farm-to-fork' tracking of Halal Food is also needed to facilitate greater transparency across the supply chain. A large gap and need to unify Standards & Certifications in all areas of the Islamic economy also persists, causing increased confusion in both consumers and authorities. With so many untapped needs also in the B2B space, we therefore believe that the Digital Islamic Economy in its entirety and the opportunities therein, beyond consumer goods and B2C services, is actually far larger.

However, such opportunities, as with any, are not immune to challenges. The permissibility of technology and media, as well as the actual extent of its use is an ongoing moral debate in itself, with its own spectrum of views.[343] Beyond this, the viability of digital solutions needs to be carefully considered. Existing and prospective Digital Islamic Services providers need to remain focused on understanding and addressing practical Muslim needs, which has many variants. Geography is one such variant. For example, a Halal Food restaurant finder will be very useful in countries with Muslim minorities, where it is difficult to access Halal Food, but would have minimal impact here, where, by default, Halal Food is readily available everywhere. Other variants include transparency and sensitivity. Singapore's CrescentRating is successful in providing Muslim consumers information on the best Halal Travel destinations and providers to facilitate their travel decisions through a Halal rating system.

Another challenge is in funding. Our interviews with players across the Islamic economy spectrum confirm that the digital ecosystem around Islamic needs is still at a fledgling stage, with significant need for investment. The Middle East region benefits from an active investor community, particularly in the technology, media and telecommunications (TMT) sectors, representing the clear majority of venture capital transactions. Despite this, our review of the global and regional TMT funding landscape, however, reveals limited VC funds in the Middle East (although Sharia-compliant) specifically targeted at Islamic needs and Digital Islamic Services, implying a huge gap in this space that needs to be filled. Ultimately, lack of investment was cited as the reason why successful innovations such as ImHalal.com, a 'Halal' search engine similar to Google but designed to filter content deemed as Haram (forbidden), eventually had to shut down. The service was hugely successful, which attracted around 10 million visitors, over 70 Million search queries, and won the Halal Industry Development Corporation's (HIDC) Best Halal Innovation Award.[344]

Internationally, movement in this direction has started to take place, with new funds and initiatives launched in 2014 dedicated to investing in the Islamic economy, especially in Malaysia, a key Islamic market.[345] In the Middle East, Investors, incubators, NGOs and government authorities should come together to support entrepreneurs and Digital Islamic Services innovations, especially if the region seeks to be a hub for activity and lead in this space.

We are yet to also see interest from global players such as Google and Yahoo! in the Digital Islamic Services space. With limited funds in the region specifically targeting the Islamic needs sector; the Digital Islamic Economy largely remains untapped.

Short form video: a future, but not *the* future, of television

Deloitte predicts that in 2015 total time spent watching short-form (under 20 minutes' duration) video online will represent under three percent of all video watched on all screens. Short-form revenues will be about $5 billion: by comparison long-form TV content will generate over $400 billion from advertising and subscription revenues alone.

These ratios may appear surprising, given that short-form is often proclaimed as the future of television. A brief foray on the Internet reveals many articles, with eye-popping numbers to accompany, arguing that short-form is already dominating over long-form, mostly at the expense of traditional TV.[346]

Some stats seem to suggest that short-form could usurp traditional long-form television. One of the most successful TV shows in the US at present, *Big Bang Theory,* attracted an average audience of 17.5 million viewers in its most recent season, with each episode broadcast in a 30-minute slot.[347] In comparison, Korean star PSY holds the title for the most-watched video on YouTube, *Gangnam Style,*[348] which has amassed over two billion views since its release in 2012.[349] PSY's official channel has had almost four billion views.[350]

It is not just professional music videos that can generate billions of hits: the home-made, low-budget clip can do even better. By December 2014 PewDiePie, a UK-based Swede, had amassed seven billion views and 32.5 million subscribers,[351] and was adding a further 350 million views per month.[352]

His videos, mostly voiced-over video game play, typically get a few million views each, and since 2010 he has accumulated billions of views by posting over 2,000 clips.[353] To place that number of clips/episodes in context, the longest-running current TV show is the Simpsons, with a 'mere' 560 episodes and counting.

Opening children's toys on camera can also generate billions of views. DisneyCollectorBR is a non-Disney affiliated 'channel' (a collection of uploaded videos) whose core output is to show new Disney-branded children's toys being taken out of their box and used, accompanied by a voice-over.[354] About fifty new videos are posted a month.

The top 100 YouTube channels generate over ten billion views per month globally.

Yet despite these successes – and there are many more – short-form generates a small percentage of all screen-based viewing time, and an even smaller proportion of revenues. How can short-form's numbers be so big, and at the same time also so small?

The answer lies with metrics: comparisons of short-form and long-form are often based on similar-sounding but unequal metrics. Short-form is measured in views; long-form in viewers (see side bar: Views and viewers). Short – and long-form both have subscribers; but for the former the marginal cost is a click; while for long-form it is a commitment of at least a month, and sometimes several years.

Side bar: Views and viewers

Television viewing is typically quantified by viewers (live or within seven days) and online video by all-time views. There are fundamental differences between these two metrics, which are occasionally overlooked when comparing traditional TV with newer forms of video format.

In mature television markets, over $2 billion is spent globally measuring TV viewing among a representative sample of respondents every year. Whenever anyone in the sample is in front of a TV set, their viewing habits are recorded and aggregated. The approach is typically agreed by all key industry players, and acts as the 'currency' that underpins the $200 billion global TV advertising industry.

With online video, the definition of a view is typically any request made to a server to play a piece of video. There is no agreed measurement of what constitutes a view, and a view could be anything from a millisecond to the entire clip. According to comScore's data, the average length of a 'view' is about four minutes.[355] There do not appear to be any industry-wide or national standards for measuring online video views.

There is no certainty that a video is actually visible on a screen when it is playing; it may well be playing 'under the line', on a part of the page that is not visible on a screen. There is no data on how many people may be watching each view. There is also no way of knowing for sure how each online video is used. Music videos, like music stations on TV, may be used more as a jukebox, playing music in the background, rather than as a conventional video service where viewers predominantly look at a screen.[356] Of the top ten all-time views on YouTube, which together have amassed billions of views, nine are music videos.[357] Up to 40 percent of all online video views may be views of music videos.[358]

While harmonizing different metrics is never entirely straightforward, comparing on a like-for-like basis reveals a distinct consumption pattern.

We estimate that 10 billion hours of aggregate online short-form video per month should be shown on screens, but not necessarily watched, in 2015.[359] This is a spectacular achievement for a format that barely existed a decade ago, but it is equivalent to only 20 hours' worth of global consumption of long-form video (television programs and movies). Deloitte estimates that in an average month over 360 billion hours of long-form video will be watched,[360] principally on television sets, and mostly live.[361] We do not expect this total to vary substantially over the coming years.

Online short-form content should generate about $5 billion of advertising revenue in 2015.[362] This compares to about $210 billion from long-form advertising on television.[363] We expect short-form subscription services to be in experimental phase in 2015 and to generate trivial revenues; turnover for long-form pay-TV subscriptions should be approaching $200 billion.[364]

The production values, monetization, genres, devices and consumption patterns for short-form are likely to differ markedly from long-form.

In 2015 long-form television shows are likely to have budgets of up to several million dollars per hour, and tens of millions of dollars per series.[365] We believe that short-form production budgets are typically in the thousands to tens of thousands of dollars per clip. They can't be much higher: a short-form video that gets a billion views at a $2 CPM may leave a little over a million dollars, after deducting the platform's commission.[366] And fewer than a couple of dozen on-line video stars are likely to generate in excess of a billion views in 2015.[367] For most, a billion views would likely require dozens, and often hundreds, of videos to be created.

The available budget influences the most popular genres on short-form aggregation sites, namely: music; how-to clips (predominantly of make-up and video games); video game play; clips from traditional TV programming (such as individual comedy sketches and sports highlights); unboxing (mostly children's toys being opened); movie trailers; and entertainment news.[368] Original content is mostly low-cost relative to long-form, with recording equipment usually consisting of a single modest camera, no special lighting, and often self-shot. The exceptions to this rule are music or movie trailers and TV excerpts.[369]

These popular genres of short-form video differ entirely from the most-watched types of television program in 2015: drama, soap operas, family entertainment, sport and reality. The reason these types of program may never become major hits on short-form sites is down to budget – premium global TV sports rights alone are expected to be over five times the value ($28 billion) of short-form revenues ($5 billion) in 2015.

The two formats are unlikely to encroach on each other's screens. Short-form is consumed mostly on laptops, smartphones and tablets, and is often watched in short bursts, to fill gaps during the day, when waiting for a friend, or to 'graze' or when distracted. The brief length of a short-form view is a factor in the challenge in monetizing directly the format: a viewer may only tolerate watching a single, brief video ad prior to watching a two-minute clip.

By contrast, television is watched predominantly in the evening, is often 'appointment-to-view' (that is, time is scheduled and set aside to consume those programs) and long-form is primarily watched for several hours per session. In many homes the TV is turned on a regular time, and left on for 3-4 hours every night. Long-form viewers are more tolerant of advertising breaks with multiple ads, if this comes after 15-20 minutes of program.

Many viewers may well also prefer long-form content as it reduces the need to choose. Short-form, by contrast, can require multiple choices to be made every hour.

We expect short-form only rarely to be watched on a television set (under five percent of all short-form viewing). This is partly because the age group with the highest consumption of short-form content is the under-30s, who are more likely to consume video content on a laptop, and also less likely to own a television set. But another reason is because short-form content is usually optimized for smaller screens; low-production values feel edgy on small screens, but may irritate on larger screens.[370]

Online short-form content should generate about $5 billion of advertising revenue in 2015. This compares to about $210 billion from long-form advertising on television.

Short-form's bold rise in the Middle East: a new viewing format complementing traditional long-form television

Deloitte predicts that in 2015 total time spent watching short-form video online will also represent under three percent of all video watched locally on all screens, in line with its global sub-three percent share.

On average, the region's viewers will consume an estimated 545 million hours per month[371, 372] of short-form video (5.5 percent of global short-form estimates) in addition to watching over 23 billion hours per month[373] of traditional long-form television (about 5 percent of global long-form viewership).

Traditional long-form consumption in the region is based on well-established television viewership patterns, which historically, at about 3.11 hours per day in 2012 and 3.10 hours per day in 2009, have not changed dramatically over the years.[374] As such, we expect long-form consumption to remain more or less consistent, in line with global trends, driven by steady television household growth, in the years ahead.

Short-form on the other hand is a relatively new sensation, and one that has also exhibited arguably even greater success at home than abroad. At the turn of this decade, the Arab Spring, which catapulted YouTube's success in the Arab market,[375] had triggered the Arab digital revolution, and set the stage for short-form video in the region. Since then, the format's local adoption has grown from strength to strength. Today, at around 70 percent penetration with localized versions across eight Arab countries (e.g. Saudi Arabia, UAE, Egypt and Morocco),[376] the Middle East is YouTube's second largest market worldwide,[377] second only to the US.[378]

With YouTube's recently reported 50 percent year-on-year increases in its viewership growth, both in the Middle East and globally,[379] annual content consumption on YouTube alone in the region, at this rate, is set to increase from its reportedly 5.3 billion hours last year[380] to 7.94 billion hours this year.[381]

A myriad of regional cases testify to short-form's (and YouTube's) late success in the region.

For instance, in 2013, the spoof video by Saudi comedians Hisham Fageeh and Fahad Albutairi, *No Woman, No Drive*, mocking the country's ban on female driving, attracted over 12 million views within a few days.[382]

One of the channels from Jordan's Kharabeesh, an animated and satirical channel about regional issues, was named one of YouTube's top 10 channels in 2013 with over 68 million views, now averaging about 23 million views a month.[383]

Creative Culture Catalyst (3C), a Riyadh-based web production house, runs a comedy-focused YouTube channel; Telfaz 11. Its most popular show *La Yekthar* ("Put a Lid on It" or "Zip It") has accumulated over 80 million views[384] and over 755,000 subscribers.[385]

Another Saudi-based media company UTURN Entertainment Group, established in 2010, is an exclusive content producer for YouTube. Their most popular show *3al6ayer* ("On the Fly") attracted over 66 million views and around 850,000 subscribers.[386]

The extent of short form's success in the region has been such that large players such as Al Jazeera have also embraced the format. For example, the network launched Al Jazeera Frames, an online portal consisting of selected short three to five minute social documentaries in various formats from film to animation. The initiative seeks to promote the online community's most talented filmmakers and directors and raises awareness of important social issues which arise from their coverage.[387]

These are highly impressive statistics and achievements, and emphasize short-form's rapid success in the region, especially in the much shorter timeframe than the US has had. Aside from the aforementioned differences in short-form as a distinct viewing format, its rise has its own story in the region. A number of factors and forces are behind short-form's rapid local uptake.

Firstly, short-form is widely perceived to be and used as a more authentic, uncensored and trustworthy source of information, like social media. Anytime a controversial event occurs, short-form videos can be uploaded on YouTube to tell the story, which could otherwise be censored or suppressed. Ultimately this was the spark behind the Arab Spring, where YouTube was widely used by Arab users to track political events and keep in touch with the real story on the ground. The platform is now highly used as a tool for freedom of expression, creativity and a reference point for regional news. This is seen in our recent study of news consumption in the Middle East region (Egypt, Saudi Arabia and the UAE), where 75 percent of news consumers surveyed revealed that they would be more likely to access a news story if it is accompanied by video, and 83 percent claimed that video improves their understanding of news.[388]

Secondly, short-form video can be very interactive. For instance, YouTube in the region is used more as an interactive rather than a pure passive viewing platform. Surveys of short-form viewing in the region confirm this, where in the UAE 75 per cent of participants said they are using YouTube not only to view videos, but also to communicate with friends and other users.[389] The same survey shows that in Saudi Arabia 35 per cent of users have shared their own short-form content via uploading on the platform.[390] This is reflected in some of YouTube's latest headline statistics, which reveal that two hours of video from the Middle East region are uploaded on the platform every minute.[391]

Thirdly, mobile in particular is driving local short-from consumption. The ongoing rise of smartphone penetration has led to the Middle East region becoming the first in the world to consume the majority of the format on mobile devices.[392] This is shown in one survey, which shows a majority 59 percent of YouTube traffic in the Middle East & Africa region was via mobile, one of the highest rates in the world.[393] For instance, in Saudi Arabia, 50 per cent of short-form YouTube content is accessed via a mobile device. Similarly, in the UAE, 40 per cent of YouTube content is consumed on mobile devices.[394]

Fourthly, the Middle East youth, at 70 percent of the population (aged less than 35 years),[395] is also driving short-form's adoption and consumption. This is evident in our demographic analysis of YouTube users, which shows that the majority (50 percent) of daily YouTube users are less than 35 years, whereas 35 percent are aged 35 to 44 years, and the remaining 15 percent are aged 45 years or more.[396]

Given short-form's rise and success, how does it stack up against long-form in the region? In dollar terms and viewership levels, traditional long-form television, both locally and globally, is still king.

In 2015, we estimate that regional short-form revenues will be in the range of $150-200 million (3-4 percent of global short-form revenues).[397] In line with global expectations, this will also be driven by advertising, mainly on YouTube, as experimentation with subscription services will carry forward into the region as well. Compared to long-form video, this is a factor of ten smaller, which itself we estimate will generate over $3 billion (under 1 percent of global long-form) this year, with over $2.3 billion from advertising and over $700 million from subscription revenues.[398]

In viewership terms, the significance of long-form over short-form is even clearer in the Middle East, where long-form television in the region typically has 10-100 times more viewers than short-form.

For example MBC's top 10 dramas alone have amassed more than 0.6 billion viewers in 2013, ranging from 48 million to over 123 million viewers.[399] *Arab Idol*, MBC's flagship show and one of its most popular, in just its second year in 2013, had amassed over 100 million viewers.[400] This is far more than the regional short-form success cases we have examined, which at most have tens of millions of viewers.

The difference is also clear when comparing average time spent online (which includes streaming short-form videos amongst other activities such as social networking) against average time spent watching traditional television. Our surveys show that, on average, viewers in the region spend almost an hour more per day on long-form television than online, where short-form video is often accessed online.[401]

This difference is multiplied further when comparing total hours viewed across both long and short forms, reflected in our overall prediction for short-form in the region.

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Bottom line

We do not expect short-form online content to usurp long-form traditional television.[402] It is a future, but not *the* future, of screen-based entertainment; and it is unlikely ever to be the predominant video format, as measured by hours watched or revenues. Short-form's success should be respected, but it needs to put in context. Any claims about short-form usurping traditional long-form content should be analyzed carefully, using comparable metrics (see side bar: Big Bang Theory and Gangnam Style: a comparison).

Short-form should not be considered as a direct competitor to 'traditional' long-form content, but rather as an additional screen-based medium, addressing needs that were previously un-served or which were catered for by other media, such as magazines, guides to playing video games, or cookery books.[403]

Stars are likely to emerge from short-form, but they may well have to diversify to monetize their fame as advertising to increment revenues. For example Zoella, a UK-based video blogger (vlogger), has signed make-up and book deals on the back of her online ubiquity.[404] Zoella's first book holds the UK record for first-week sales, at 78,000. Vloggers looking to increase their revenues should observe product placement regulations carefully; as short-form gets a higher overall profile, it is likely to come under closer scrutiny.[405]

Multi-channel networks, set up to aggregate vloggers, may also need to look to additional revenue streams, such as taking cuts from ancillary deals with brands that are looking to tap into vloggers' reach.

A charge often made of traditional TV advertising is that some of this is ignored or skipped over. Digitally served advertising is often assumed to be more precise. However, is also the case that short-form videos may also be skipped, ignored, muted, or even be played out 'below the line', that is outside of the current field of view.

Regardless of whether the ads on short-form are watched all the way through, the most popular short-form videos are often ads in themselves. A toy being unboxed should promote interest in that toy; someone watching a video of games play is more likely to purchase the game; music videos can stimulate demand for paiddownloads and concert tickets.

Side bar: Big Bang Theory and Gangnam Style: a comparison

At first glance short-form's billions of views make television's mere millions of viewers look meagre. *Big Bang Theory,* averaged 17.5 million viewers in the 2013-2014 season.[406] By comparison, as of end-2014, Korean star PSY's hit *Gangnam Style*[407] had amassed over 2.1 billion views since 2012.[408]

If we convert both viewers (of *Big Bang Theory*) and views (of *Gangnam Style*) to total hours viewed, we estimate US residents have spent, in aggregate, 38 million hours watching *Gangnam Style* since 2012. This is equivalent to the total viewing time for four-and-a-half episodes of *Big Bang Theory* in the US market, or one fifth of a 24-episode series. We have assumed that the average view of *Gangnam Style* is 200 seconds (80 percent of the total time), and that a third of all global views have been in the US.[409]

Middle East perspective

Much of the general rationale around short-form versus long-form is universal and also holds true in the Middle East. Across all levels (consumption, viewers and revenues), the fundamental difference and significance of long over short-form is starkly clear and far more apparent in this part of the world.

Even so, short-form has had a big positive impact in the region, arguably more so than in other markets, and its evident success cannot be overlooked. The resounding popularity and scale amassed by short-form as a newer format in the Middle East offers a tremendous platform and opportunity for regional media companies, advertisers, new talent, talent seekers, content producers and consumers alike.

Advertisers have recognized this, and, with the top 20 advertisers in the region all on YouTube, have integrated short-form as a key part of their marketing strategies and campaigns. For example, brands such as P&G are sponsoring up to 250 channels, that were developing content specifically for Ramadan across multiple categories including cooking, lifestyle, beauty and so on.

Media players in the region have also spotted and jumped onto short-form's bandwagon, integrating short-form content as part of long-form programming in different ways. MBC now offers viewers of its popular Turkish drama series five-minute episode recaps the day before it is aired on television.[410] Sharjah Media Corporation's popular reality talent show *Munshid Al Sharjah*, similar in format to *Arab Idol*, but dedicated towards finding the next Nasheed (Islamic inspired music) star from across the Muslim world, enables contestants to audition online, by submitting short audition videos up to three minutes in length.[411] Al Jazeera had partnered with YouTube to create a short-form video archive of "Iraqi voices" (Iraqi citizens' views), featured as part of its long-form coverage of the 2010 Iraq elections.[412]

Investment funds such as twofour54's ibtikar, uses short-form series such as *What's Up UAE*, an adventure show, to promote sites and destinations that the UAE has to offer.[413] Similarly, the *Qasr Al Hosn* series, which consists of 13 short-form video segments, covers the event which was held in Abu Dhabi to celebrate its 250-year history.[414]

YouTube's Partnership Program, in which it shares a portion of its advertising revenues with its users ('Partners') based on the popularity of their content and viewership statistics, has enabled innovative content creators to commercialize themselves through the platform.[415] Jordan's Kharabeesh, with over 50 YouTube channels and over 2 million subscribers, generates in excess of 30 percent of its revenues from YouTube alone.[416]

As such we expect short-form to only rise in its complementarity to traditional long-form television. A key challenge inhibiting short-form revenues is in pricing, which is still low in the region. Compared to a multi-billion dollar US market, short-form revenues in the hundreds of millions is very low, especially for a region which is meant to be the second largest consumer of short-form content (vis a vis YouTube) in the world.

In any case, growth in short-form revenues will continue to be spurred by many businesses, both small and large, buying into the new format, having recognized the value in its ability to reach an increasingly online Arab population.

The ‘generation that won’t spend’ is spending a lot on media content

Deloitte predicts that US and Canadian millennials[417] will spend over $62 billion on media content in 2015. This is greater than the total spend on Internet advertising in the US and Canada,[418] and as such represents a significant contribution to the media sector from the generation of 18-34 year-olds often accused of defaulting to unpaid sources of content.[419] There are 83 million millennials in the US and Canada, and $62 billion of spending on media content equates to $750 each.

These numbers may surprise given other trends and perceptions: haven’t millennials stopped buying CDs, subscribing to newspapers, or paying for cable TV? So how can 18-34 year-olds in these two countries spend an average $750 on media in 2015?

The reality is that millennials are spending less on traditional media than they did in the past, and less than older generations, but they are still spending (see Figure 8).

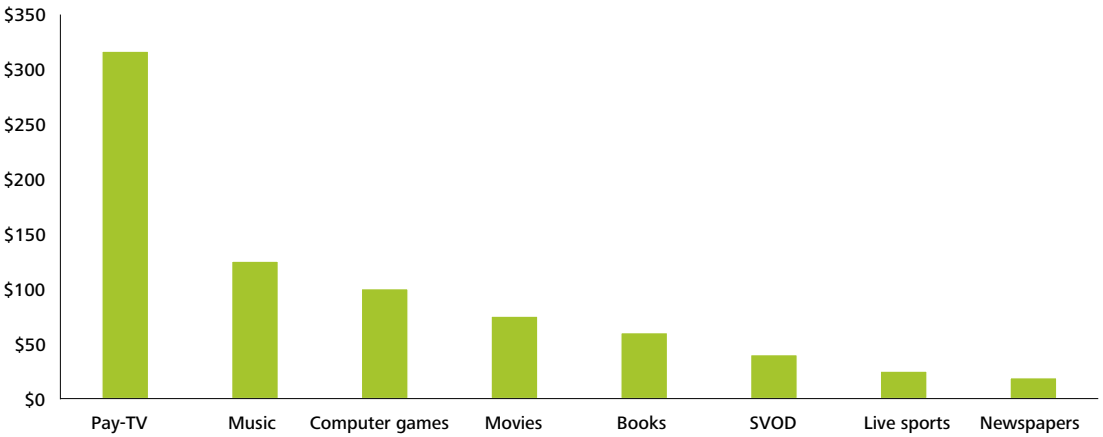
The biggest media expenditure for most households in the US and Canada is pay-TV. This is also true for millennials, almost half of whose annual media spending ($316 of the expected $750 total) is on traditional pay-TV. About 70 percent of 18-34 year-olds live away from the parental home, and 80 percent of those are in a household that will pay for TV in 2015, with each subscription shared by 1.7 people who are 18+, for an estimated $316 spend on TV.[420, 421] About four-fifths of all 18-34 year-olds have access to pay-TV bundles, at an average cost of $80 per month.[422, 423]

Of the remaining 30 percent of Americans 18-34 who live at home,[424] even though their parents may be opting for premium services to keep the kids happy,[425] we assume millennials are not paying or contributing to subscription costs.

Turning to music, while millennials purchase little physical content, music is still a big part of their budget, at $125 in 2015. We estimate that 80 percent will attend a live event, and that most would like to spend more on live music than in prior years.[426] This reflects the long-term trend across all age groups: between 1990 and 2010, spend on music concerts, performing arts and sporting events doubled from a quarter to a half of a percent of total consumer spending.[427] We also estimate average spending on live music among 18-34 year-olds will be about $100, which is more than double the average $48 per capita in the US as of August 2014.[428] Additionally, we forecast that millennials will spend $25 on average on digital music downloads and streaming in 2015. Younger consumers represent a significant proportion of streaming service subscribers; an estimated 40 percent of Spotify’s 50 million monthly active users and 12.5 million[429] premium users are 18-24.[430]

We expect that US and Canadian millennials will spend about $100 on video games in 2015, or $8 billion in total. This age group over-indexes among video gamers: two-thirds of 16-34 year-olds describe themselves as ‘regular’ or ‘avid’ gamers, compared to only a third of non-millennials. We estimate that millennials will account for about a third of the $22 billion spend on computer games in the US in 2015.[431]

Figure 8. Millennials’ $750 spend on media content in 2015



Source: Deloitte, 2014, based on multiple sources

Millennial spend on movies should average a little more than $75 in 2015. While they are the group most likely to watch movies on different screen sizes,[432] appetite among millennials for the movie theater should remain strong. We expect the youngest millennials, 18-24 year-olds, while just a tenth of the population, will purchase about a fifth of all movie admissions in the US and Canada in 2015, equivalent to eight movies.[433] We estimate that on average, the overall millennial population of 18-34 year-olds will watch 6.5 films per year, and pay an above-average ticket price of $12: they will attend on busy Friday and Saturday nights[434] and pay more than the average ticket price of $8 in the US which is lowered by the reduced rates for children, seniors, and students.[435]

Spending on books is likely to be about $60 of the $750 total. The typical millennial reads books, both print and digital, with a median consumption of five per year in the US. We assume that 18-34 year-olds will pay $12 per book on average,[436] with textbooks often costing tens of dollars.

Streaming video on demand services (SVOD) will likely add another $40 in 2015. In both the US and Canada, SVOD services such as Netflix are used by 43 and 35 percent of 18-34 year-olds respectively.[437] At $9-$10 per month per service, or over $110 per year, this suggests an average expenditure of at least $40.

As for live sports, we estimate millennials will spend an average $25. North American live sports gate revenues are estimated at $17.8 billion in 2014[438] or nearly $50 per capita. Although millennials may be less devoted fans of major league sports than older generations, the difference is minimal: 93 percent of all North Americans watch TV sports, compared to 86 percent of 18-34 year-olds.[439]

A sixth of US millennials, or over 12 million, is likely to subscribe to a print newspaper in 2015, paying about $120 per year, which means the average millennial will spend nearly $20. American 18-34 year-olds are half as likely as the national average to subscribe to a print newspaper,[440] but spending has declined rather than ceased. Assuming a $10 monthly average spend per newspaper consumer, for ad hoc purchases as well as subscriptions (and not even counting digital subscriptions)[441] that would be $120 per year for those younger readers, and $1.4 billion in annual revenues for the US newspaper industry, or about ten percent of all circulation revenues.[442]

Cumulative media spend of $62 billion for this age group in the US and Canada is a significant amount, but this is less than five percent of their total expected spending of $1.45 trillion.[443] It may seem that 18-34 year-olds are allocating less of their spending power to content than people of similar ages did in the past. However spending less on content is surprisingly expensive: consuming news, video and music for free requires expensive hardware and high-speed wired and wireless Internet access. The typical millennial owns one or more new smartphones and has a big monthly data plan. Streaming video over a wireline connection requires a fast service (at least 5 Mbit/s to stream high definition video)[444] with either a big cap or unlimited consumption. Millennials who replace their PC and tablet every four years and their games console every five would spend about $3,000 per year on technology hardware and connectivity.

The $750 annual content spend by millennials in the US and Canada is all well and good. But how is that figure likely to compare with other parts of the developed world, specifically Western Europe and Japan?

We expect pay-TV to be the largest segment of spend, as in the US and Canada, at about $100 annually. Spend however is highly variable. Japan is the third-largest pay-TV market in the world, but at $8 billion in 2013,[445] it is less than a tenth of spend in US and Canada of almost $90 billion.[446] Pay-TV spend in the UK is higher than the rest of Europe, but penetration at 57 percent and spend per month about $60 are both lower than in the US and Canada.

Our estimate is that the other major components of spending may be lower than in the US and Canada, by a similar proportion. 18-34 year olds in other countries go to concerts, listen to music, attend sporting events, go to movies, and even read books. The rates vary, and the price paid can be very different, but we expect that non-TV spending is at least $200-250 in the rest of the developed world compared to over $400 in North America, suggesting that their total spend is on the order of $300-350 annually. Across over 110 million millennials in those countries,[247] that is another $33-38 billion in content spending. Taking all countries in the developed world together, that gives a total of $100 billion.

Middle East: Arab millennials are spending less, but still spending

Deloitte predicts that millennials in the Middle East will spend up to $15 billion on media content in 2015, around $120 per millennial, in purchasing power parity (PPP) terms. Millennials in the Middle East represent over 37 percent of the total regional population, a total of around 123 million millennials.[448] They are the most influential age group as they make up a significant portion of the population. High rates of smartphone adoption, broadband, technological advancements and increasing literacy rates play a key role in the growth of media consumption in the Middle East in 2015 and beyond. Despite these advancements however, media spending by millennials in the region is quite low in comparison to more developed markets such as North America.

Unemployment amongst millennials in the region is quite high, at around 25 percent. Youth employment in the region has been impeded by weak economic growth, which has been emphasized by political issues and uncertainties. This has resulted in high rates of emigration to GCC countries which already host large numbers of Arab expats looking for better employment opportunities.[449] As a result of a very diverse set of markets across the region with varying purchasing power, media spending is heavily skewed towards the GCC. Compared to millennials in Canada and the US (North America) who are expected to spend an average of $750 per capita on media in 2015, millennials in the Middle East are expected to spend an average of around $120[450] in PPP terms – where the majority is spent on the three core segments; pay-TV, music and computer games.

Pay-TV uptake in the Middle East. Pay-TV in the Middle East is gaining steady momentum, although it still lags in comparison to global benchmarks, with penetration estimated at 10 percent of households.[451] This is due in large part to the widespread availability of free-to-air (FTA) channels; accessibility to free online streaming and general low spend on pay-TV. However, the large portion of tech-savvy millennials who are typically willing to pay for television entertainment demonstrates optimistic growth opportunities for the pay-TV industry. By 2017, Saudi Arabia is expected to be the largest pay-TV market in the Middle East generating annual revenues of $466 million, compared to $404 million in the UAE and $258 million in Egypt.[452]

In addition to lower spending on pay-TV in the Middle East, structural societal differences compared to the West also contribute to relatively fewer millennial households in the Middle East. The number of millennials living outside of their parents' home tends to be lower compared to North America, due to a combination of factors including traditional values and concerns over increasing living costs – in general, there are fewer millennial homes in the region. Households in the region also tend to be typically larger than in other regions, often sharing one pay-TV subscription. At an average cost of $19 per month per household for a pay-TV package,[453] Deloitte predicts that millennials in the Middle East will spend a total of $548 million per year on pay-TV, equivalent to an individual average of $11, in PPP terms.[454]

Spending on music is relatively limited compared to North America. The music market in the Middle East is estimated to be valued around three billion dollars[455] compared to $15 billion in the US alone.[456] The lower spending on this segment is attributed in large part to the availability of free downloads in addition to limited accessibility of live music, which is heavily concentrated in the UAE.

The music industry in the Middle East has faced widespread challenges in the face of piracy. Around 50 percent of consumers access music through free online downloads, while only eleven percent pay for legal online downloads.[457] International digital music players have limited presence in the region - such as iTunes, which is focused more on the application rather than the music market.[458]

Live music has witnessed optimistic growth over recent years as the UAE has become a regional hub for concerts, attracting high profile international artists and becoming home to large-scale annual festivals such as the Jazz Festival. Concert tickets are available at an affordable range – starting at around $65.[459] This is generally limited to those residing in the UAE, with the occasional larger scale concerts attracting concert goers from outside of the country.

Lebanon has also become recognized as a center for music in the region. Lebanese artists have traditionally been amongst the most popular Arab artists to appeal to a broad pan-Arab audience.[460] Lebanon capitalized on its population's love for music and entertainment by launching Music Hall, a live music venue in 2003. Its offerings include a mix of genres from hip-hop and cabaret to opera, appealing to a diverse audience. With sold out tickets almost every weekend, its popularity drove the launch of a franchise in Dubai. The interest in music has further encouraged the establishment of young, home-grown artists such as Mashrou' Leila – an indie/rock band which turned to crowdfunding to achieve one of the biggest independent music releases

in the region, raising around $66,000 in a matter of weeks.[461]

Although music is the second largest media spend segment in both North America and the Middle East, millennials in the Middle East are expected to spend significantly lower on music than their counterparts in North America, at around $24 in 2015, in PPP terms.[462]

Mobile gaming in the Middle East is experiencing rapid growth. The regional gaming market is expected to be worth around $1.7 billion in 2015, with mobile gaming representing the fastest growing segment both regionally and globally.[463] Growth of this segment in the Middle East is driven primarily by high smartphone penetration and mobile broadband (particularly in the GCC). In 2015, more than 66 percent of internet users in Saudi Arabia alone will play games online.[464] The ubiquity of connected devices has made access to games through applications on smartphones and tablets much easier. Smartphone users are willing to pay up to $26 on applications per month, gaming being the most popular type of paid application.[465] The Middle East is witnessing high demand from an audience which is willing to pay for content, with a market response to increase the supply of local and regional gaming content.[466]

Deloitte predicts that in 2015, the average millennial in the Middle East will spend around $27[467] in PPP terms on computer games, compared to $100 in North America.

Movies in the Middle East: a unique form of entertainment. The regional film industry stands at around the $100 million[468] mark in terms of box office ticket sales, compared to $38 billion globally.[469] Around 38 percent of people try to watch a movie in the cinema, compared to 57 percent who prefer to wait until movies are available on FTA channels.[470] Similar to the pay-TV story, the availability of free content poses a limitation to paying for cinema tickets. Due to delayed windowing in the region, in many instances movies are made available online before reaching cinemas. In Saudi Arabia, which makes up a large portion of the millennials in the region, cinema is prohibited by law and there is a very limited film industry. Although there are around 70 multiplexes currently in the pipeline for the GCC alone, the number of cinema screens across the region is quite low compared to more developed markets.[471]

However, the increasing number of annual film festivals in the region (around 15 festivals in 10 different countries)[472], along with increasing investment in cinemas, reflects rising interest in the industry and growth potential. Millennials in the region are likely to spend significantly less on movie tickets than in North America. Deloitte estimates that around 47 million out of the 123 million millennials will go to the cinema – averaging about $12 at most in PPP terms.[473]

e-books have driven Middle East reading trends upwards. Trends over the years have suggested that the average consumer in the Middle East spends less on books than a Western counterpart. However, the region saw e-book sales grow from $5 million in 2009 to $57 million in 2013[474] - the infiltration of devices such as tablets and e-book readers and broadband penetration has encouraged digital forms of reading. Compared to millennials in North America who are expected to spend $60 on books in 2015, millennials in the Middle East are expected to spend a significantly lower amount.

SVOD spending in the Middle East is negligible on a global scale. Despite growth potential in the Middle East, particularly amongst millennials, the Middle East makes up less than one percent of the global SVOD market.[475] Even though the Middle East is considered to be a high growth market, subscriptions for SVOD services significantly lag behind other more established Western markets. SVOD providers in the region are still quite limited, especially in comparison to the likes of Netflix and Hulu. However, online streaming in some markets, particularly in the GCC, has reached 40-50 percent, demonstrating solid potential for SVOD in the region.

Compared to more developed markets, spending on SVOD by millennials in the Middle East is expected to be negligible compared to $40 in North America.

Supply shortage of live sports in the Middle East. Over the years, sports attendance in the region has been quite limited in comparison to more developed markets. Major events such as the Formula One in Bahrain and Abu Dhabi, Tennis Championships in Qatar and the UAE and the upcoming Qatar FIFA 2022 World Cup have created buzz around live match attendance, but supply remains quite low.

Football is undoubtedly the most popular sport in the region with the largest fan base. Attendance of football matches has however been limited to domestic football league games such as the UAE Pro-League – which typically see attendance rates of about one tenth of those at an English Premier League match. Ticket prices in the UAE are also around one tenth of those for an English Premier League game ($7 compared to $70).[476]

Nevertheless, efforts have been made to build on the sports attendance market in the Middle East. The Dubai

Tennis Championship recorded the highest number of spectators ever in 2012, with 100,000 people attending over the two-week period.[477] Additionally, the Formula One events in Bahrain and Abu Dhabi continue to attract significant audiences from other countries, and the 2014 AC Milan vs. Real Madrid match in the UAE demonstrated the market's potential. Whilst millennials in North America are expected to spend an average of $25 on sports attendance, their counterparts in the Middle East are expected to spend less in 2015, but the number is expected to increase with growing interest and investment in the market.

With digital on the rise, millennial spending on newspapers is minimal. Although newspapers in the Middle East have demonstrated strong resilience compared to those in the US and UK, which are suffering large decreases in advertising revenue and decline in newspaper circulation, the majority of millennials have begun turning to social media and independent news reports as sources.

In the face of political turmoil over the years, millennials have stopped relying on mainstream media. Social media is the most commonly used method of accessing news content, with 77 percent of consumers in the Middle East having access to a social media account, and 57 percent using those accounts to access news content. However, the second most popular source of news is print, at 45 percent, followed closely by laptop/computer at 44 percent and smartphones at 41 percent.[478] However, the percentage of millennials who access news through laptop/computer and smartphones is likely to be higher (compared to the total population).

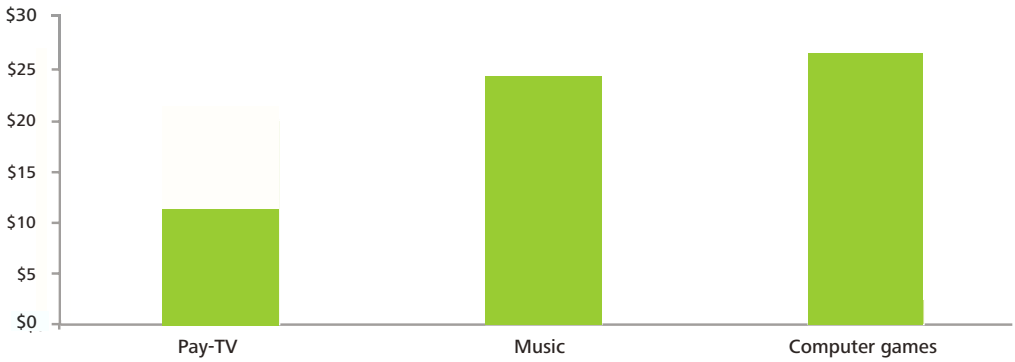
Millennials in North America are expected to spend around $20 on print newspapers, the least compared to the other media segments. On the other hand, millennials in the Middle East are likely to spend much lower than $20.

Theme parks are also popular amongst millennials in the Middle East. The leisure and entertainment industry has been growing rapidly in the region, particularly in the GCC and more specifically in the UAE. Millennials in the Middle East are likely to increase spending on theme parks as the market continues to develop, with more innovation and consumer choice. The lower cinema spend in the region positions theme parks and family entertainment centers as attractive alternative forms of entertainment, with high growth potential – particularly in Saudi Arabia where cinemas do not exist.

There has been a steady increase in tourists in the GCC – the UAE had welcomed almost 6 million tourists in the first half of 2014 alone, and continues to enjoy a growth rate of tourist arrivals which is almost double that of the rest of the world.[479] Leisure and entertainment activities perform particularly well in the UAE, home to water parks such as Yas Waterworld, Aquaventure and Wild Wadi, as well as the Ferrari World, Sega Republic, Kidzania and Global Village theme parks, to name a few. Ticket prices can range anywhere from $10-$131 (depending on the park) for basic entry, appealing to consumers across the income spectrum. In Saudi Arabia, the average price for basic entry to a theme park is only $7.

The development of three new parks with Hollywood, Bollywood and Lego themes are expected to be complete in 2016, drawing in over five million visitors a year.[480] As more incumbents enter the market and cater to different age groups, household incomes, preferences and cultures, spending by millennials on theme parks and family entertainment centers is likely to increase steadily in parallel to the market.

Figure 9. Millennials' $120 individual average spend on media content in 2015 (three core spend segments – pay-TV, music and computer games)



Source: Deloitte research and analysis, 2015

Millennials in the Middle East are spending less, but they are still spending. Evidently, the dollar contribution per millennial in the Middle East is significantly lower than that in North America. This is predominantly due to the widespread availability of free content and lack of exclusive, local content. Although there is much room to grow in the region in the majority of the media segments, millennial media spending in the Middle East will tend to be quite limited due to structural differences in comparison North America. The generally larger family households and common family dependency confines spending on media by millennials – although there is much growth potential, particularly in certain segments, spending on media in this region will tend to lag behind more developed markets.

Bottom line

Millennials are expected to generate $750 on average in direct spend on content in the US and Canada. But we should also consider their indirect and ancillary spend.

For example 18-34 year-olds watch over 24 hours of television per week in the US,[481] and 17 hours in Canada.[482] Both figures are lower than the national averages for all viewers 18+; but millennials represent an attractive demographic, and represent billions of dollars of the nearly $75 billion North American TV advertising.[483]

Further, in addition to the $200 in annual spending on movie tickets, live sports events, or concerts, millennials spend on concession snacks, sports jerseys and concert merchandise, all of which add to the profitability of the sector as a whole. The licensed sports apparel industry in the US and Canada was worth $13 billion in 2013,[484] equivalent to 70 percent of gate admission revenues.

Monetizing millennials sometimes requires a content provider to offer new services that may not directly be linked to the original media proposition. As an example, college-age fans of American college football often leave games at half-time, not because of a disappointing sporting event, but because they can't get online or upload photos to social media.[485] As a result, hundreds of college and professional stadia are upgrading connectivity. Equally, movie theaters, concert halls and even outdoor music festivals may want to invest in Internet access to meet the needs of a generation where one in three consider Internet access as important as air, water, food and shelter.[486]

Although we estimate that millennials are paying for TV services and attending live sporting events, the leagues and individual teams have a strong interest in making sure that they continue to do so. The revenues from the media rights for sporting events are rising quickly, as we wrote in Predictions 2014.[487] The 18-34 year olds of today who attend sporting events are more likely to be the part of the sports TV audience of the future, supporting the prices of those video rights. There need to be ongoing efforts by leagues and franchises to make sure that sufficient affordable seats are available for younger audiences, in order to create devoted fans in the future. 70 percent of Americans 13-29 year olds say that the biggest deterrent to them attending more games are ticket prices.[488]

Devices are the new status symbol, and these don't work unless they are connected to a fast network. Therefore 18-34 year-olds are likely to continue to spend heavily on tech hardware and telecom services at high levels. That may come at the expense of media and content spending. 18-34 year-olds will still spend on content, but they may be choosier and more-price sensitive than young audiences in the past.

Oddly enough, the fact that millennials who won't spend on traditional media are willing to spend on other kinds of content is not bad news for the traditional media industry. If they weren't willing to spend at all, then there would be no hope. But the experience of the book, computer gaming, OTT providers, cinema and music industries establishes that millennials will open their wallets for certain types of media.

Middle East perspective

With millennials in the Middle East making up almost half of the population, they are the media sector's key target segment. The region's favorable demographic has played a dominant role in the industry's continued growth over the years. Although millennials in the region are spending significantly less on media than in North America, there is a large opportunity for growth as more and more of the youth are willing to spend on media, particularly good quality local content.

With a favorable media outlook for the region, industry players should look towards effective monetization strategies to realize the industry's full potential. The region has been suffering from a range of content gaps – both supply in international English content and in particular, highly in-demand Arabic content. These gaps have contributed to the low spending on pay-TV and SVOD in the region, and have encouraged piracy and illegal streaming.[489] Access to high quality, local content should be high on the agenda of pay-TV and OTT operators in response to consumer demands.

The region has seen increased investment in home-grown content through joint ventures, partnerships or organic initiatives to make Arabic content more accessible to a wider audience.[490] Strategic partnerships are the most viable way to address the challenges faced in the region – content developers, broadcasters, pay-TV platforms and SVOD service providers need to collaborate to realize the market potential. Some players have already recognized the value of partnerships, such as icflix and du.[491]

Another segment which has plenty of room to grow is live sports attendance. Raising awareness of the potential value of the sports industry and investing in effective marketing strategies is key to realizing its potential. There has been limited attention paid to marketing sports – although infrastructure and consumer demand is there. The significantly lower ticket prices in the Middle East hinders live sports revenues, however, large investments such as MBC's broadcast rights of the Saudi Professional League has brought attention to monetization of domestic leagues.

The lack of digital music platforms has also limited spending in the segment. Easing regulations and barriers to entry could potentially attract large international players to set up and provide services in the region to stimulate spending on digital music.

Millennials in the Middle East are willing to spend on media, an industry which has seen positive growth in recent years. It is up to the key players in the industry to differentiate themselves and respond to the evolving, tech-savvy and influential millennial consumers.

Print is alive and well – at least for books

Deloitte predicts that in 2015 print will represent more than 80 percent of all book sales in dollars worldwide.[492] In the US, the world's largest book market, the figure is lower at just under 80 percent,[493] but the percentage of print is higher in other developed world countries, and even more so in the developing world.[494]

A decade on from the launch of the eReader,[495] print will dominate book sales even in markets with high digital device penetration. Over 30 percent of Americans own an eReader, over 40 percent have tablets,[496] and ownership of smartphones is likely more than 60 percent by the start of 2015. As can be seen in Figure 10, eReaders are not as popular in other countries, and there are some differences when we look at device ownership by millennials (generally defined as 18-34 year olds, although there are other definitions).

Print is likely to generate the majority of books sales for the foreseeable future: eBook sales volumes have hit a plateau, or seen decelerating growth, in major markets including the US, UK and Canada.[497] This has occurred only over the last year, but as of early December 2014, US print book sales were up two percent year over year.[498] The longer-term trend has not been as good. Although eBooks do not make up the majority of the book market, they have taken significant share: in the period 2008-2013 total US book sales were up eight percent to $15 billion and eBook sales were $3 billion. If eBooks are removed from the total, book sales would be down eight percent over that time frame.[499]

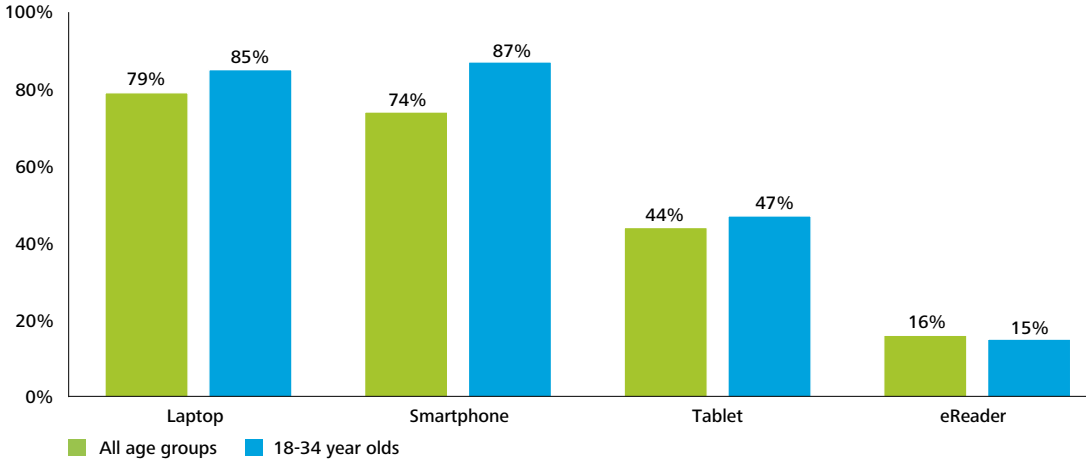
In some print markets, such as newspapers, most of the demand is being driven by older consumers who grew up in a print-only world. This is not the case for books. The aversion of millennials to physical CDs, DVDs, print newspapers or magazines does not extend to print books.

Younger readers are still reading, and in print:[500] 92 percent of 18-29 year-old book readers in the US read in print in 2013, above the average for the population as a whole.[501] Three-quarters of millennials read a print book, but only 37 percent read an eBook. Four-fifths of 18-29 year old Americans have read at least one print book, and their median reading of five titles is the same as for other age groups.

They aren't just reading they are doing so intensely. In a different US survey, a quarter of 16-34 year-olds described books as a 'passion', in line with the average for all ages.[502] Millennials were however more passionate about music (38 percent), equally passionate about movies, but less enthused about video games (16 percent). And just three percent proclaimed themselves passionate about magazines. Not only were younger respondents passionate about books, they were also particularly fond of print copy. Nearly half of 16-34 year-olds agreed that "eBooks will never take the place of real books for me." This was a similar proportion to older readers. Interestingly, 44 percent of 16-24 year-old females strongly preferred 'real' print books, but only a fifth of similarly-aged males felt that way.[503]

Figure 10. Device ownership by millennials and all age groups

Q: Which, if any, of the following, do you own or have ready access to (Laptop, smartphone, tablet, eReader)?



Source: Deloitte Global Mobile Consumer Survey, Developed countries, May – July 2014
Weighted base: All respondents/those aged 18-34: Australia (2,015/659); Finland (1,000/294); France (2,000/595); Germany (2,000/587); Italy (2,000/599); Japan (2,000, 497); Netherlands (2,000/587); Norway (1,000/330); Singapore (2,000/700); South Korea (2,000/670); Spain (2,000/576); Sweden (2,000/614); UK (4,000/1,280).

Why do millennials show a preference for print books? One UK study found that 62 percent of 16-24s prefer buying print books over eBooks[504] because they like to collect, 'like the smell' and 'want full bookshelves'.[505] One recent example of this preference is the mix of physical to digital sales of a book aimed squarely at younger consumers. *Girl Online*, the debut novel of video blogger Zoella with a substantial teen fan base, sold 20 physical copies for every electronic copy.[506]

A key value of print books appears to be their cover. Covers have been shown to drive sales;[507] but they also send a message to those around you about what you are reading and what kind of person you are.

As has been noted, "the act of reading a book in public conveys important information to other readers".[508] EBooks don't have covers that are visible to others.

A US survey found that 16-34 year olds take more pride in their book collection, are more likely than older generations to buy books that they don't read, and often carry around books even when they aren't reading them. These behaviors don't apply to eBooks, or at least don't apply as strongly.

It may also be the case that physical books are superior when it comes to information retention.[509] Early studies showed little difference in recall between short passages read on a screen and read in print. However for longer passages (even 28 pages, shorter than most books) a more recent study found a significant difference in recall between print and digital.[510] The study consisted of a small sample (only 72 participants), but other research supports this finding.[511] Younger readers read for pleasure or to keep up with current events, but less so than older readers.[512] On the other hand, they are much more likely than older readers to read for work or school, or to research topics of interest. They need to remember what they read: they may be tested on it, or it may help them in their jobs. A preference for print makes sense for them.

As for even younger readers, one US study suggests that 13-17 year olds are even less likely than older age groups to read eBooks rather than print.[513] For even younger readers, over 95 percent of children's picture book sales are in print format, not digital, and that number has been flat for years.[514] This matters, as kids who watch traditional TV or read printed newspapers are more likely than those not exposed to these media to watch traditional TV and read physical newspapers as adults. Toddlers who read printed picture books are more likely to progress to printed easy-reader first books, and then on to physical copies of teen novels.

The future of book retailing is complicated. At the beginning of 2013, the number of high street bookshops in the UK had fallen by more than half in seven years.[515] If eBooks were dominating print, that trend would have continued or accelerated, but that does not appear to have happened: closures of independent bookstores in the US have gone into reverse, with over ten percent growth between 2009 and 2013.[516] But a continued preference for print does not appear to be a panacea for physical bookstores: in the UK nearly 40 percent of all books (print and eBooks combined) were bought from online-only retailers in 2012.[517]

Bottom Line

The essence of this prediction is that eBooks are not replacing print in a big way, unlike other digital form factors; but though they aren't taking over, they are still a large and growing market. It might be expected that smartphones are too small for reading long-form content like books, but some data suggests that the number of books being read on smartphones is higher than on tablets (largely due to much higher ownership of smartphones),[518] and phones are getting bigger with the rise of phablets.[519] Measuring book consumption is difficult: while purchase data is available, many books are gifts,[520] and the technologies that measure TV viewing or Internet usage don't work for print books. Further, most book sales data does not measure self-published books, which tend to be digital rather than print. However, survey data shows that younger readers are still reading, and still reading in print.

Bricks-and-mortar booksellers should not consider the resilience of print to be matched exactly by a similar strength in bookstore sales. Online sales of physical books are likely to remain strong. However physical retailers should extol the value of buying print in person. You can browse far more easily, you can appreciate the font, and you can feel the paper. And you can walk out reading the book, rather than having to wait a few days for the book to be delivered.

With 40 percent of US primary and secondary students using a tablet for at least some of their classes,[521] more research is likely to be needed on the difference between print and screen. If there are differences, they are most likely to relate to content that needs to be retained for years or even decades. The same is likely to apply to tertiary education and the training markets. Other print medium publishers, like newspapers and magazines, might learn lessons from books: how can they duplicate some of the attributes that cause millennials to persist with print?

A preference for print books is likely to have little effect on the trend towards the paperless office. Globally, demand for uncoated free sheet paper (used in printers and photocopiers) is rising, but that is largely driven by the developing world: in North America and Europe demand is declining annually at a rate of 2.6 percent and 3.4 percent respectively.[522] Individual enterprises are shrinking their office printing even faster: between 2011 and 2014 Deloitte Canada reduced the number of pages printed by 22 percent, despite increasing headcount.[523] Most enterprise printing is material meant for only short-term recall, rather than longer-term deep learning.

Telecommunications

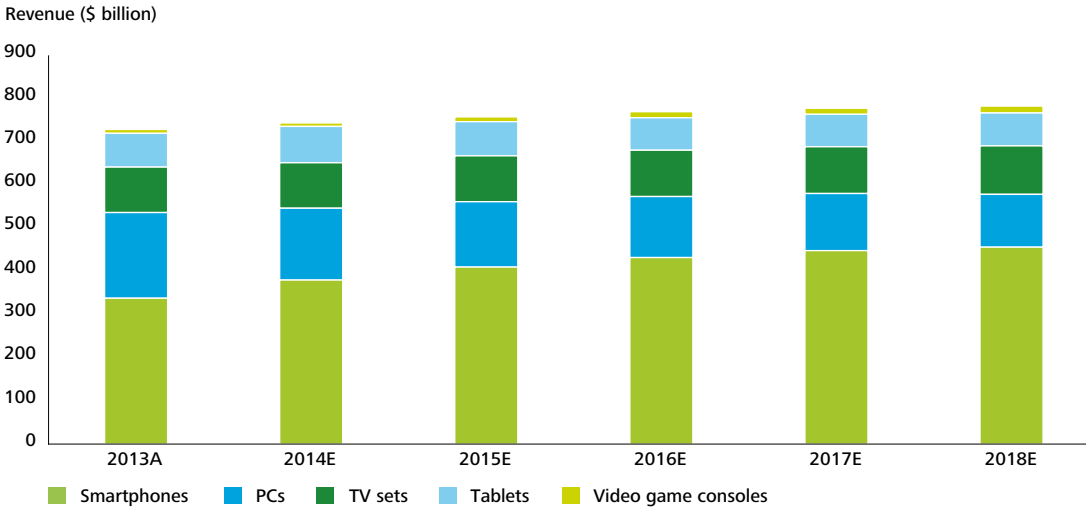
One billion smartphone upgrades

Deloitte predicts that one billion smartphones will be purchased as upgrades for the first time in 2015, generating over $300 billion in sales.[524] We expect smartphone upgrade volumes to continue increasing through 2018, and possibly beyond.

The quantity of smartphones bought as upgrades is unparalleled among consumer electronics devices. In 2015 smartphone sales will be greater in units and revenues than the PC, television, tablet and games console sectors combined (see Figures 11 and 12).[525] The smartphone's share of units and revenue should continue growing through 2018.

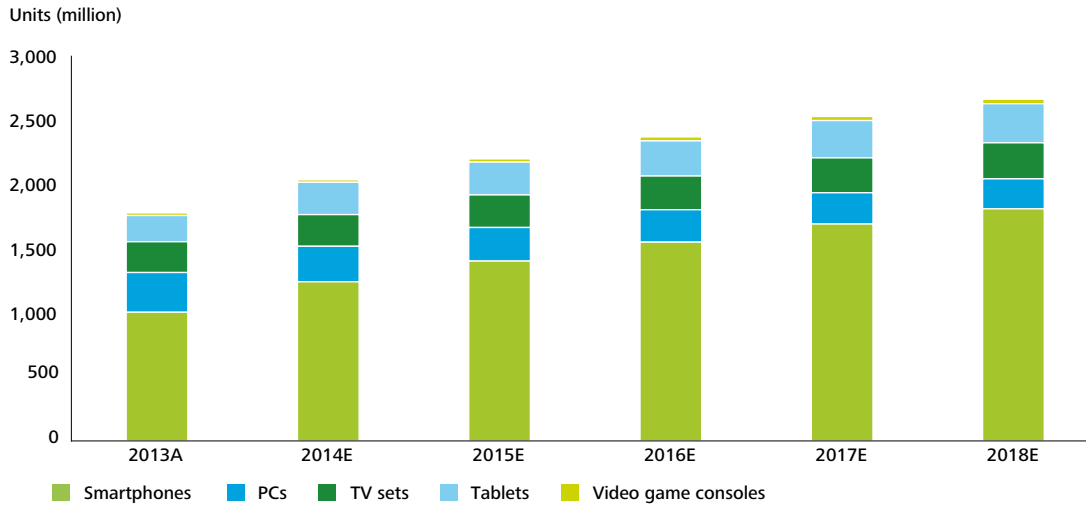
The smartphone's predominance is driven mainly by upgrades. The smartphone base is forecast to increase from 1.8 billion in 2014 to 2.2 billion this year.[526] We expect smartphone sales of about 1.4 billion smartphones in 2015, which implies that just over a billion (about three-quarters) will be upgrades. According to Deloitte's research, undertaken in May-July 2014, about seven in ten smartphone owners in 14 developed markets had upgraded their phone in the previous 18 months.[527] This is more frequent than for any other consumer electronics device, which may surprise in view of the fact that in 2015 most smartphone owners are likely to spend more time looking at TV screens, and information workers and students may spend more time looking at PC screens.[528]

Figure 11. Combined global sales revenue of PCs, smartphones, tablets, TVs and video game consoles, 2013-2018



Source: Deloitte, 2014, based on multiple sources

Figure 12. Combined global sales units of PCs, smartphones, tablets, TVs and video game consoles, 2013-2018



Source: Deloitte, 2014, based on various industry sources

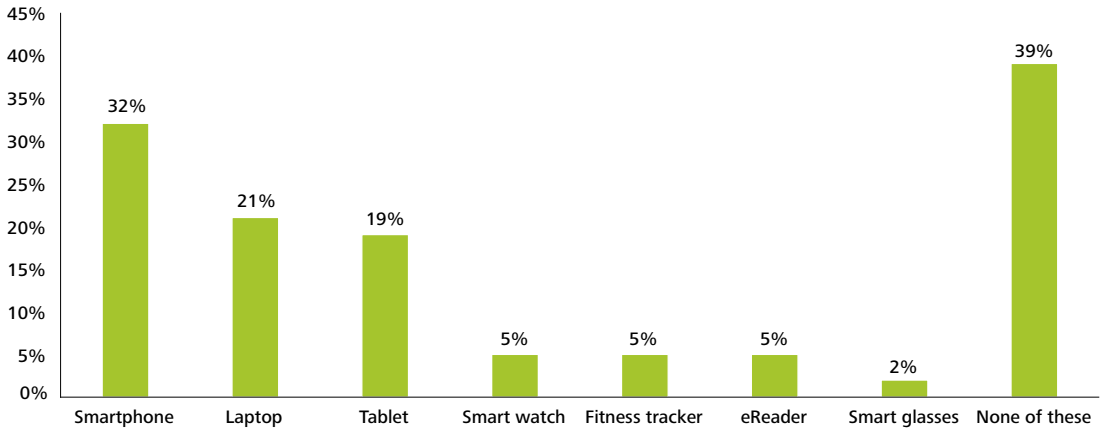
However the smartphone is the most personal of consumer electronics devices: the most constant companion, the most personal of choices, the most customized and reflective of the owners, the least likely to be shared with other users, and the most frequently looked at.[529]

Indeed, our research found that respondents in many countries chose the smartphone as the device they were most likely to purchase in the next 12 months, with a third expecting to buy a smartphone, compared to 21 percent for laptops and 19 percent for tablets (see Figure 13).

The huge production volumes of smartphones manufactured also make this the most competitive market among devices, undergoing the most substantive improvement on a year-by-year basis. Our view is that the device replacement cycle for smartphones is the shortest relative to other devices (see Figure 14).

Figure 13. Device purchase intent in the next 12 months

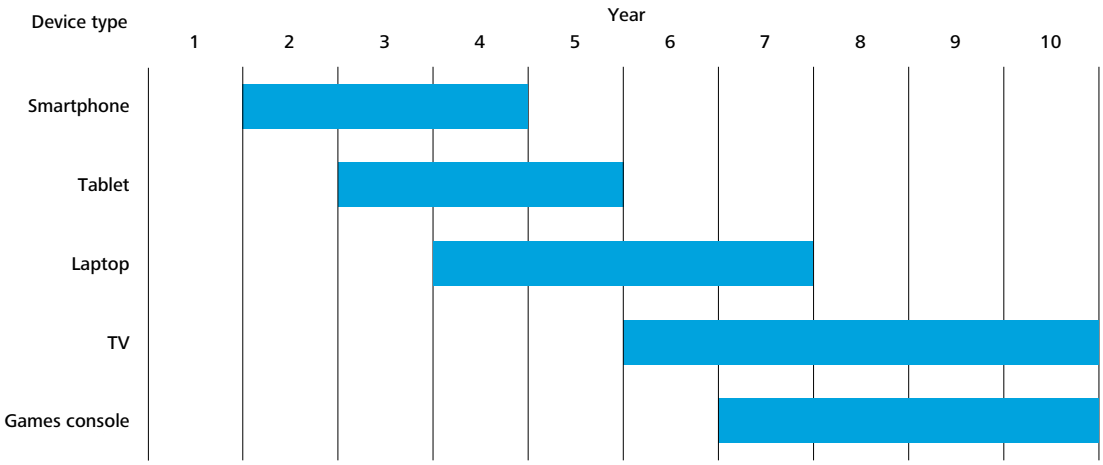
Q: Which, if any, of the following devices are you likely to buy in the next 12 months?



Source: Deloitte Global Mobile Consumer Survey, Developed countries, May - July 2014

Weighted base: All respondents: Australia 2,015; Finland, 1,000; France 2,000; Germany 2,000; Italy 2,000; Japan 2,000; Netherlands 2,000; Norway 1,000; Singapore 2,000; South Korea 2,000; Spain 2,000; Sweden 2,000; UK 4,000; US 2,001

Figure 14. Device replacement cycle, by type of device (years)



Source: Deloitte, 2014

Some may question the need for users to swap one small rectangular and expensive slab for another.[530] Arguably there is little perceptible benefit in upgrading from a quad-core to an octa-core device;[531] 3G is good enough and 4G unnecessary; there is little noticeable difference between a 12 MP (megapixel) and 20MP photo, or between a high definition and 4K screen;[532] wide-angle lenses that take better selfies aren't needed; and square corners are not superior to rounded ones (or vice versa).

Assessing the smartphone upgrade market from a purely technical perspective, it might be concluded that most existing owners do not 'need' a new device. But this assessment is too narrow; there is a wide spread of motivations, practical and emotional, which will drive the billion upgrades we anticipate for 2015 and the 1.15 billion for 2016.

In the near term smartphones will offer both an ever-wider range of functionality (such as a fingerprint sensor) and enhancement in existing functions (such as a better camera).

At first glance, fingerprint readers may appear superfluous. They enable us to do things (such as unlock phones, authenticate an in-app payment, gain access to enterprise email, or authorize an in-store contactless purchase) that we can already do with passwords and PINs.[533]

But fingerprint readers make each step faster and slicker: a single touch of a reader is, for some users, more elegant than multiple taps of a touchscreen. This is also where one-upmanship comes in, and envy may drive the decision to upgrade. A fingerprint reader enables people do things slightly differently from others whose phones lack a reader, as well as being superior from a practical perspective.[534]

The camera is a core functionality of smartphones, as well as the feature phones that preceded them. We expect that a common (but rarely ever sole) reason for upgrading a phone will be to take *and* share better photographs, from anywhere in the world.[535]

There is a wide spread of motivations, practical and emotional, which will drive the billion upgrades we anticipate for 2015 and the 1.15 billion for 2016.

Every year the photographic capability of smartphones improves. 4G enables faster sharing;[536] better sensors enable improved low-light photos; wider lens apertures let in more light, making possible the shooting of slow-motion video. Faster processors and micro-actuators reduce the blur from camera shake. The latest flashes offer a more natural light, lessening the chance of 'bleached' faces, or washed-out balsamic glaze on the second course of a fancy meal. Filters change the mood.

All these enhancements result in photos more worthy of sharing; and faster connectivity speeds enable and encourage us to distribute them more frequently and in higher resolution.[537] A panoramic photo is about eight megabytes in size, and takes mere seconds to share at 4G speeds. A generation back, holiday snaps could only be inflicted on friends and family post-vacation.

Better cameras may trigger upgrades to get more memory. Although this may seem logical, it is arguably irrational, if we exhaust memory only because we are averse to deleting un-needed snaps. A 64-gigabyte (GB) phone can store over 30,000 high definition photos, few of which will be looked at again.

Some of the practical motivations for upgrading may not be picked up by standard, questionnaire-based market research. A common reason for upgrading in 2015 will be to get a larger screen, ostensibly to browse more easily, or watch more video. Few might admit however that the principal benefit of a larger screen is to avoid the need to put on reading glasses.[538]

This year, a common complaint among smartphone users will be that their device 'feels slow'. This will be fact as well as perception: smartphones used frequently for data applications tend to last about four years before becoming too slow to operate.[539] Phone hardware is locked down and generally can't be upgraded; but the software used on the device, including the operating system (OS), is upgraded at least annually. New software, be it an OS or an app, is designed for the majority of phones likely to use it and pay for it. Every year, the newest smartphones incorporate faster processors and more random access memory (RAM); so over time, as software becomes more complex, the processor and memory in a device increasingly struggle to undertake existing and new functions.

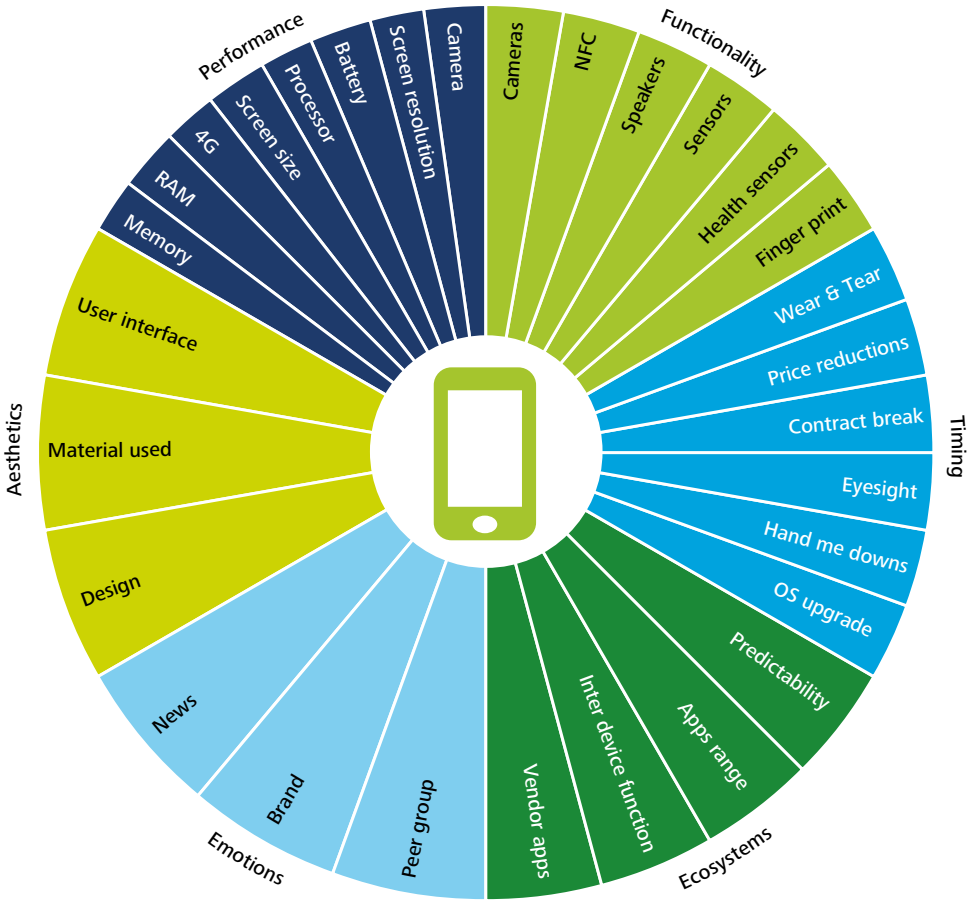
Upgrading a smartphone on the basis of looks may seem superficial, but this decision can also be rationalized. Better-quality materials – whether metals, plastics or even bamboo – are now being used, and these can make devices more durable as well as more eye-catching. New screens tend to be stronger, and also to have better viewing angles, as well as superior visibility in sunlight.[540] Many smartphone models are now dust – and water-resistant.[541]

Peer pressure is likely to be a factor in many decisions to upgrade. It's not just the envy invoked from seeing friends and family with pristine new devices, replete with brand new functionality; it's also the news flow, with some new smartphone launches dominating the tech sections of websites and also national news bulletins.

Added to that is pestering from children, eager for their parents to upgrade so as to get an upgraded hand-me-down smartphone for themselves.

In many cases, the timing of an upgrade will be linked to the expiry of a contract, a price reduction, or a sales promotion. But the decision to actually upgrade a phone, and the choice of which model to upgrade to, will likely have been driven by many of the aforementioned factors, as well as many other impulses, summarized in Figure 15. Vendors and carriers should be aware of them all.

Figure 15. Drivers for phone upgrade



Source: Deloitte, 2014

Middle East: 70-100 million smartphone upgrades

Deloitte predicts that in 2015, Middle East region sales from smartphone upgrades will surpass 70-100 million units for the first time, generating around $18-28 billion in revenues.[542, 543, 544] In line with our global expectations, we foresee regional upgrade volumes to grow further, as penetration rates continue to rise in the years to come. The majority of upgrades will take place in the GCC, which has the highest penetration levels, whereas in large parts of North Africa, with much lower smartphone penetration, many will be new adopters, buying a smartphone for the first time.

Estimates as to the exact size of the region's smartphone base vary considerably. Most reports consider Middle East and Africa (MEA) as one region, or follow an inconsistent definition of the Middle East region's geography. In our estimations, we have defined the Middle East region as the pan-Arab geography covering the GCC, Levant and the North African countries that border the Mediterranean.[545] Based on this, Deloitte estimates that the region's smartphone base is around 70-100 million units in 2014,[546, 547] representing about 20-30 percent penetration.[548, 549] We expect this to break 30-40 percent in 2015, in line with wider estimates, which reportedly anticipate smartphone penetration to rise by around 39 percent.[550] Deloitte therefore predicts the Middle East region's smartphone sales could reach around 110-140 million units by 2016.[551]

The region is widely known and has proven to be one of the fastest in the world to have adopted smartphone devices in just a few short years, with growth rates already comparable to Asia and the Americas.[552] This is an impressive feat, especially considering the region's relatively late adoption of smartphone technology, compared to the aforementioned regions including others such as Europe, which are much larger and more mature smartphone markets.[553]

The upgrades market is indeed the first and foremost contributor of overall smartphone sales in the region, led by the wealthier GCC countries, whose average smartphone penetration rate has risen to around 70 percent.[554] This is echoed in our device usage research across some of the region's largest smartphone markets, the UAE, Saudi Arabia and Egypt, where at least 62 percent have access to a smartphone device, a 'must have' amongst the top three of the four average devices that they own (see Figure 16).[555]

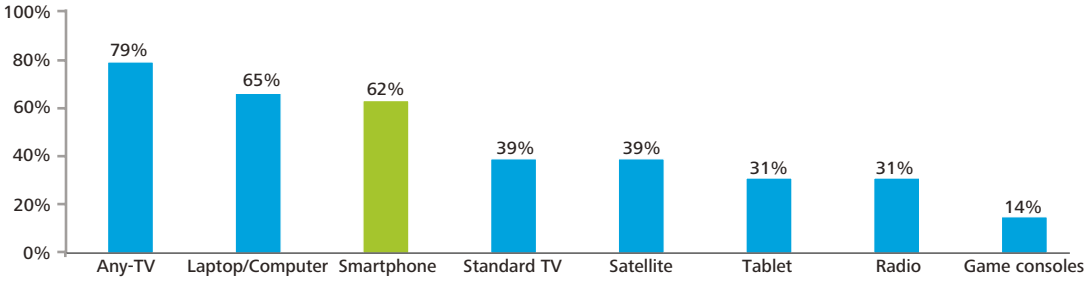
In the more affluent GCC countries, we also expect the replacement cycle to be lower than the global average. Whilst globally, our research shows consumers are highly likely to upgrade within the next 12 months, reports suggest that the upgrade cycle of GCC consumers could be as short as six to eight months.[556] Global manufacturers have picked up on the GCC's quick adoption, affordability and desire to have the latest smartphone model, selecting these markets for new product launches. Similarly, retailers at certain times are also offering promotional options to trade for the upgrade. This is particularly the case in the UAE, which is recently reported to have reached 78 percent smartphone penetration, still growing strongly.[557]

However, many users across North Africa will have a lower replacement cycle, as they will be buying smartphones for the first time, and with more modest budgets restricting their upgrade frequency, will take more time to acclimatize to the new smart format. On average, we therefore estimate the region's upgrade ratio to be more or less in line with the global average at 75 percent of all smartphone sales.

Aside from upgrades, the market for new smartphone buyers has driven the region's smartphone sales in its own right, and, at only 20-30 percent penetration, still holds significant potential, which should not be overlooked.

Ongoing advancements in local mobile infrastructure, such as network expansions and affordably priced LTE deployments, have also contributed to growing smartphone penetration across the Middle East, opening up high speed mobile access to more rural populations,

Figure 16. Device penetration in the GCC and Egypt



Source: Deloitte, 2014

Weighted base: All respondents: UAE 1,000; Saudi Arabia 1,000; Egypt 809

especially in large markets such as Saudi Arabia.[558]

The region's large youth demographic is another obvious demand driver. One study revealed that over 70 percent of smartphone owners in the region are under 34 years of age.[559] Considering that over 70 percent of the entire region's population also fall within this age bracket,[560] it is clear that the region is underpenetrated by far. To fulfill youth demand, the local smartphone market would have to more than double in size, before even including the demand for upgrades.

The key to unlocking this potential is through affordability, especially beyond the GCC, in more populous countries with lower GDP per capita levels, where consumers are not as wealthy and far more price-sensitive. Declining smartphone prices around the world have exhibited the strongest correlation with market growth. Globally, the Average Selling Price (ASP) of a smartphone declined from just under $340 in 2013, to just under $320 in 2014. The Middle East showed much faster than average growth with a lower ASP of just over $305 in 2014. This compares to Europe's ASP of just over $370 in 2014, which experienced slower growth. On the other hand the fastest growing markets, Asia and Latin America, both have the lowest ASPs in 2014 at just under $280 and $250 respectively, but have the highest growth rates. Globally and locally, ASPs are forecast to reduce much further, with local ASPs forecast to be as low as $230 by 2017.[561]

The effect of reduced unit prices is two-fold. Not only does it enable more price-sensitive consumers to purchase and adopt their first smartphones, thereby increasing smartphone penetration and the future upgrades market, it also makes it cheaper for users to upgrade their existing smartphones, increasing the propensity and frequency to upgrade.

Aside from cost, many of the consumer drivers motivating smartphone upgrades alluded to and discussed earlier (see Figure 15), naturally apply locally as well.

The most salient of these is local consumers' increasing general usage and reliance on the device's multi-functional capabilities for managing much of their personal, social and working lives. This has instilled a strong level of 'stickiness' and attachment to the device. Local reports suggest that consumers here check their smartphones as much as 100-150 times a day, making it a truly embedded 'lifestyle gadget' in the Middle East.[562]

Smartphones, with larger screens and faster mobile broadband networks, have also become a tremendous source of media consumption. As a 'second-screen', smartphones are already the second largest platform for media consumption after television; with as many as 25 percent of smartphone owners across the UAE, Saudi Arabia, Lebanon and Egypt consuming media content through their smartphones every day.[563]

Much of this is attributed to the region's fast uptake in social media, which, coupled with high quality smartphone cameras, has created a new 'photo-culture' in the region. There are already over 55 million Facebook users across the Middle East, more than 14 percent of which use Instagram, and this is expected to grow further.[564] One survey last year found Qatar and the UAE to be the region's top 'selfie' countries, proclaiming Qatar to be the 'selfie' capital of the Middle East, with an average of 52 selfie-takers per 100,000 residents.[565]

Similarly, smartphones also provide ideal access to short-form video, keeping consumers informed and entertained on-the-go. This is a very popular mobile media consumption trend in the region, where Middle East users have become the first in the world to consume the majority of the format on mobile devices.[566] Over 90 percent of smartphone users in the UAE and Saudi Arabia alone use their smartphones to watch video, more than half of which do so at least once a day.[567]

The higher data requirement, mostly stemming from increasing multimedia usage, is translating into rising local demand and shipments of devices with upgraded specifications. For instance, shipments of 4G handsets to the region increased more than four times throughout 2013 alone, and now account for at least half of all smartphones sold in the region.[568]

Increasing smartphone usage is not only restricted to media consumption. Mobile payments, online commerce and access to services such as utilities, telecoms and mobile government also feature very prominently. Almost half of all UAE and Saudi smartphone owners already use their devices for online banking activities, with a quarter of Saudi and almost half of UAE users expecting to increase smartphone-based payments.[569] PayPal estimates m-commerce will grow to represent a fifth of the total Middle East region's e-commerce market this year, topping $3.0 billion.[570] Regional mobile government services have also expanded and experienced remarkable adoption rates on smartphones over the past year (see prediction: Mobile government: a new mode of public engagement).

Last but not least, Arab consumers simply love their technology, deriving immense satisfaction from being the first to own the latest and greatest smartphone. Driven in part by peer pressure, having the latest smartphone is certainly a fashion statement here. This is evident in the pre-launch demand for the new iPhone 6 and 6 Plus models, which even at a 70 percent premium above the typical retail selling price, sold out rapidly.[571]

Bottom line

The smartphone is the most successful consumer device ever: the landmark of a billion upgrades in a single year is testament to this.

Just being in the smartphone industry, however, is no guarantee of success, and the market is becoming increasingly competitive. The challenges for smartphone vendors: retaining loyalty, taking share in a maturing market, maintaining margin, and determining which functionality their customers want at each point in time, are likely to get steadily more acute over time.

In addition to optimizing hardware, vendors will need to increment the range of intangible factors used to enhance their devices' appeal. These range from the availability of technical support, to the ease of transferring data between the old and new devices and from the perceived security of client data to the caliber of the accompanying app store.

Vendors need to ensure that all functionality addresses current needs and anticipates latent ones. Incorporating superfluous functionality, or technology that is hard to use, will diminish profitability.

Offering cameras with ever-higher resolution may offer quality increments that few owners would be able to discern;[572] whereas incorporating better low-light capability may have wider appeal, as the improvement would be more immediately noticeable.

Smartphone vendors should continue to work closely with carriers. In markets with subsidies and two-year contracts, upgrades have both advantages and disadvantages for carriers. They need to fund the upfront device cost, or offer the ability to pay in installments, but the upgrade also gives them a chance to lock in a customer, reduce churn and perhaps even sell them upgraded service levels. In markets with no subsidies, the vendors need to optimize pricing and features in order to appeal to retailers and consumers.

For purchases of the few hundred million smartphones by enterprises, the selection process can be more complex than for consumers. CIOs are unlikely to care too much about the need for a smartphone optimized for sharing holiday snaps; but the HR department may want to offer such devices to attract and retain staff. In some cases, phones that are more resilient and waterproof may be perfect for field workers; and for companies needing additional security, fingerprint readers and NFC chips may be of particular interest.

Middle East perspective

Over the past few years, the Middle East has witnessed some of the fastest smartphone adoption and penetration rates in the world, particularly in the GCC countries.

Smartphones have become an essential part of life for many local consumers, and they are willing to continue spending on upgrades for enhanced features, a more suitable screen size or a higher resolution camera. This is certainly true for higher-end consumers, who will pay the maximum amount to obtain the best of the best.

However, growth has been in tandem with lower than average ASP levels, which suggests that most consumers are more price-sensitive, and will upgrade if the price is right, in pursuit of value for money, or to stay within a limited budget. This explains the relatively low 20-30 percent penetration level estimated for the Middle East region, attributed to the more populous but less wealthy countries across the Levant and North Africa.

Competition in the region amongst smartphone makers at all levels is certainly intensifying. At the higher-end, makers are increasingly challenged with differentiating their smartphones to retain lucrative buyers, offering new technical features, such as NFC or biometrics, or through more exclusive special edition designs, with gold-plated handsets for example.

At the low-mid end, more makers are entering the market and competing on price. Examples include Obi from China, Wiko from France and XOLO from India.[573] Existing brands such as Microsoft have also launched low cost models under $100,[574] with Samsung, Huawei and Lenovo reportedly looking to release their own.[575] This has led to growth in the sub-$150 smartphone segment's share of the local smartphone market, which more than doubled from 2013 to 2014.[576]

To maximize sales in this fast evolving market, smartphone makers need to continue to expand their net. Offering a greater variety of models at different price points is one way for makers to play in the low-, mid- and high-end space. Makers should also apply this in conjunction with a tailored geography strategy. The GCC, Levant and North Africa are very different markets, where each country has its own environment, and will require its own strategy, distribution model and product mix. For example, the GCC are likely to spend at higher price points, and are also the best markets to test top-of-the-line models. The Levant has plenty of room for growth and North Africa is still relatively untapped, with much lower penetration levels. Lower priced models are likely to fair well there.

Partnerships with telecom operators, service providers and distributors are also key in improving access to markets which are otherwise difficult to reach.[577] Sales can be planned in line with improvements in telecoms infrastructure, where better data coverage and declining data plan prices are also contributing to increasing smartphone penetration.[578]

Mobile penetration across the Middle East region is already well over 100 percent, with the GCC's smartphone penetration already headed well into that direction. There is no reason why smartphone penetration and eventually upgrades cannot one day hit that mark across the rest of the region as well.

Mobile government: a new mode of public engagement

Deloitte predicts that the number of mobile government (m-gov) smartphone applications across the Middle East region will surpass 500 apps by 2016. This follows a sharp increase in m-gov services development in the region, which saw the number of m-gov smartphone applications increase from close to 200 apps in 2013 to over 400 apps in 2014.

Currently, there are over 1,850 m-gov services worldwide (including smartphone apps, SMS services, mobile web-enabled browser services and others). With each annual wave of expansion in the region's m-gov services base, we expect a progressively increasing element of maturity (steadier growth), as has been the case with the most mature digital governments such as the US and Australia, which have over 310 m-gov services (up from over 240 in 2013, a 29 percent increase) and 130 m-gov services (up from over 120 in 2013, around a 6 percent increase) respectively.

Side bar: e-government and m-government

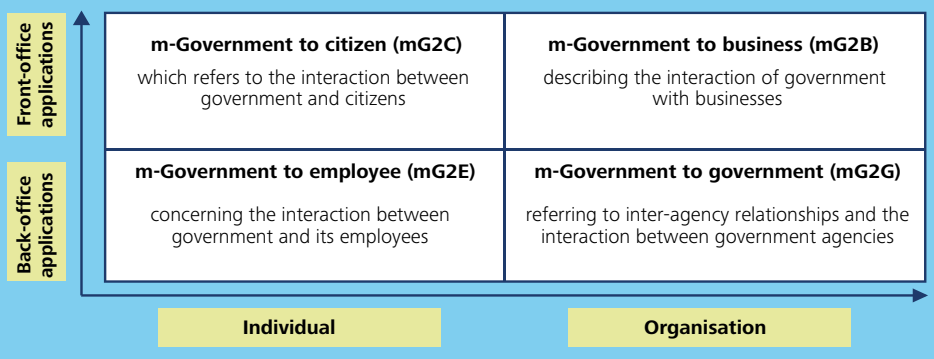
Definitions of the terms electronic government (e-government) and mobile government (m-government) vary, with different interpretations.

e-government: Often, the definition of e-government is limited to internet-enabled applications only, or to interactions between government and outside groups.[579] In the broadest sense, e-government refers to the use of information and communication technologies (ICT) to improve the management, delivery and effectiveness of all government activities, including services to all its stakeholders (not only to the external public or its citizens). The concept is commonly associated with and limited to recent government web portals that have been setup over the past decade or so, whereas in actual fact e-government has been practiced by governments around the world for more than 50 years, with national statistics offices using the first mainframes to record national data for example.[580]

m-government: Commonly viewed as a mere replacement or progressive stage of e-government,[581] m-government is actually a subset or extension of e-government to mobile platforms,[582] where mobile is a channel, another means of improving government activities, processes, service delivery, and its ability to connect with its stakeholders. As such, the ITU and OCED define m-government as the adoption of mobile technologies to support and enhance government performance and foster a more connected society.[583] It is important to note that in many cases, m-gov services (defined below) require back-office processes that run on e-government infrastructure for interoperability (ability of software and hardware on different machines from different vendors to share data) and cost effectiveness.[584] The significance of m-government should therefore not merely be seen as a separate or additional area, but rather as an integral and essential part of any e-government strategy and system.[585]

m-government (m-gov) services: This can encompass any government activity or service that can be delivered directly through a mobile device (usually mobile and smartphones but also can be tablets, wearables and other IoT devices). It includes voice services (e.g. calling a public taxi), messaging services (e.g. SMS, MIM), smartphone apps, mobile web-enabled browsers, and emerging service platforms such as Near Field Communications (NFC) services. Although there are four main types of m-gov service delivery (see Figure 17), m-gov services are largely government to citizen (G2C) services. It is important to note however that this definition excludes commercial and non-government organization (NGO) services.

Figure 17. Primary delivery models of m-government



Source: "Introduction of m.Government & IT Convergence Technology", KAIST Institute for IT Convergence (2010)

The m-gov services landscape and outlook

Internationally, Europe, Middle East and North America are leading developments, together representing nearly 70 percent of all m-gov services worldwide. The Middle East region alone represents 24 percent of the global m-gov services base (see Figure 18).

Locally, the GCC countries, at over 85 percent of the region's m-gov services (see Figure 19), are driving regional m-gov developments, through new and upgraded national e-government and m-government initiatives.

The UAE for instance, following the Prime Minister's launch in mid-2013 of his m-government vision to deliver all government services via mobile,[586] expanded its m-gov app base by more than 2.6 times in 2014. Similarly, Saudi Arabia, following the launch of its 'Second National e-Government Action Plan' including initiatives to implement mobile government infrastructure,[587] has increased its m-gov smartphone app base by more than 3.3 times from 20 to 67 apps over the past year.

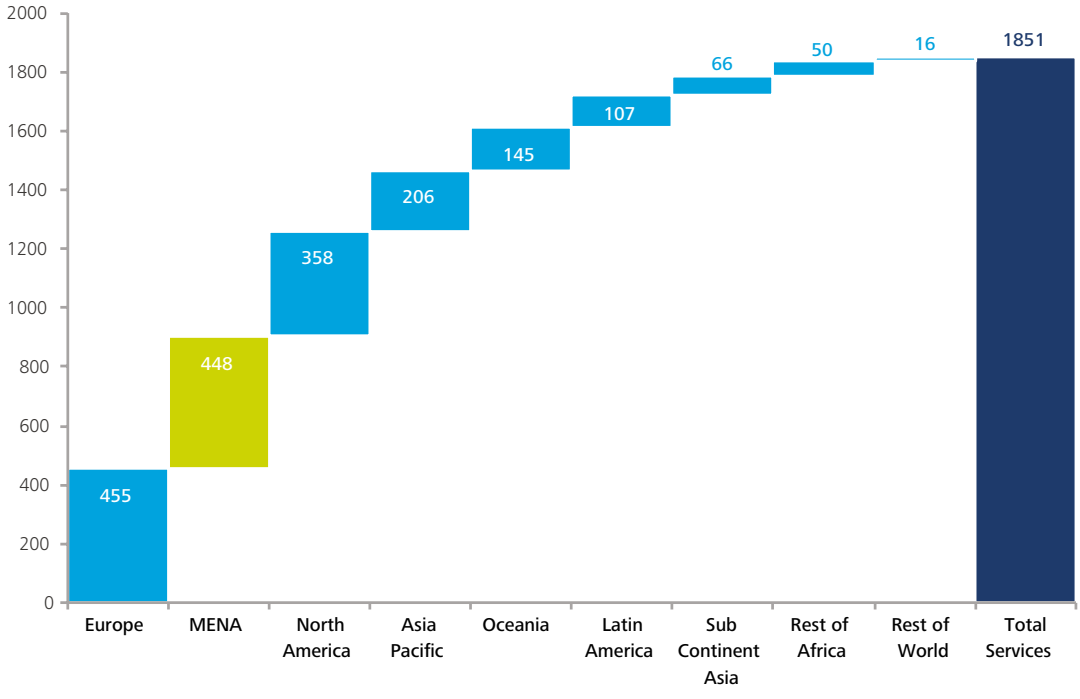
Qatar's Mobile Apps Development Program (part of their 2020 e-government strategy)[588] and Bahrain's annual target of developing 10 smartphone apps (part of their second e-government strategy for 2011-2016)[589] have led to both launching over 40 m-gov smartphone apps to date, each representing around 10 percent of the Middle East region's m-gov services.

The rapid growth in m-gov smartphone applications has been and will continue to be led by the UAE, with around 40 percent of the region's government apps.

Whilst m-gov services have shown impressive advances across the world, mobile government in general is still developing, especially in the region, with much room for growth. Mobile government applications currently represent less than 0.001 percent of all apps available globally. Adoption of services is low, even in more developed digital economies, where mobile is close to saturation, but is growing rapidly.

In line with recent reports,[590] Deloitte expects Arab governments to continue expanding their m-gov offerings across all channels, but with smartphone apps still occupying the lion's share.

Figure 18. International breakdown of m-gov services by region, 2014



Source: Deloitte research and analysis, 2014

Mobile government: a new phenomenon

The explosion in m-gov smartphone apps has been a relatively recent phenomenon, both locally and globally, which has only taken place over the past few years. The UN's latest e-government survey confirms this, which found the number of countries offering mobile apps and mobile portals had doubled from around 25 countries in 2012 to around 50 countries in 2014.[591]

The region is now technology-ready for m-gov services

The relatively late timing does not surprise, and comes after years of incremental advancements and improvements in smartphone devices, the commercial app ecosystem and the underlying high speed mobile broadband infrastructure required to drive their use.

The proliferation of mobile devices, especially in the Middle East has reached a sufficient mass to enable government services to effectively reach most, if not all of its stakeholders (e.g. employees, businesses, citizens and residents) via mobile. The Middle East has over 100 percent mobile penetration.[592] The GCC, already averaging over 70 percent in smartphone penetration,[593] is driving the region's smartphone device adoption. As such, smartphone penetration in the Middle East is reportedly expected to grow this year by as much as 39 percent.[594]

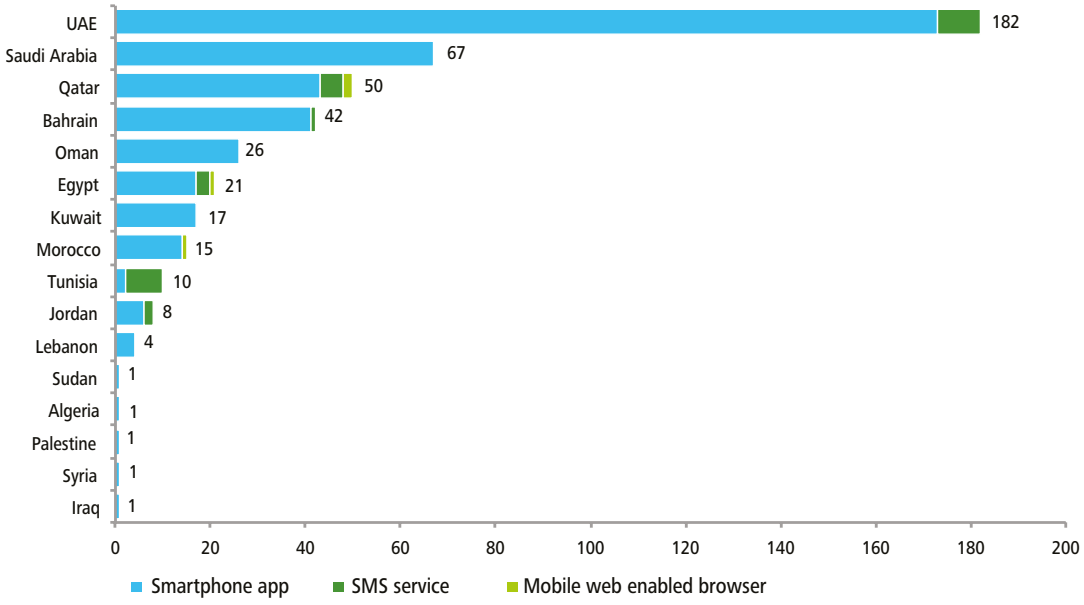
In tandem, the surrounding app ecosystem has developed markedly. Since the Apple and Google Play app stores were first launched in 2008, the global app base has grown by over 50 times, almost doubling each year, from 60,000 apps[595] to around 3.17 million in 2014.[596] With an estimated 10 billion app downloads in 2010, some analysts expect a further ten-fold increase to as much as 100 billion downloads this year.[597]

The past few years have also been significant for high-speed 3G, 4G and LTE mobile broadband networks, with most regional operators, namely in the GCC, announcing and activating their deployment.[598]

With such a strong and pervasive mobile environment, governments both internationally and locally have recognized the need to harness smartphone apps as a platform to enhance their performance and connectivity with their people.

Studies conducted by non-governmental organizations (NGOs) reaffirm this, which show that mobile is far more effective than traditional online communication in the rapid organization and mobilization of people.[599] This is especially the case here at home, where many local governments have experienced first-hand the rapid mobilization of their people during the Arab Spring, through new and alternative channels. The movement was powered via mobile devices and social media; some estimate that smartphones represent as much as 40 percent of total impressions (e.g. social media posts, tweets, comments) in the Middle East, 45 percent higher than the global average.[600] Similarly, governments can also harness the power of social media to engage with their citizens and residents through integrating social media with their m-gov services.

Figure 19. Arab m-gov services, 2014



Source: Deloitte research and analysis, 2014

Smartphone apps are king

Our findings show that smartphone apps are by far the dominant platform of choice for service delivery, accounting for the vast 90 percent majority of m-gov services worldwide. This is followed by SMS at 6 percent and mobile web-enabled browsers at 4 percent (see Figure 19). NFC has also emerged as a new platform for the first time in 2014, but at around 0.1 percent is still in a very early stage of use.

The dominance of smartphone applications is natural, as they are a common part of most citizens' daily life. Numerous surveys in the region illustrate this. One survey found smartphones to be users' favorite device, citing that over half of Middle East youth would buy a smartphone if only given the choice to buy one device.[601] Another shows very high usage patterns, with 60 percent of users checking their smartphones at least twice a day, and the average adult spending nearly an hour a day on their device.[602] A third survey shows particularly high application usage, with 40-90 percent penetration of mobile applications across internet-connected smartphone users in the Middle East region.[603]

The benefits of smartphone apps for all stakeholders: citizens, government, employees and businesses

In this context, there are many advantages in using smartphone applications to deliver government services.

For citizens they provide a complete, self-contained and customizable experience, provide convenient and flexible 'anytime and anywhere' access, enable faster information flow with real-time updates, encourage user-generated input, and can use device-native capabilities such as the phone's camera, GPS and cross-integration with other applications (e.g. social media) to provide a highly personalized service. For example, users can share photos and pinpoint location data with ease when reporting local problems, receive the most efficient emergency response by receiving the closest ambulance based on their location and remotely access government services outside of public office hours.

For governments, user preferences and high usage of smartphone devices naturally enables the best direct two-way interaction. This encourages greater citizen participation (e.g. for obtaining feedback) and enhances government's transparency, accountability and perception. Governments also benefit from more and much richer sets of data, which can be analyzed to understand their citizens better, as well as to tailor and enhance their service offerings. Remote self-service capabilities significantly increase efficiency, productivity, and reduce costs in government processes. This helps officials better manage their financial and human resources, for example through reducing physical queues. High smartphone penetration rates and usage also improve government's reach across a wider population base. Overall performance improvements to meet objectives also become more attainable, for example with collecting payments, generating jobs, helping job seekers, connecting buyers and sellers, or in reducing the carbon footprint (via paper reduction and reduced travel).

Such benefits also translate to government employees, who can reap similar benefits to citizens. More efficient internal procedures reduce overheads for employees and enable more flexible and remote working arrangements. With as many as 66 percent of employees around the world using at least two mobile devices for work,[604] the benefit of m-gov services for employees globally and in the region is potentially huge.

Businesses also stand to benefit greatly. More efficient m-government processes alleviate administrative burdens, reducing associated time, effort and costs, for example on the processing of employee visas. On this basis, one survey showed that 43 percent of SMEs and 44 percent of large companies preferred electronic interaction with government institutions.[605] Dedicated m-government budgets, such as the UAE's reported $54.5 million budget to develop m-gov smartphone apps, are only expected to increase over the next five years, representing a potentially large opportunity for solutions providers.[606] Telecom operators benefit from the surge in the use of mobile services, particularly data through smartphone apps. As such, operators such as Etisalat and du have announced plans to develop m-government solutions.[607] International organizations such as Apple have also shown keen interest, for example through their reported strategic partnership with the UAE government in its e-transformation and development of smartphone apps.[608]

Dedicated m-government budgets, such as the UAE's reported $54.5 million budget to develop m-gov smartphone apps, are only expected to increase over the next five years, representing a potentially large opportunity for solutions providers.

Success has been most visible in the UAE, where the Dubai government had reported in early to mid-2014 that around 38 percent of its services were being accessed via online channels. The majority of this is likely to be via mobile, according to a national m-gov survey.

Adoption

So how have m-gov smartphone applications fared in the region? Results indicate that new m-gov services have been well-received, illustrated through their rapid adoption and use.

Success has been most visible in the UAE, where the Dubai government had reported in early to mid-2014 that around 38 percent of its services were being accessed via online channels.[609] The majority of this is likely to be via mobile, according to a national m-gov survey, which found that mobile is increasingly consumers' preferred channel for interaction, over web-based government services.[610]

Smartphone apps which alleviated administrative burdens were the most popular, covering government payments (of traffic fines, utility bills, visa services, parking tickets), and card issuance processes (for ID cards, health cards, and driver's licenses).[611]

The UAE's ePay portal and mPay app, enabling centralized government payments (from Dubai Police, RTA, DEWA, national charities and others) is a prime example of this. Both platforms exhibited marked year-on-year growth of 27 percent to over $1.5 billion and 265 percent to over $8.6 million respectively in 2013.[612] Similarly in 2014, ePay transaction volumes increased a further 16 percent to 5.2 million, generating a 25 percent increase in value, approximately $1.9 billion in collections.[613]

Dubai's DEWA app also saw adoption increase more than 22-fold from 26,000 downloads in 2010 to over 577,000 downloads by mid-2014. In 2013, DEWA reported 3.3 million transactions through its website and smart app, which saved the equivalent of 56,331 equivalent trees through paperless transactions and 11,000 tons of carbon dioxide by saving customers' travel to and from DEWA offices.[614]

Regional successes were also recently highlighted and recognized in the second edition of the UAE's Best Mobile Government Service Award. Winners include Lebanon's LAF Shield app, providing active news and information, enabling citizens to report any form of danger directly to the Lebanese Armed Forces and Saudi Arabia's Ministry of Education app, providing comprehensive information (news, events, circulars, academic calendar, and polls), school and student search services. Both apps have at least 100,000 downloads. Other winners include Oman's Public Authority for Consumer Protection (PACP) app and Bahrain's Traffic Services app, with at least 50,000 and 10,000 downloads respectively.[615]

Middle East perspective

There has no doubt been impressive progress in the development of m-gov services, both locally and globally, all within a relatively short timeframe of a few years. Smartphone apps have proven to be the dominant platform and channel for m-gov services and results over the past couple of years have shown a strong appetite for its uptake and use. Whilst growth will still be strong in the short-term, we expect this to level off in the mid- to long-term. Some in the industry suggest that there is only a two-year 'golden window' for smartphone applications development, indicating that m-gov app growth is in its last year.[616] Even with this being the case, smartphone apps are never static, developers are still needed to implement upgrades and redesign to keep up with continuously advancing mobile operating systems, as well as evolving user and government needs.

Concentration is now shifting towards encouraging the more widespread adoption of m-gov services and its integration with supporting back-office e-government infrastructure. Although uptake has been fast, it has been off a low base, as online web portals on their own have been slower, compared to smartphone apps, to attract users since launching.

Lack of awareness has been cited as a key issue and stumbling block behind m-gov service uptake. A UAE m-government survey shows that despite high levels of satisfaction from m-gov services users, overall awareness among the general population is low, where only four out of 10 UAE residents (39 percent) have heard about the UAE m-gov program.[617] This is illustrated in penetration levels of the most popular m-gov apps such as the RTA app, which only has a 23 percent penetration among UAE residents, while the mPay and DEWA apps, despite their fast growth in usage, are still only at 15 percent penetration.[618] Considering that the UAE has the highest smartphone penetration in the world at over 78 percent, these statistics are quite low, but indicate great potential for growth in m-gov service usage. As seen in the private sector (e.g. retail, entertainment), the power of marketing and awareness campaigns, and the use of mobile as an effective communication platform should not be underestimated. Jordan's SMS awareness campaign is a strong case in point. In 2013, Jordanian government agencies sent 16.5 million SMSs to mobile subscribers to raise awareness about certain issues and new e-government and m-government SMS services. In turn, this doubled enquiries from residents about e-government and SMS public services, with 2.1 million text messages sent in 2013, up from around 1 million in 2012.[619]

Jordan's SMS campaign also underscores the importance of applying a multi-channel optimization strategy as part of e-government plans. Expectations from citizens for easier access to more public information and government services from anywhere, anytime and through any channel are only increasing. Governments must be careful not to see m-gov apps as a replacement, but rather as complementary to their range of offerings; e-government portals, SMS and other channels such as social media remain vital and are still needed. Counter (face-to-face), paper-based and telephone (voice) services remain essential in public service delivery. The main challenge in this is how to make different services and entities integrate with each other and the citizen seamlessly, to deliver services in the optimal manner.

Successful m-gov apps remain limited.[620] International m-gov apps in general are of much higher quality and standard than Arab government apps in terms of efficiency, effectiveness, ease of use, innovation and user experience. In terms of service delivery, it is about quality, rather than quantity. Arab governments need to expand focus on the quality aspects of their applications, rigorously testing them to ensure they function adequately as intended and be more user-friendly, intuitive, and interactive (via gamification, incentive or discount programs) for example. Other supporting areas such as capacity building (for instance skilled human resources in app development, networks, data processing and analytics), business process reengineering, and security in protecting sensitive user data, should remain an integral part of policy plans and in the design of any m-gov service.

Local governing entities have taken a number of positive steps in this direction, such as the UAE telecom regulator's establishment of the region's first Mobile Innovation Center, offering consulting, training and a mobile applications testing laboratory. The UAE Best Mobile Government Service Award is another credible example. Arab governments need to build on this, to partner with governments in other regions, businesses, investors, entrepreneurs and students in addition to soliciting feedback from their own citizens to foster innovation and inspire the best solutions in this space. Stakeholder cooperation is key in making m-gov plans a success.

The connectivity chasms deepen: the growing gap in broadband speeds

We expect the global number of broadband homes to have grown by about two percent to 715 million by the end of 2015.[621] Average broadband speed obtained in most markets should increase by between 15 and 25 percent.[622] This average, however, obscures significant differences between households. In many markets the top decile of homes are likely to enjoy ten times or greater the average speed of those in the bottom decile. Countries with ubiquitous fiber to the premise (FTTP) are likely to have the most consistent broadband speeds.

In short, the term 'broadband' is now a blanket term which describes an ever-widening range of different performance levels, from a few megabits per second (Mbit/s) up to a few hundred Mbit/s. When broadband was first rolled out to homes in the late 1990s, services started at about 512 Kbit/s.[623]

We also anticipate a further variability in broadband speed, dependent on each home's circumstances. A diverse set of factors, from thickness of walls to age of router, from time of day to browsing habits of household members and neighbors determine the actual speeds that are attainable at each broadband-connected device.

The variability in speed attained at the device has major implications for the addressable audience for any online service.

There are two main factors that determine broadband speeds attainable.

One is location: typically, the further a home from an exchange, the lower the speeds. Rural homes are more scattered, and so typically, due to the distance from the exchange, have lower broadband speeds. For example in Germany, as of mid-2013, about 80 percent of urban homes had access to 50 Mbit/s services, but in rural areas, under a fifth had access.[624]

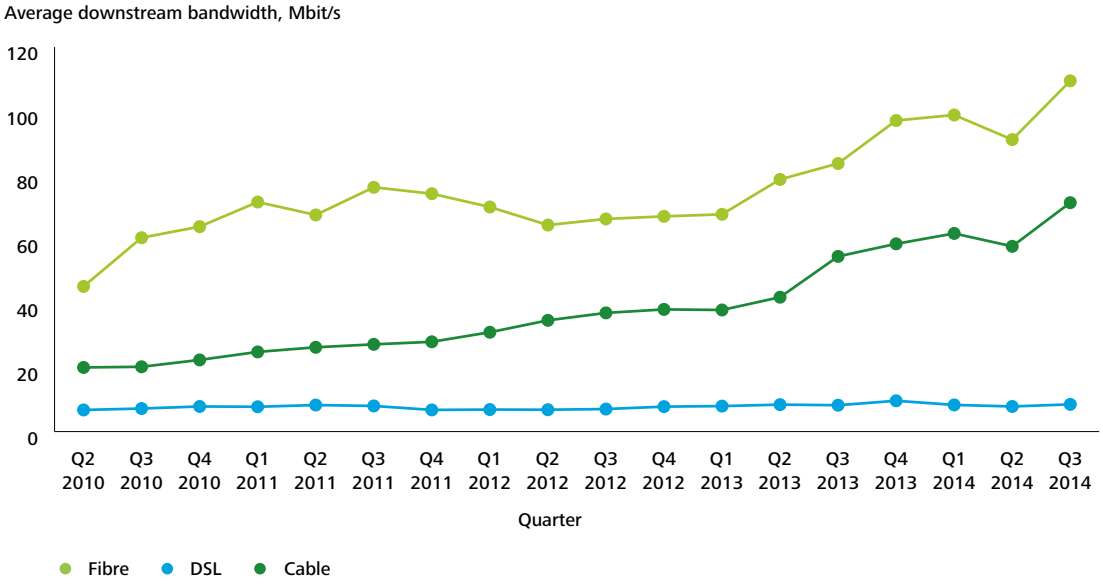
A second issue is technology: there are four main types of broadband technology, each of which offers a different range of speeds:

- Standard ADSL – the original broadband technology – offers a maximum speed of 8 Mbit/s. An enhanced version of the technology, known as ADSL+ offers treble that. We forecast 280 million ADSL homes (40 percent of the total) as of the start of 2015.[625] ADSL works over existing copper lines, and requires an upgrade at the telephone exchange.
- FTTC (fiber to the cabinet), the most commonly deployed upgrade to ADSL, is forecast to be in about 175 million homes (a quarter of all broadband homes) as at the start of 2015.[626] FTTC extends a fiber connection to a street-side cabinet; thereafter the connection is via the existing copper wire. FTTC is typically advertised at 30-40 Mbit/s downstream, with 70 Mbit/s and faster services also available for an additional fee. Speed declines by about half within 800-1000 meters from an exchange, by 75 percent within 1.6-1.8 kilometers.[627] By 2020 FTTC will be able to reach 100 Mbit/s, which should be sufficient for the majority of current online services.[628]
- FTTP (fiber to the premise)[629] is forecast at 110 million homes (16 percent of broadband homes) as of Q1 2015.[630] FTTP extends fiber all the way to the home.[631] FTTP speeds are currently up to 1 Gbit/s.
- Cable is in about 135 million homes (19 percent of broadband homes). Cable broadband providers with DOCSIS 3.0 networks market services starting at 50 Mbit/s. Peak speeds offered are in the hundreds of Mbit/s. The technology allows for faster speeds, but few websites today can cope with them. About 80 percent of cable broadband is DOCSIS 3.0; other networks are much slower. DOCSIS 3.0 based cable broadband speeds have increased significantly in recent years: in the UK, they rose from 11.7 to 43.3 Mbit/s between December 2010 and May 2014.[632]

Each technology currently supports a different set of applications. ADSL should always be good enough for general browsing and e-mail, but may be insufficient for streaming to a television set, depending on the distance from the exchange. FTTC should be sufficient to streaming video to a 40 inch TV set during prime-time, but speeds vary by distance from the exchange, as well as by grade of service chosen. DOCSIS 3.0 cable and FTTP can cope with most broadband applications, including simultaneous high definition television streams.

Over time, at a global level, the speed of each of these technologies has increased, with cable and fiber broadband technologies getting faster, but ADSL has remained at approximately the same speed (see Figure 20).

Figure 20. Changes in standalone residential bandwidth offered by technology in Mbit/s (Global)



Source: Point Topic, 2014

The variation in speeds by technology may increase in the near-term. For example a planned upgrade to FTTC, known as G.Fast, offers up to 1 Gbit/s speeds over existing copper connections, by increasing the range of frequencies over which broadband signals travel.[633] The drawback with this approach is that it works over very short distances – ideally 100 meters or less. This is an acceptable distance in neighborhoods packing in dozens of homes within 100 meters of a cabinet, but in some rural areas homes may be over 100 meters from the road, and many kilometers from the exchange.

There is also a planned upgrade to the cable broadband technology standard, called DOCSIS 3.1. This is being introduced in response to the faster speeds being offered over FTTC and FTTH networks. The new cable standard offers speeds up to 10 Gbit/s down, and 1 Gbit/s up. These enhancements will again further extend the gulf in broadband speed by household.[634]

Broadband providers could deploy cabinets in close proximity to every home wanting high speeds, but as private businesses in the absence of subsidy, they will inevitably tend to focus on upgrading connections in cities, as they offer the highest potential return.

Another approach could be to deploy fiber to every home, or to extend the reach of cable networks, but both would require significant investment.

FTTC is the most likely technology to be deployed in markets with ubiquitous pre-existing copper networks: it is a fraction of the cost of extending fiber to the premise. However its performance is markedly affected by distance from the exchange, so it may increase speeds for those with existing access to fast broadband, rather than bring slow broadband speeds more in-line with the average.[635]

Distance and technology are, however, just two of the factors affecting broadband speeds in each home. A further issue is affordability. In most markets, broadband pricing varies by technology deployed; the faster the service, the greater the cost. For some homes, paying an extra $20 per month may be immaterial, whereas for homes below median income levels, this additional cost may be unaffordable. The premium payable for faster broadband is a principal reason behind its relatively slow take-up. In the UK, as of March 2014, only 14 percent of homes passed had subscribed to either FTTC or FTTP.[636]

Affordability means that variation in broadband speeds will also exist within the same neighborhood, based on income levels, as well between urban, suburban and rural households.

Distance and technology are, however, just two of the factors affecting broadband speeds in each home. A further issue is affordability.

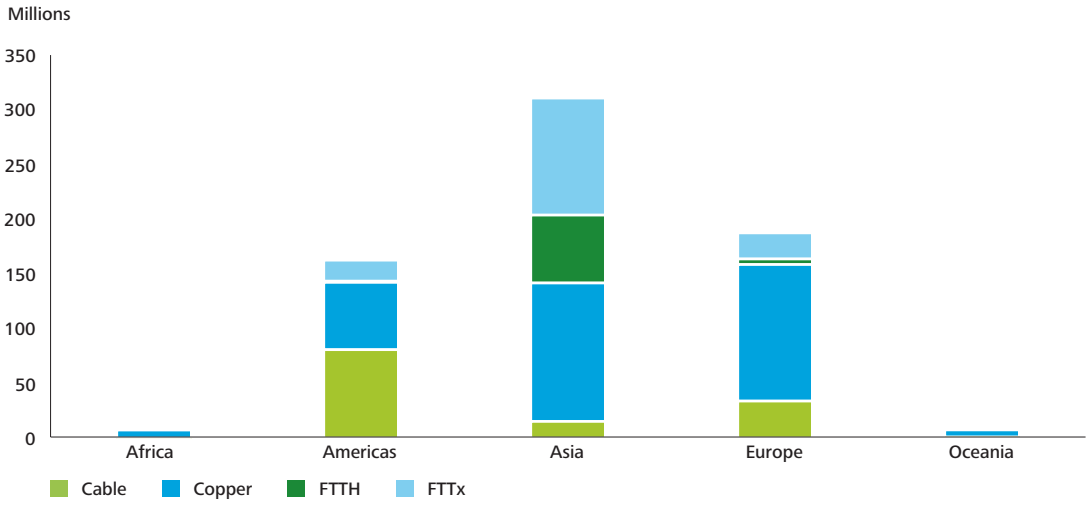
So far we have focused on broadband speeds to the home. Once within the home, there are multiple factors which deplete the actual speed obtained at the device. One is whether wireless or wireline is used. A wireless router is easier to use, requiring little installation. But using Wi-Fi can result in a 50 percent drop in speed. Providing a wired connection is too complex for most households. An intermediate step uses power line adaptors, which run broadband signal along the power supply. This can work if the electrical cabling in the house is sufficiently modern, and the power line adapters used are compatible with the router provided by the ISP. The age of the router affects speed too – the older the router, the slower the throughput. Construction materials used can also determine performance. Older houses with thick walls block wireless signals, as do newly renovated homes with layers of foil-backed plasterboard.[637] Underfloor heating based on coils of hot water pipes also deflects signal, as does anything metallic. The highest speeds within Wi-Fi home are generally closest to the router; but in some cases the device needing the fastest speeds (typically the television) may not be adjacent to the router.

The speed obtained at the device is further affected by other members of the household. Broadband is a shared resource, and a high-speed connection shared among bandwidth-hungry family members may still result in modest speeds at the point of consumption.

The range of speeds obtained is evidenced in many empirical studies. Data from a major content distribution network, found that about half of connections it interfaced with around the world were at 4 Mbit/s or faster, a fifth were at 10 Mbit/s or faster, and just one tenth were at 15 Mbit/s and up.[638]

This prediction has focused on the divergence in broadband speed within specific markets. There are also marked differences in broadband speeds by geographical region which are likely to continue through 2015 and beyond. Figure 21 below shows the number of broadband homes by technology for all global regions.

Figure 21. Broadband homes by region and by technology



Source: Point Topic, 2014

A fragmanted but growing broadband landscape in the Middle East

Deloitte predicts that in 2015, total internet penetration in the Middle East will reach around 38 percent, over approximately 25 million homes.[639] Fixed broadband penetration however, is expected to reach over 21-22 percent of all Middle East households (around 14 million households).[640] Fixed broadband penetration rates vary significantly across the region due to high economic disparity – particularly when comparing GCC countries with significantly higher penetration rates to those in North Africa where dial-up connections are more common.

Purchasing power as well as broadband tariffs differ across the region. In comparison to the rest of the world, the region generally has high broadband tariffs due to several reasons. The majority of state-owned telecom companies across the region hold monopolistic market positions, where local telecom regulators have limited influence over broadband tariffs.[641] Additionally, in less developed countries where sufficient broadband infrastructure is not available, the service comes at a much larger cost. UAE's Etisalat recently announced plans to launch 5G services in the region,[642] while some countries in other parts of the region are yet to launch 3G.

However, the dynamic economies in the GCC and high potential markets such as Iraq, offer significant room for broadband growth. Particularly, regional advancements in FTTH infrastructure (primarily in the GCC) have stimulated market growth and development. FTTH is expected to grow at 8 percent per annum, to penetrate as much as 17 percent of local fixed broadband connections by 2018.[643]

Government led initiatives, such as National Broadband Plans (NBPS), have been initiated to encourage favorable broadband market conditions. Affordable, universal high speed broadband to support a country's market and economic development are priority for many governments. Broadband has seen low investment and underdeveloped infrastructure in terms of technology and coverage due to limited competition, while mobile broadband markets are developing increasingly well in terms of penetration and coverage. Governments across the region have dedicated efforts to stimulate the broadband market in a systematic and holistic way by adopting national broadband policies, strategies and plans to foster access.[644]

National Broadband Plans in the Middle East.

Broadband penetration is typically dependent upon several factors including the country's infrastructure, access to financing and the population's purchasing power.[645] With wider access to financing and generally higher disposable income, GCC governments such as Qatar, Bahrain, KSA and the UAE have paved the way in terms of strategies, policies and plans, which correlates with generally higher broadband adoptions in the area.

One example of an NBP in the GCC is the Qatar National Broadband Plan (QNBP), which was released in 2013. The plan consists of broadband development initiatives which aim to support and promote broadband market development, involving all necessary stakeholders (including the private sector) in order to address both the supply and demand sides.[646] Namely, initiatives were collectively designed to achieve four key targets by 2016; the ability to choose between a minimum of two broadband retail providers (irrespective of location), to have 95 percent of households with access to affordable and high-quality broadband services, to have all businesses, schools, hospitals and government institutions have high-quality access and finally, to have digital literacy expanded to all of the mainstream population.[647]

Telecom operators such as Ooredoo and Vodafone Qatar have made considerable investments in fiber roll out, and their involvement in the QNBP ensures that assets are shared to maximize impact. Some direct benefits of the QNBP are acceleration of innovation and knowledge creation across both public and private sectors, improved quality and efficiency of ICT services and increased market competition.[648] This progress positions Qatar on the right path to achieve its 2020 e-government strategy and become a knowledge-based, diversified economy which is not solely reliant on natural resources.

Bahrain has also recognized the value of implementing a plan to reach high connectivity speeds by leveraging infrastructure from the country's national water and electricity utility company.[649] By investing in high speed and cost-effective broadband infrastructure, the country will be able to realize the benefits of e-services and reliable, high bandwidth networks, and capitalize on long-term socio-economic benefits.[650]

Another NBP in the region which has been rolled out is Egypt's 'eMisr', which is planned to eventually serve as a backbone to other national initiatives such as e-health, e-government and e-education. Some of the key goals of eMisr is to promote job opportunities, stimulate economic growth and improve overall quality of living for its population.[651] Egypt's large population of over 80 million as well as limited capital poses quite a challenge to its NBP goals. The goal for 2015 is for 75 percent of

the population to have fixed internet services at two Mbps, 22 percent subscribed to high speed internet and eight million mobile internet subscribers. The long-term goal for 2021 is to have 90 percent of households with fixed internet services at 25 Mbps, 9 million households subscribed to high speed internet, and 14 million individuals subscribed to mobile internet.[652]

Socio-economic impacts of NBPs. There are various socio-economic benefits of NBPs and other forms of long-term investment in a country's broadband technology – both from an enterprise and consumer perspective.

Direct benefits come as a result of investments in ICT and infrastructure rollout which directly promotes and encourages market development and business expansion. Direct benefits are quite short-term but lay the foundation for longer term, more impactful spillover effects.[653]

Indirect effects of large scale initiatives are also generated by all types of economic activity which consume ICT. These can help drive economic growth through, for example, increased efficiency and productivity, reduced costs, innovation and increasing employment opportunities.[654] Indirect, longer term effects both encourage and leverage innovations as they are gradually adopted. Investment in ICT generates positive network externalities as the benefits that are realized from using technologies increase and become more ubiquitous in a society.[655]

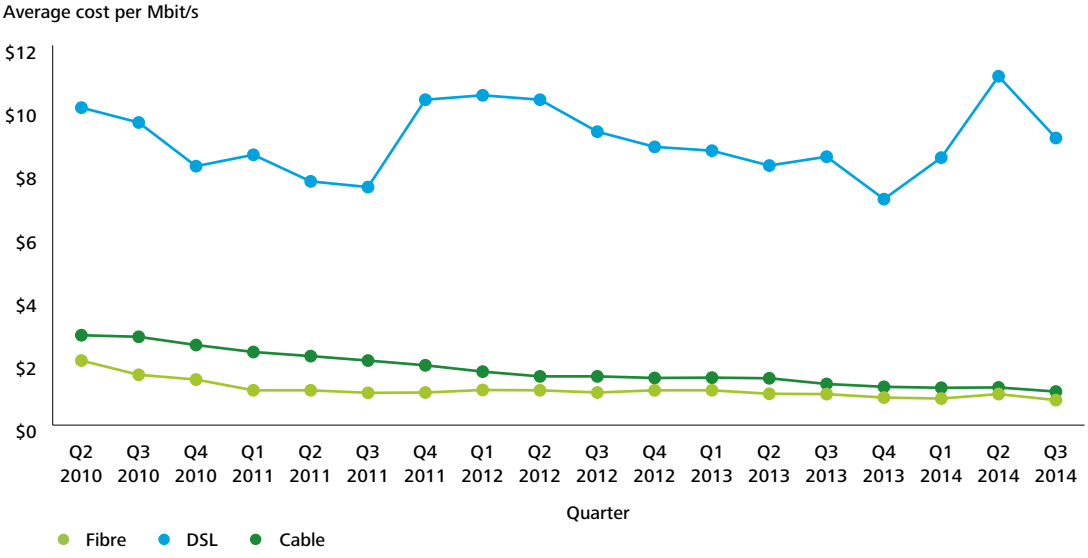
Bottom line

When we talk about broadband divides, this often refers to the gulf between the 'haves' and the 'have nots'. This gap is important, but it is also critical to recognize variations between the 'haves'. The gulf between those with access to the fastest broadband speeds and those on basic speeds has widened over recent years; and in the near term looks likely to increase further.

There are evident implications for regulators. It may not be sufficient simply to call for broadband to be recognized as a universal service, in the same way as fixed line telephony in many countries. The definition of what broadband is needs to be updated regularly. Speed is a key parameter. Historically this has focused on downstream speed, but in future, as broadband usage evolves, upstream speed will become increasingly important as users upload more content.

Regulators should also consider how price per megabit is affected by technology. Households with access only to ADSL broadband, do not just have lower speeds, but are also paying significantly more per Mbit/s (see Figure 22).

Figure 22. Changes in standalone residential average cost per megabit, US dollars, at PPP rates (Global)



Source: Point Topic, 2014

Any private or public entity looking to deliver over-the-top services (OTT), whether this is video-on-demand (VOD) or online tax submissions should consider what ranges of broadband speeds households are able to get.

Video is particularly affected by interruptions to service. Any company, whether a standalone subscription VOD provider, or a broadcaster offering on-line catch up, should monitor closely available speeds. Households that cannot access fast broadband connections but wishing to have on-demand service may need to be offered alternative approaches, such as satellite caching (whereby content is via satellite to a digital video recorder).

Companies offering online shopping ideally want to offer the richest experience possible – but this requires fast broadband connections which are not always available.

This prediction focuses on 2015 and the likely outcomes during this time period. In the long-term there is ample opportunity for more disruptive innovation with broadband delivery, including the use of hot air balloons to deliver high speed connections to rural areas. With this approach, signals are relayed between arrays of balloons before reaching a ground station which is itself connected to the Internet. This approach is expected to deliver 3G type speeds.[656]

Middle East perspective

Governments have made efforts to address issue of low broadband penetration and disparity within the region through National Broadband Plans which consist of long-term goals. Many countries struggle to fully realize the benefits of national initiatives – misaligned priorities across institutions, ineffective or weak incentives for infrastructure and service providers as well as lack of compelling services for the citizen can all contribute to lower than expected adoption levels.[657]

So far, countries have taken independent approaches to focus on their internal markets. However, adoption of a common regulatory framework in the region, particularly in sub-regions (i.e., Gulf countries, Levant, etc.) would reap higher and more beneficial returns in terms of broadband development – similar to that of the European Union (EU).[658] Currently, the region is one of the most fragmented on a global scale in terms of regulations, local laws and institutions which vary in each country, acting as a potential barrier to investments.[659]

In addition to a common approach, competition has been proven to be a key driving force to broadband development. Competition encourages investment, creates incentives for operators to increase efficiency and ultimately, provides maximized benefits for end users (both in terms of quality and price).

The spillover effects which a country or region reaps as a result of efforts to maximize broadband development is crucial for the general economic development of the region. This is particularly the case in the Middle East, where a young population is fueling broadband usage through high rates of social media adoption and device consumption. Encouraging competition and standardizing regulations and frameworks is key to drive broadband development.[660] Establishing concrete infrastructure for both fixed and mobile broadband will complement the increasing demand for different types of media, such as digital OTT services. With growing broadband penetration and fiber rollouts in the GCC, in addition to higher disposable incomes, the region is likely to see an increase in international interest – particularly OTT services.

Contactless mobile payments (finally) gain momentum

Deloitte predicts that by end-2015, five percent of the base of 600-650 million near-field communication (NFC[661]) equipped phones will be used at least once a month to make contactless in-store payments at retail outlets[662]. This compares with monthly usage by less than 0.5 percent of the 450-500 million NFC-phone owners as of mid-2014[663]. Contactless mobile payment will not be mainstream by end-2015, but niche adoption will be a major progression from near nil in prior years.

Looking further ahead, Deloitte expects the number of NFC-enabled devices being used for making in-store payment should rise steadily over the medium term, as consumers become more familiar with the process, and more banks and merchants in more markets accept this form of transaction[664]. We expect the volume of NFC-smartphone transactions and the range of spend value to increase steadily over time.

While usage of phones to make contactless payments is expected to increase over time, they are likely to co-exist for some time with all other means of payment, from contactless credit cards to cash. It will be a long while before the majority of us can jettison our physical wallets.

The logic of using mobile phones to make in-store payments has long been recognized, and as far back as the late 1990s prototypes of vending machines equipped to take payment via mobile phones and over cellular networks were being exhibited at trade shows. The benefit of using short-range wireless technologies over a distance of a few centimeters to transmit payment information has also long been understood. Speedpass, the first contactless payment device (a key fob for use in gas stations) was launched in 1997[665]. In the same year, the Hong Kong metro system introduced a contactless pre-paid fare collection system.[666]

Indeed, the combination of contactless payment and mobile phones has existed for over a decade. The first phones with any form of contactless technology were launched in 2004 and the first phone with NFC went on sale in 2006.[667] For many years, smartphones have been used to effect financial operations, such as checking balances, transferring funds, and transacting online.

But prior to 2015 the use of phones to make in-store payments using any technology (such as QR codes, or other short-range wireless technologies) has been minimal, with only a small proportion (ten percent or lower) of the smartphone base claiming to have paid in-store via their phone at any time.[668]

Deloitte expects that 2015 will be an inflection point for the usage of mobile phones for NFC-enabled in-store payment, as it will be the first year in which the multiple prerequisites for mainstream adoption – satisfying financial institutions, merchants, consumers, technology vendors and carriers – are sufficiently addressed.

We expect the largest card issuers in the majority of the largest developed countries to have activated NFC-smartphone payments by end-2015, although adoption patterns are likely to vary by region, due to differing economics and technical (e.g. payments processing) models.

For financial institutions (card issuers and banks), NFC in-store phone payments offer continuity and improvement to their business models. They levy a commission on the transaction value, which they may share with a handset vendor or other entity.[669] They underwrite the risk on the payment. Account holders are subject, with one of approaches used, to the same transaction limits as with a physical card and the repayment terms for credit card holders are the same.

The core advantage with any contactless smartphone transactions is the potential for greater security, when payments are made with phones featuring either built-in (via hardware or software) or SIM-based tokenization capability.[670] When someone pays using an NFC-device, the tokenization facility creates a unique code (known as a token) which is sent from the device to the merchant's NFC-enabled till. The credit card number is not transferred which means in the event of a breach, only card information used in traditional transactions would be exposed.[671] The card information is either stored with the issuing networks (such as Visa or MasterCard), or is stored in the cloud (HCE), or in a secure element on the phone. The token is only good for a single transaction and unusable otherwise. A fraudster who intercepted the transaction would only get access to the single-use token but not the card details.[672]

Using a fingerprint, an eye scan or a heart rate sensor as an additional form of authentication makes the payment more secure still.[673] The combination of biometric authentication, an embedded secure element and tokenization may provide more robust security than card swipes or chip and PIN.

For merchants, NFC-equipped phones can enable fast and, with some systems, high-value transactions.[674]

All forms of payment have friction points: cash requires change and credit cards require PINs or signatures; but contactless payment requires only a card or device to be placed on a compatible reader. A fundamental benefit with some contactless smartphone payment systems is that the spending limit can be the same as the account holder's credit or debit card limit.[675] By comparison, contactless cards typically have a payment threshold (typically under US$50)[676] and a transaction limit (the number of contactless payments made) before additional identification is required, so as to mitigate the impact of a stolen contactless card. As one example, the 23.8 million contactless card transactions in the UK in June 2014 had an average value of $11.03.[677] This was about one seventh of the average transaction value of all credit and debit cards in the UK in the same month ($78.52).[678]

Accepting NFC payment requires compatible point-of-sale (POS) terminals, and new POS terminals cost several hundred dollars. As of the start of 2015, there were already millions of NFC-ready payment terminals globally, out of the tens of millions of terminals in use around that world. Over the course of 2015 that base is likely to see a significant increase, particularly in the US where merchants are replacing their terminals to comply with the EMV mandate, these will most likely to be ones supporting NFC.[679]

By end 2015, we expect a minority of merchants to be supporting contactless smartphone payments. These will often be retailers that have already made the investment in replacing POS systems, and will often be stores with a high volume of relatively low-value transactions, such as fast food outlets.

For most of the parties involved in the adoption of NFC mobile payments, the reason to adopt is financial. For consumers it is also behavioral. Using NFC-equipped smartphones to make payments will be adopted only if it can make the payment process simpler, sleeker or provide specific incentive in the form of digital coupons or discounts.

The multiple components that enable NFC-smartphone in-store payments have been falling into place over the last few years. Hundreds of millions of smartphone owners have already submitted their credit card data (one or multiple cards) to a range of vendors so as to be able purchase apps, or download songs, or purchase additional cloud-based storage.[680] Tens of millions of consumers have become acclimatized – over the course of many years – to the idea of contactless payments using their credit and debit cards, and in some markets their contactless transport cards.[681] For most people, using a fingerprint reader is a rare requirement, typically occurring only when passing through border control in some countries. But as of early 2015 it has become an everyday action for approaching 100 million individuals using phones equipped with a fingerprint reader.[682]

So for smartphone users who already have credit card data linked to their phone, have made contactless payments and are accustomed to submitting a fingerprint to unlock their phone or authorize an app purchase, submitting a fingerprint reading to authorize a contactless payment should not feel unfamiliar.[683]

The existence of hundreds of millions of contactless credit and debit cards should not constrain the usage of NFC-enabled smartphones as an additional means of payment. We would expect that when offered a choice, about 30 million individuals may opt to pay using their phone instead of a contactless card.

For some, this will be because they are more likely to be holding their phone than their wallet. A few may decide to pay by smartphone to signal their status as early adopters. With some approaches, a smartphone may offer a higher payment limit than a regular contactless card.

Some NFC-based smartphone payment systems require pre-payment.[684] We would expect these systems to remain popular, and co-exist with approached linked to debit and credit cards. Pre-pay would prevail among the under-banked.

We would expect that when offered a choice, about 30 million individuals may opt to pay using their phone instead of a contactless card.

Bottom line

Contactless payment, initially in single-vendor closed-loop systems, has already been available for decades, but it is only in recent years that contactless cards have started to enjoy a surge in adoption. 2015 should see strong growth in contactless mobile and card payments usage, but the rise will be from a small base to a slightly less small base. Customer education and marketing will be essential to increase awareness of the ability to pay using a phone.[685]

While we expect significant growth in usage in 2015 relative to the prior base, many challenges remain before smartphone contactless payments can become mainstream, even in developed countries.

For financial institutions, smartphone contactless payments offer an additional way to transact which also may help maintain the current ecosystem, albeit at a cost in terms of commissions.

Retailers should consider four main benefits: reducing the need to protect customer data, the higher speed of contactless transactions relative to other payment means, the ability to attract consumers with higher disposable incomes, and the opportunity to provide more personalized experiences, for example by integrating loyalty schemes.[686]

Handset vendors can differentiate their devices through the inclusion of components, such as a fingerprint reader, or a tokenization engine, that would enable contactless payments. These functionalities need to be offered as part of a payment ecosystem, and should be easy to use.

Over time, other contactless processes such as premise entry and exit could be incorporated in a handset; and contactless payment is likely to be combined with other processes at the point of transaction, such as collection and redemption of loyalty points.[687]

All players should consider how contactless smartphone payments could be made even more secure. One possible way of doing this would be to use the location data routinely collected by smartphones as a security check.[688] Deviations from a normal purchasing location could trigger a request for further verification, such as PIN entry.

In the medium term the impact of contactless mobile is wide: it provides the opportunity to deliver new customer experiences such as displaying special offers in store to NFC based devices, it may catalyze the removal of point of sales systems for merchants. And NFC may become incorporated into a wider range of devices beyond phones.

Endnotes

1. Deloitte is not including the Information and Entertainment sector in this analysis. We have categorized Smart TVs, game consoles, set top boxes and the like as being part of the Internet of Humans, rather than the Internet of Things. See: "Internet of Everything Market Tracker", ABI Research (as accessed on 16 Dec 2014): https://www.abiresearch.com/market-research/product/1017637-internet-of-everything-market-tracker/
2. Source: Gartner, who estimate device unit sales (excluding Information and Entertainment) for 2014 at 636 million and forecast 2015 sales of 1.015 billion units. See: "Gartner Forecast: Internet of Things, Endpoints and Associated Services, Worldwide", spreadsheet download, Gartner (20 Oct 2014): http://www.gartner.com/document/2880717 [Registration required]
3. "Gartner Forecast: Internet of Things, Endpoints and Associated Services, Worldwide", Gartner, spreadsheet download (20 Oct 2014): http://www.gartner.com/document/2880717 [Registration required]
4. We calculate the value of a $10 IoT module within a $40,000 car as worth $10, and not as a $40,000 IoT-enabled device. Deloitte estimates that the average cost of an IoT modules will be about $10, so a billion units are about $10 billion in IoT specific subsystem hardware revenues, although embedded in larger devices worth collectively hundreds of billions of dollars.
5. Gartner has excluded most of the Internet of Humans Information and Entertainment services revenue from their $69.5 billion services forecast: "Video media service revenue and video game ecosystem revenue are excluded from the information and entertainment category, but the revenue from both segments is available in "Forecast Analysis: Consumer Video Media Services, Worldwide, 3Q14, 5 December 2014" (G00269649), and "Forecast: Video Game Ecosystem, Worldwide, 4Q13" (G00246826)." See: "Gartner Forecast: Internet of Things, Endpoints and Associated Services, Worldwide", spreadsheet download, Gartner (20 Oct 2014): http://www.gartner.com/document/2880717 [Registration required]
6. "IoE, Enterprise & M2M", ABI Research (as accessed on 9 Dec 2014): https://www.abiresearch.com/market-research/practice/ioe-enterprise-m2m/ [Registration required]
7. Gartner total service revenues for 2015 are $69.5 billion, while consumer services revenues excluding Information and Entertainment will be $5.2 billion, or 7.5 percent. See: "Gartner Forecast: Internet of Things, Endpoints and Associated Services, Worldwide", spreadsheet download (20 Oct 2014): http://www.gartner.com/document/2880717 [Registration required]
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11. Based on experimental data, five laundry loads were washed and dried. Total time of doing all tasks (not counting the machine time of doing the washing and drying) averaged 180 seconds per load, of which turning the machines on was under five seconds.
12. This obviously varies by appliance power usage and local electricity rates and off-peak discounts. In Ontario Canada, off-peak rates are 7.7 cents per kilowatt hour (kWh), versus 11.4 cents during mid-peak periods. The average dryer load takes about an hour at 3500 watts, or 3.5 kWh; or 27 cents off peak and 40 cents mid-peak. The difference of 13 cents means that even at one dryer load per day, only $47.45 would be saved annually. See: "Smart Meters and Time-of-Use Prices", Ontario Ministry of Energy (30 Oct 2014): http://www.energy.gov.on.ca/en/smart-meters-and-tou-prices/
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15. A fully connected car offers many potential applications, ranging from self-diagnosis for repairs, telematics for insurance, and even autonomous driving. Once vehicles are connected for those purposes, features such as remote start will also be possible, but for most cars remote starting on its own is unlikely to be a common reason for investing in a M2M link.
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23. In line with our global definition of IoT, focused more on machines and enterprise usage (than on people and consumer usage); we are only considering the business (enterprise) side of 'IoT market' estimates. As such, there were about 42 million business M2M connections in 2013 across the Middle East and Africa (MEA), according to Cisco. This is about 5 percent of the 820 million business M2M connections reported globally. We have assumed MEA's share of global business M2M connections to be reflective of the overall enterprise IoT market. Source: "Cisco VNI Service Adoption Forecast" (2013-2018), Highlights Tool, Cisco (2013-2018): http://www.cisco.com/c/en/us/solutions/service-provider/vni-service-adoption-forecast/vnisa_highlights_tool.html

24. The Middle region's portion of the MEA IoT market was estimated by a rough comparative analysis of MENA versus SSA metrics, specifically GDP and total Mobile broadband subscriptions, at (and around) the same period (2012-2013). This was done to compare relative spending power, need and mobile connectivity at a regional level, both key features required for IoT devices and services procurement and deployment. The analysis of these two metrics shows that the Middle East region and SSA are more or less equally split, implying the Middle East region is about 2.5 percent of the global enterprise IoT market. With very active IoT developments in the region over the past few years, we expect the Middle East region is likely to be ahead of Africa, hence the 2-3 percent range. Source: "Cisco VNI Service Adoption Forecast" (2013-2018), Highlights Tool, Cisco (2013-2018): http://www.cisco.com/c/en/us/solutions/service-provider/vni-service-adoption-forecast/vnisa_highlights_tool.html ; "Global Internet Report 2014", The Internet Society (2014): http://www.internetsociety.org/sites/default/files/Global_Internet_Report_2014_0.pdf ; World Bank

25. The region's percentage share is still likely to apply today, given that MEA shares are forecasted by Cisco to remain the same through till 2018. We however believe with regional developments seen that going forward, beyond 2015, the Middle East region is likely to accelerate and expand its share faster than SSA. Source: "Cisco VNI Service Adoption Forecast" (2013-2018), Highlights Tool, Cisco (2013-2018): http://www.cisco.com/c/en/us/solutions/service-provider/vni-service-adoption-forecast/vnisa_highlights_tool.html

26. Regional prediction estimates are based on the Middle East region's roughly estimated 2.5 percent share of the global enterprise IoT market, which has been applied to our global prediction estimates to ensure consistency in our overall methodology.

27. Although regional IoT market estimates vary by definition and size, growth estimates are generally between 20-30 percent for IoT hardware and connectivity, faster than global growth of 10-20 percent. We have therefore assumed that a similar difference applies to associated IoT services in the region, with 10 percent faster growth than global. Source: "Cisco VNI Service Adoption Forecast" (2013-2018), Highlights Tool, Cisco (2013-2018): http://www.cisco.com/c/en/us/solutions/service-provider/vni-service-adoption-forecast/vnisa_highlights_tool.html ; "M2M Middle East Forum: Etisalat is proving that operators have opportunities in the region", Analysys Mason (3 Oct 2013): http://www.analysysmason.com/Research/Content/Comments/M2M-MENA-Etisalat-Oct2013-RDRK0/ ; "Middle East and Africa - UAE Internet-of-Things (IoT) and Machine-to-Machine (M2M) Communication Market", Micro Market Monitor (2015) – UAE IoT growth at 28 percent CAGR: http://www.micromarketmonitor.com/market/middle-east-and-africa-uae-internet-of-things-iot-and-machine-to-machine-m2m-communication-4358866877.html ; KSA IoT growth at 26 percent CAGR: "Novatel Wireless and NOMD Strengthen Market Position in Saudi Arabia", Micro Market Monitor Data, Market Watch (12 Dec 2014): http://www.samenacouncil.org/samena_daily_news.php?news=50636

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67. "The M2M opportunity in the Middle East", Gemalto (14 Oct 2013): http://blog.gemalto.com/blog/2013/10/14/the-m2m-opportunity-in-the-middle-east/#sthash.eif4EPB3.dpuf

68. "An in-depth view on UAVs is available here, see: Unmanned aerial vehicle in logistics", DHL (2014): http://www.dhl.com/content/dam/downloads/g0/about_us/logistics_insights/DHL_TrendReport_UAV.pdf

69. The caliber of the camera depends on the price paid. See: "Parrot's Bebop drone is a speed demon", Mashable (19 Nov 2014): http://mashable.com/2014/11/18/parrot-bebop-drone-2/

70. The new BeBop drone from Parrot, one of the three largest consumer drone manufacturers, costs about $900 as part of a kit including three batteries. See: "Parrot's Bebop drone is a speed demon", Mashable (19 Nov 2014): http://mashable.com/2014/11/18/parrot-bebop-drone-2/

71. As well as smartphones, other devices can be used to control drones, including smart glasses and virtual reality glasses. Currently our view is that the installed base of such devices is minimal. For more information on alternative controllers, see: "Parrot AR.Drone 2.0: Even more piloting possibilities!", Parrot (6 Jan 2014): http://blog.parrot.com/2014/01/06/parrot-ar-drone-2-0-even-more-piloting-possibilities/

72. To see some compilations of drone footage, see: "The 7 most viral drone videos in the world", Business Insider (27 Sep 2014): http://www.businessinsider.com/7-best-viral-drone-videos-in-the-world-2014-9?IR=T ; "The best drone videos from around the web", Time (8 Jul 2014): http://time.com/2967209/best-drone-videos/; "Killer whales caught in stunning drone footage", Livescience (21 Oct 2014): http://www.livescience.com/48371-drone-photographs-killer-whales.html

73. This system combines a drone with a third-party camera, and uses long-range Bluetooth to follow the individual. For more information, see: "AirDog: World's First Auto-follow Drone for GoPro Camera", Kickstarter (as accessed on 8 Dec 2014): https://www.kickstarter.com/projects/airdog/airdog-worlds-first-auto- follow-action-sports-dron

74. For example see: "Farming takes flight drones save IL farmers time and money / public news service", Farming Drones (21 Jul 2014): http://farmingdrones.com/farming-takes-flight-drones-save-il-farmers-time-money-public-news-service/

75. To see footage of cows being herded by drone, see: "Cow drone herding", YouTube (28 Dec 2012): https://www.youtube.com/watch?v=kK9gVzSYjJM#t=21

76. For example, see: "FAA allows drone use in missing person search", The Hill (9 Nov 2014): http://thehill.com/policy/transportation/217393-faa-allows-police- to-use-drone-in-missing-person-search. Also see: "Model drone finds elderly man, missing for three days, alive", ArsTechnica (23 Jul 2014): http://arstechnica.com/ tech-policy/2014/07/model-drone-finds-elderly-man-alive-after-going-missing-for-three-days/

77. UAVs can be used to provide additional aerial surveys between bore holes. See: "Drones offer 360° vision for oil-hunting geologists", The Conversation (15 Jan 2014): http://theconversation.com/drones-offer-360-vision-for-oil-hunting-geologists-22022

78. For an example of a company providing such a service, see: "Wind Turbine Blade Inspections", Atmoscam (as accessed on 8 Dec 2014): http://www.atmoscam.com/uav-industrial-services/wind-turbine-blade-inspections

79. "Cyberhawk UAV inspection cuts cost of decommissioning North Sea oil rig in IMechE PE magazine", Cyberhawk (as accessed on 8 Dec 2014): http://www.thecyberhawk.com/2013/02/cyberhawk-uav-inspection-cuts-cost-of-decommissioning-north-sea-oil-rig-in-imeche-pe-magazine/

80. For more information on how drones are being used by archaeologists around the world, see: "New to the Archaeologist's Tool Kit: The Drone", The New York Times (13 Aug 2014): http://www.nytimes.com/2014/08/14/arts/design/drones-are-used-to-patrol-endangered-archaeological-sites.html?_r=0

81. "Low-income countries might get drone deliveries before the U.S. Here's why.", The Washington Post (3 Dec 2013): http://www.washingtonpost.com/blogs/the-switch/wp/2013/12/03/low-income-countries-might-get-drone-deliveries-before-the-u-s-heres-why/

82. For example see: "Behind the mind-boggling shots captured by BBC drones", Wired.co.uk (12 Feb 2014): http://www.wired.co.uk/news/archive/2014-02/12/ bbc-drone-journalism. Also see: "Hundreds of Thousands Evacuated as Typhoon Nears Philippines", NBC News (5 Dec 2014): http://www.nbcnews.com/ watch/nbc-news/suburban-buffalo-snow-day-captured-by-drone-361764419988

83. For example, see: "Drone cameras take wedding photography to new heights", CBS News (5 Aug 2014): http://www.cbsnews.com/videos/drone-cameras-take- wedding-photography-to-new-heights/

84. For example, see: "France probes fresh drone flights over nuclear power plants", Euronews (1 Nov 2014): http://www.euronews.com/2014/11/01/france- probes-fresh-drone-flights-over-nuclear-power-plants/. Also see: "Attack of the drones: Hollywood celebrities are besieged by paparazzi spies in the sky. Worried? You should be… because they'll soon be a regular fixture over YOUR home.", Mail Online (8 Sep 2014): http://www.dailymail.co.uk/news/article-2746231/Attack-drones-Hollywood-celebrities-besieged-paparazzi-spies-sky-Worried-You-ll-soon-regular-fixture-YOUR-home.html

85. The majority of reviews of drones read as research for this chapter mentioned crashes during testing. In all the following reviews or other articles, the product reviewers experienced a major crash. See: "Review: Using the DJI Phantom 2 Vision+ camera drone with Apple's iPhone", Apple Insider (3 August 2014): http://appleinsider.com/articles/14/08/03/review-using-the-dji-phantom-2-vision-camera-drone-with-apples-iphone. Also see: "I almost killed someone with a drone", The Verge (13 Nov 2014): http://www.theverge.com/2014/11/13/7205741/i-almost-killed-someone-with-a-drone. There are also multiple examples of drones crashing, even when controlled by professionals, see: "Drone crashes into spectators at Virginia bull run", The Verge (26 Aug 2014): http://www.theverge.com/2013/8/26/4659698/drone-crashes-into-spectators-at-virginia-bull-run ; "A tourist who crashed a drone into Yellowstone has been banned from the park for a year", The Verge (24 Sep 2014): http://www.theverge.com/2014/9/24/6838561/drone-pilot-banned-from-yellowstone-after-crash

86. "Parrot AR.Drone 2.0 Quadricopter: A Drone Anyone Can Fly", Livescience (15 Feb 2014): http://www.livescience.com/43426-parrot-ar-drone-2-0-quadricopter-guide.html

87. Drones can be hard to pilot precisely. For an example of this, see: "Drone Quadcopter hits groom in the head // Epic Fail", YouTube (4 Aug 2013): http://www.youtube.com/watch?v=ocqB6_y71xE ; one drone being used in the Grand Canyon failed while over the canyon, the owners then descended into the canyon to retrieve it, despite the lack of any trails. See: "New docs show drone landed on Lincoln head at Mount Rushmore in 2013", ArsTechnica (27 Sep 2014): http://arstechnica.com/tech-policy/2014/09/new-docs-show-drone-landed-on-lincoln-head-at-mount-rushmore-in-2013/

88. One drone was stranded on the top of a national monument in the US. See: "New docs show drone landed on Lincoln head at Mount Rushmore in 2013", ArsTechnica (27 Sep 2014): http://arstechnica.com/tech-policy/2014/09/new-docs-show-drone-landed-on-lincoln-head-at-mount-rushmore-in-2013/

89. In the US, the Director of the National Parks has directed all parks to prohibit drones on grounds of nuisance and safety. See: "NPS bans drones over safety, nuisance concerns", EE News (20 Jun 2014): http://www.eenews.net/stories/1060001697

90. "FAA unveils plan for integrating drones into U.S. airspace", Reuters (7 Nov 2013): http://www.reuters.com/article/2013/11/07/us-faa-drones- idUSBRE9A61H220131107

91. This communication is available in a range of languages. See: "Access to European Union law", EUR-Lex (as accessed on 8 Dec 2014): http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014DC0207

92. "Behind the mind-boggling shots captured by BBC drones", Wired.co.uk (12 Feb 2014): http://www.wired.co.uk/news/archive/2014-02/12/bbc-drone-journalism

93. "Near mid-air collisions with drones", The Washington Post (26 Nov 2014): http://www.washingtonpost.com/wp-srv/ special/national/faa-drones/

94. One approach to prevent collisions among UAVs is by using radar, but this can be inaccurate. See: "Collision-free flying for UAVs in crowded skies", Robotics Business Review (31 Jul 2012): http://www.roboticsbusinessreview.com/article/collision_free_ flying_for_uavs_in_crowded_skies

95. For example see: "Communication from the commission to the European Parliament and the council", European Commission (8 Apr 2014): http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0207&from=EN

96. One person in the US was fined $2,200 for flying a drone in New York City: the drone landed twenty feet from a pedestrian having hit two buildings before its unplanned landing. See: "Drone operator fined after almost hitting nyc pedestrian", Bloomberg (3 May 2014): http://www.bloomberg.com/news/2014-05-02/drone-operator-fined-after-almost-hitting-nyc-pedestrian.html. One person in the UK was fine £800 for flying his drone within 50 meters of a bridge and over a nuclear power installation. See: "UK's first drone conviction will bankrupt me, says Cumbrian man", The Guardian (2 Apr 2014): http://www.theguardian.com/world/2014/apr/02/uk-first-drone-conviction

97. "Chinese manufacturer programs Phantom drones with no-fly zones to protect Australian airports", ABC News (14 Apr 2014): http://www.abc.net.au/news/2014-04-14/chinese-made-drones-programmed-with-no-fly-zones/5388356

98. "DHL launches first commercial drone 'parcelcopter' delivery service", The Guardian (25 Sep 2014): http://www. theguardian.com/technology/2014/sep/25/german-dhl-launches-first-commercial-drone-delivery-service

99. The major costs of drones large enough to carry packages are in the parts of which the drones are made of. Motors, propellers, and carbon fiber frames are made in low volumes and require high mechanical precision. Radio control elements, ESC speed controllers, accelerometers, gyroscopes and other components most likely to benefit from the deprecation delivered by Moore's Law are a relatively small part of a UAV's costs and have already benefited from Moore's Law. Large scale manufacturing of parts would enable unit costs to fall significantly (in the region of 30 percent), but this is not likely to happen in 2015.

100. Some consumer drones have been destroyed in flight, for example, see: "The future of drones: Getting them shot out of the sky by neighbors with shotguns", Esquire (2 Oct 2014): http://www.esquire.com/blogs/news/quadcopticide-100214

101. There are some examples of working battery-swapping stations, however every so often the inspection of a drone health state would still be needed.

102. One approach to addressing the issue of delivery to the recipient is to lower the package using a string. See: "Inside Google's Secret Drone-Delivery Program", The Atlantic (28 Aug 2014): http://www.theatlantic.com/technology/archive/2014/08/inside-googles-secret-drone-delivery-program/379306/?single_page=true

103. "DHL launches first commercial drone 'parcelcopter' delivery service", The Guardian (25 Sep 2014): http://www. theguardian.com/technology/2014/sep/25/german-dhl-launches-first-commercial-drone-delivery-service

104. The market was worth $869 million in 2012, and is growing over 12 percent per annum, suggesting revenues in excess of $1 billion in 2014. See: "Growth and factor of Aerial Imaging Market 2013 – 2019", LinkedIn (13 Jul 2014): https://www.linkedin. com/pulse/article/20140613105811-340063519-growth-and-factor-of-aerial-imaging-market-2013-2019

105. "Aerial Filming", Hello Air (as accessed on 8 Dec 2014): http://www.heloair.com/aerial-tyler_mount.php

106. Also known as Additive Manufacturing, AM, and/or 3DP. For sake of consistency, we will use the term 3D printing throughout.

107. "Gartner Says Worldwide Shipments of 3D Printers to Reach More Than 217,000 in 2015", Gartner (27 Oct 2014): http://www.gartner.com/newsroom/id/2887417

108. Deloitte estimate: low cost consumer printers will represent much of the 2015 growth, meaning total dollar growth will be lower than unit growth.

109. "What Lies Ahead for 3-D Printing?", Smithsonian (May 2013): http://www.smithsonianmag.com/science-nature/what-lies-ahead-for-3-d-printing-37498558/?no-ist

110. "3D Printing: The Next Industrial Revolution", ExplainingTheFuture.com (as accessed on 9 Dec 2014): http://www.explainingthefuture.com/3dp_book.html

111. "Beyond 2014: Evolving Opportunities in Technology.", Wells Fargo (Feb 2014): https://www.wealthmanagementinsights.com/userdocs/pubs/Beyond_2014_Evolving_Opportunities_in_Technology_ADA.pdf

112. Having an object that looks like an automotive connecting rod but is made of light plastic with the strength of a mediocre child's toy is not the same as having an object with the strength to function as a connecting rod.

113. It was estimated to be 87 percent of the market in 2013, according to a Stifel research report from October 29, 2014. See: "Roundup Of 3D Printing Market Forecasts And Estimates, 2014", Forbes (9 Aug 2014): http://www.forbes.com/sites/louiscolumbus/2014/08/09/roundup-of-3d-printing-market-forecasts-and-estimates-2014/

114. Also known as End Product Production.

115. "3D Printer Price", MCAD (as accessed on 9 Dec 2014): http://www.mcad.com/3d-printing/3d-printer-price/

116. "Home 3D printers take us on a maddening journey into another dimension", ArsTechnica (28 Aug 2013): http://arstechnica.com/gadgets/2013/08/home-3d-printers-take-us-on-a-maddening-journey-into-another-dimension/

117. "Gartner Says Worldwide Shipments of 3D Printers to Reach More Than 217,000 in 2015", Gartner (27 Oct 2014): http://www.gartner.com/newsroom/id/2887417

118. Either ABS or PLA using Fused Deposition Modeling, or FDM. See: "Fused deposition modeling", Wikipedia (as accessed on 9 Dec 2014): http://en.wikipedia.org/wiki/Fused_deposition_modeling

119. "Why 3D Printing Is Overhyped (I Should Know, I Do It For a Living)", Gizmodo (17 May 2013): http://gizmodo.com/why-3d-printing-is-overhyped-i-should-know-i-do-it-fo-508176750

120. This may be decades away or even further: metal printers emit unsafe fumes and run at dangerously high temperatures.

121. "3D Printing: The Hype, Reality and Opportunities — Today", Gartner (8 Oct 2013): http://www.gartner.com/it/content/2589000/2589023/october_1_3d_printing.pbasiliere.pdf?userId=13498280

122. Manufacturing or retailing are likely to be higher than average, while it is difficult to imagine what a bank or software company would need a 3D printer for.

123. "The Golden Age of 3D Metal Printing: 75.8 % Growth", 3D Printing.com (22 May 2014): http://3dprinting.com/materials/metal/golden-age-3d-metal-printing-75-8-growth/

124. "3D printing and the new shape of industrial manufacturing", The Manufacturing Institute (Jun 2014): http://www.themanufacturinginstitute.org/~/media/2D80B8EDCCB648BCB4B53BBAB26BED4B/3D_Printing.pdf

125. "Advanced manufacturing is reinventing the way we work", GE (as accessed on 9 Dec 2014): http://www.ge.com/stories/advanced-manufacturing

126. "SpaceX rocket carries the first ever zero-g 3D printer to the Space Station", ExtremeTech (22 Sept 2014): http://www.extremetech.com/extreme/190629-spacex-rocket-launches-to-the-space-station-carrying-the-first-ever-zero-g-3d-printer. It is important to note that due to the danger, size and weight of a 3D printer that can make metal parts, the ISS printer is plastic only. In NASA's words: the 3D printer being used in October 2014 is only "the first step towards establishing an on-demand machine shop in space." See: "3D Printing In Zero-G Technology Demonstration (3D Printing In Zero-G)", NASA (25 Nov 2014): http://www.nasa.gov/mission_pages/station/research/experiments/1115.html ; "NASA is 3D printing objects in space", Engadget (25 Nov 2014): http://www.engadget.com/2014/11/25/nasa-is-3d-printing-in-space/?ncid=rss_truncated

127. "3D Printing: Cutting through the hype", LinkedIn (21 Jun 2014): https://www.linkedin.com/pulse/article/20140721200509-22092049-3d-printing-cutting-through-the-hype?trk=prof-post

128. The lead author on this Prediction was a speaker at the Interlog 2013 conference on spare parts in San Diego. In a room of large enterprise users, about 30 had metal 3D printers, none of whom of had yet used the machine (or at least admitted to using the machine) to manufacture one spare part. See: "How 3D-printed Spare Parts Could Save Manufacturers from any Production Interruptions", Interlog (as accessed on 9 Dec 2014): http://interlog.wbresearch.com/interlog-3d-printing-ml [Registration required]

129. There is an entire fascinating area around watermarking (or otherwise identifying) a specific 3D-printed object. See: "Secretly Tag 3-D-Printed Objects With InfraStructs", IEEE Spectrum (20 Aug 2013): http://spectrum.ieee.org/video/consumer-electronics/gadgets/secretly-tag-3dprinted-objects-with-infrastructs

130. "Ford's 3D-printed auto parts save millions, boost quality", Ford (12 Dec 2013): https://media.ford.com/content/fordmedia/fna/us/en/news/2013/12/12/ford_s-3d-printed-auto-parts-save-millions--boost-quality.html

131. "3D Printing Market Analysis By Application (Automotive, Aerospace, Aerospace, Medical), By Raw Material (Polymers, Metals, Ceramic) And Segment Forecasts To 2020", Grand View Research (Dec 2013): http://www.grandviewresearch.com/industry-analysis/3d-printing-industry-analysis

132. The auto companies themselves only produce about 20-30 percent of parts in any given vehicle. The parts makers of various levels in the supply chain produce the remainder.

133. We are indebted to Dr. Peter Frise for these insights. He is a Professor at the University of Windsor, consultant to many of the leading manufacturers and ODMs, and CEO of AUTO21, Canada's national automotive research program.

134. "3D Printing Revolutionizes the Hearing Aid Business", Forbes (15 Oct 2013): http://www.forbes.com/sites/stevebanker/2013/10/15/3d-printing-revolutionizes-the-hearing-aid-business/. It was ten million units as of October 2013, and 15 million seems a reasonable assumption for January 2015.

135. Interview with European company in the 3D medical printing business.

136. The Middle East region, Latin America and Africa (clustered as 'rest of the world' countries) together represented only 2.2 percent of world shipments in 2012 and 2.1 percent in terms of value. Source: "Worldwide 3D Printer 2012-17 Forecast and Vendor Shares", IDC (Nov 2013) ; "UAE aims to be the 3D printing hub in the Middle East region", Zawya (12 Oct 2014): http://www.thenational.ae/blogs/plugged-in/3d-printing-furniture-food-human-organs-and-prosthetic-limbs

137. Worldwide 3D Printer 2012-17 Forecast and Vendor Shares, IDC (Nov 2013). Source: "UAE aims to be the 3D printing hub in the Middle East region", Zawya (12 Oct 2014): https://www.zawya.com/story/UAE_aims_to_be_the_3D_printing_hub_in_the_Middle_East_region-ZAWYA20141012100845/

138. "3D Printing: The new industrial revolution", D2M Solutions, Gulf Industry (May 2013): http://www.d2m-solutions.com/assets/Concept-Implications-of-3D-Printing.pdf

139. Interview with D2M Solutions
140. Interview with D2M Solutions
141. Actual cost is between AED 500 and AED 1,000. Source: TIM Website: http://www.tim-me.com/services.html
142. TIM Website: http://www.tim-me.com/services.html
143. "This Year Educational 3D Printing Contracts Averaged almost $32,000", 3D Printing Industry (21 Oct 2014): http://3dprintingindustry.com/2014/10/21/educational-3d-printing-onvia/
144. "3D Printing: Cutting through the hype", LinkedIn (21 Jul 2014): https://www.linkedin.com/pulse/article/20140721200509-22092049-3d-printing-cutting-through-the-hype?trk=prof-post
145. "The Royal College of Art presents: Stay Plastic", Downtown Design (Oct 2014): http://www.downtowndesign.com/news/exhibitors/2014/10/stay-plastic-%281%29/
146. In a Deloitte survey fielded in 14 developed countries in May to July 2014, 'battery life' ranked, on average, as the second most important factor when choosing a next smartphone, following the option 'To be a smartphone'. In Germany, Singapore and Spain, 'battery life' ranked number one.
147. Deloitte estimate, based on over 40 percent of smartphones sold in 2015 having a five inch or larger screen, and of significant numbers of iPhone mobile digital device users moving from a four inch screen to a 4.7 inch or larger screen. iPhone, Apple Pay, Touch ID are trademarks of Apple Inc., registered in the U.S. and other countries. Deloitte TMT Predictions is an independent publication and has not been authorised, sponsored or otherwise approved Apple Inc.
148. Screen area is a single diagonal dimension; batteries occupy volume in three dimensions. Assuming bezel size and device thickness remain constant, a phone with a five inch screen has 20 percent greater screen area than a four-inch device, but its volume is about 50 percent greater, a proportion of which is likely to be allocated to accommodating a larger battery.
149. Not all the improvements are driven by Moore's Law: some are driven by non-Moore's Law effects such as new standards, software, radio technology, antennas.
150. "The rechargeable revolution: A better battery", Nature (5 Mar 2014): http://www.nature.com/news/the-rechargeable-revolution-a-better-battery-1.14815#/batt2
151. "World Vehicle Population Tops 1 Billion Units", Wards Auto (15 Aug 2011): http://wardsauto.com/ar/world_vehicle_population_110815
152. "Specific energy", Wikipedia (as accessed on 4 Dec 2014): http://en.wikipedia.org/wiki/Specific_energy
153. All energy storage is normally expressed in watt hours, but since all smartphone batteries work at the same voltage (3.8 volts) most smartphone battery capacity is described in mAh
154. "Energy density", Wikipedia (as accessed on 4 Dec 2014): http://en.wikipedia.org/wiki/Energy_density
155. The market demand for ever thinner phones is one of the reasons why the user-swappable battery has disappeared on a growing range of phones. User-replaceable batteries require a battery compartment and a door to be incorporated into the housing to accommodate fool-proof replacement without exposing sensitive electronic components to static discharge, dirt, and so on. Batteries have to be encased in a tough plastic housing to mitigate the risk of puncture by careless users which would result in the destruction of phone as a consequence of leaking electrolyte
156. "Power-to-weight ratio", Wikipedia (as accessed on 4 Dec 2014): http://en.wikipedia.org/wiki/Power-to-weight_ratio
157. Spot lithium carbonate prices are around $7,000 per tonne, or $7 per kilogram, or $0.007 per gram. A 2000 mAh battery weighs 32 grams, and 2-3 grams of lithium, so roughly 2 cents of lithium.
158. This technology places a heavy draw on the battery as the entire screen has to be lit, even if a significant number of pixels may be dark or "OFF"
159. This is an emissive screen, which combines the display and backlight function.
160. Our current view is that OLED may become the default on high-end phones as of 2020.
161. The iPhone 6 and iPhone 6 Plus mobile digital devices share most components, including the same processor and motion co-processor. The larger model has a larger screen and a larger battery, but can support significantly longer Internet use and video playback. See: Apple Inc. (as accessed on 4 Dec 2014): https://www.apple.com/uk/iphone/compare/
162. A 2015 PC would require about 10 megawatts if performance per watt had remained as it was in the 1980s.
163. For a detailed analysis of power efficiency in LTE smartphones, see: "An empirical LTE smartphone power model with a view to energy efficiency evolution", Intel Technology Journal (2014): http://vbn.aau.dk/files/176790997/An_Empirical_LTE_Smartphone_Power_Model_with_a_View_to_Energy_Efficiency_Evolution.pdf
164. This is in line with Moore's Law
165. Second generation (2G) mobile technology, launched in 1991 is capable of up to 64 Kbit/s transmission; fourth generation (4G), launched in 2009, can deliver speeds of up to 75 Mbit/s. This represents about a 50 percent increase in speeds per year
166. An SOC might special purpose processors to handle things like graphics and radio communications or these might remain separate devices for design reasons. Some even include rudimentary processors which exclusively handle a single I/O port, ensuring extremely rapid response time to events, well beyond what would be possible from the "main" CPU running the operating system.
167. A growing range of taxi cabs in major cities are expected to incorporate USB chargers. See: "Next-Gen NYC Taxis to Have USB Ports for Phone Charging", Tested (5 Apr 2012): http://www.tested.com/tech/43768-next_gen-nyc-taxis-to-have-usb-ports-for- phone-charging/; "London's new Metrocab electric taxi could save cabbies £40 a day", Auto Express (16 Jan 2014): http://www.autoexpress.co.uk/car-news/85276/londons-new-metrocab-electric-taxi-could-save-cabbies-ps40-a-day. New fleets of trains incorporate USB chargers, see: "On board the new Eurostar, the sleekest under-sea train", CNet (13 Nov 2014): http://www.cnet.com/uk/pictures/on-board-the-new-eurostar-the-sleekest-under-sea-train-around-pictures/

168. Note also that the charging circuit, which is in the smartphone and not in the charging unit, will typically power the phone off the charger while the battery is being charged and stop charging the battery once it is fully charged. Therefore there is some advantage in terms of battery life to leave the charger plugged in provided the battery is not overheated, which is unlikely to happen with a smartphone. For more information on how to prolong the life of a Li-Ion battery, see: "BU-808: How to Prolong Lithium-based Batteries", battery University (as accessed on 4 Dec 2014): http://batteryuniversity.com/learn/article/how_ to_prolong_lithium_based_batteries

169. "Miniaturized satellite", Wikipedia (as accessed on 11 Dec 2014): http://en.wikipedia.org/wiki/Miniaturized_satellite

170. Satellites are classified strictly by weight, rather than size. However, assuming similar densities, the average 10 kilogram satellite will be not much larger than 3-4 10 cm by 10 cm by 10 cm modules, or less than 5 liters in volume. This is before any components may be unfolded or unfurled: there are three meter satellites that have antennas or solar panels that can extend more than ten meters.

171. "Nanosats are go!", The Economist (7 Jun 2014): http://www.economist.com/news/technology-quarterly/21603240-small-satellites-taking-advantage-smartphones-and-other-consumer-technologies

172. "Report cites gains by U.S. industry in commercial market", Space News (17 Jun 2013): http://www.spacenews.com/article/satellite-telecom/35827report-cites-gains-by-us-industry-in-commercial-market

173. The various Direct-to-Home satellite TV services are the majority, at $90 billion or almost 80 percent of services. Ibid

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282. According to an interview with Wamda in 2012, the offline retail market was worth $425 billion at the time. In 2012 PayPal reported e-commerce revenues to be $9 billion, which gives a total retail market of $434 billion. Online commerce in the region therefore represents only 2.1 percent of the total retail market. Source: "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

283. We estimate retail e-commerce to represent roughly 4.7 percent of total retail sales. Estimate is based on a world average taken across 20 different countries of all types of economies. Source: "Global B2C Ecommerce Sales to Hit $1.5 Trillion This Year Driven by Growth in Emerging Markets", eMarketer (3 Feb 2014): http://www.emarketer.com/Article/Global-B2C-Ecommerce-Sales-Hit-15-Trillion-This-Year-Driven-by-Growth-Emerging-Markets/1010575

284. Growth Is a PayPal estimate, which according to other sources is a general consensus in the industry. Source: "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

285. Estimates are based on multiple sources. See "Sizing the Digital Islamic Economy" box. Estimates of the Digital Islamic Economy do not include Islamic Finance and only consider Muslim consumer spend on Modest Fashion items (not all Fashion items). Estimations cover the entire Middle East region (Middle East and North Africa)

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289. See: "Defining the Digital Services landscape for the Middle East", Deloitte (2014)

290. For more detailed definitions see: "The Digital Islamic Services landscape", Deloitte (2015)

291. "Dubai To Launch State Of The Global Islamic Economy Report 2014", The Halal Times (27 Sept 2014): http://www.Halaltimes.com/dubai-Islamic-economy-development-centre-launch-state-global-Islamic-economy-report-2014/

292. "Dubai Islamic Economy Development Centre Launches 'State of the Global Islamic Economy Report' and 'Global Islamic Economy Indicator 2014/2015'", Zawya (7 Dec 2014): https://www.zawya.com/story/Dubai_Islamic_Economy_Development_Centre_Launches_State_of_the_Global_Islamic_Economy_Report_and_Global_Islamic_Economy_Indicator_20142015-ZAWYA20141207135158/

293. Deloitte research and analysis: overall and individual country estimates are based on review and input from various sources including World Bank, Wikipedia, Pew Forum data. Source: "Muslim populations by country: how big will each Muslim population be by 2030?", Pew Forum Muslim Population Data Table, The Guardian (27-29 Jan 2011): http://www.theguardian.com/news/datablog/2011/jan/28/Muslim-population-country-projection-2030 ; "The Future of the Global Muslim Population", Pew Forum (27 Jan 2011): http://www.pewforum.org/2011/01/27/the-future-of-the-global-Muslim-population/

294. More precise figures are $1.849 trillion in 2013, $2.808 trillion in 2017 and $3.459 trillion in 2019. This excludes Islamic Finance and only considers Modest Fashion (not all of Fashion). Modest Fashion is assumed as 43 percent of total Fashion spend. Source: "Defining the Digital Services Landscape for the Middle East", Deloitte (2014) ; "The Digital Islamic Services landscape", Deloitte (2015) ; "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013 edition and 2014-2015 edition)

295. The Middle East region's (MENA) Muslim population is 15 percent of the global Muslim population excluding Iran. Including Iran this figure rises to 20 percent. See: "The Digital Islamic Services landscape", Deloitte (2015)

296. The region's share of total global Muslim lifestyle expenditure in 2013 has been assumed to be the same as 2012 figures and throughout the forecast period. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013 edition and 2014-2015 edition), "The Digital Islamic Services landscape", Deloitte (2015)

297. This covers the following sectors: Halal Food, Travel, Fashion (assuming 43 percent is Modest Fashion), Pharma & Cosmetics, Media, Recreation and Culture (MRC). Note MRC as defined by the "State of the Global Islamic Economy" report includes non-pure media elements as well (e.g. durables and services for recreation and culture, gardens, stationary). We have assumed non-pure media to be negligible compared to pure-media (e.g. TV). Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013 edition and 2014-2015 edition)

298. We have aligned our offline market figures to be consistent with "State of the Global Islamic Economy" report, which have been defined already for 2012, 2013 and forecasted for 2019. Figures are given for the Global Islamic Economy already. However, the MENA Islamic Economy was estimated and extrapolated for each sector by applying a per capita spend analysis based on country-specific spend data given by the report for MENA countries (e.g. MENA spend in Travel is not given. Individual country spend is given such as Saudi Arabia, whose Muslims spent $17.8 billion on Travel. Data for Saudi Arabia and other MENA countries given was extrapolated to obtain an approximation of MENA Muslim consumers spend on Travel). Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013 edition and 2014-2015 edition)

299. Other industry reports include but are not limited to: Islamic Economy Education: "E-Learning Market Trends & Forecast 2014 - 2016 Report", Docebo (Mar 2014) ; "Islamic Finance Education Report", Yurizk (2013) ; Islamic Art & Design: "The Hiscox Online Art Trade Report", Hiscox (2014)

300. We estimate retail e-commerce to represent roughly 4.7 percent of total retail sales. Estimate is based on a world average taken across 20 different countries of all types of economies. Forecast penetration of e-commerce globally is based on the same analysis on 2017 projected industry figures. Source: "Global B2C Ecommerce Sales to Hit $1.5 Trillion This Year Driven by Growth in Emerging Markets", eMarketer (3 Feb 2014): http://www.emarketer.com/Article/Global-B2C-Ecommerce-Sales-Hit-15-Trillion-This-Year-Driven-by-Growth-Emerging-Markets/1010575

301. "Ecommerce Insights", ETC Digital Portal (2014/2015): http://etc-digital.org/digital-trends/ecommerce/ecommerce-insights/regional-overview/middle-east/

302. Growth Is a PayPal estimate, which according to other sources is a general consensus in the industry. We have assumed this growth will sustain if not increase through till 2019. Source: "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

303. See: "Defining the Digital Services landscape for the Middle East", Deloitte (2014)

304. The digital share 32.6 percent is based on source figures from Wilkofsky Gruen Associates, widely used in multiple media and entertainment consumption reports. We have assumed the same share of digital applies to media consumption the region.

305. Muslim consumer spend on media, recreation and culture (assumed to be media) consumption is estimated in 2013 to be over $31 billion for the Middle East region (in total: digital and non-digital). The overall Middle East region estimate is extrapolated from country-specific consumption figures, which were only given for Middle East countries with the highest media consumption levels. The extrapolated figure is more or less in line with total regional media and entertainment spending figures from other reports (e.g. Wilkofsky Gruen Associates), where the majority of spending would be attributed to Muslim consumers, who make up around 90-95 percent of the region's population. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

306. Middle East offline market growth is 11 percent from 2012-2016. Global offline market growth is 5.6 percent. Source: Wilkofsky Gruen Associates, "The Digital Islamic Services landscape", Deloitte (2015), "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

307. Global digital market growth is 11.6 percent from 2012-2016. Global offline market growth is 5.6 percent. Source: Wilkofsky Gruen Associates, "The Digital Islamic Services landscape", Deloitte (2015), "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

308. The final estimate factors in Deloitte's digital services maturity assessment, which places Digital Islamic Services at the beginning peaking stage of the maturity curve. Estimated online market growth between 2013, 2017 and 2019 is estimated accordingly.

309. "Trends Shaping Online Travel", Euromonitor (Mar 2014): http://www.tti.org/assets/files/presentations/2014/Spring2014/Caroline_Bremner_Euromonitor.pdf

310. The offline (total) travel market for the Middle East region in 2013 is over $175 billion. Source: Economic Data Search (Leisure Travel and Business Travel for Middle East and North Africa), World Travel & Tourism Council (2013): http://www.wttc.org/focus/research-for-action/economic-data-search-tool/

311. Online travel constitutes 53 percent of e-commerce sales on average across the region's biggest e-commerce markets: Saudi Arabia, UAE and Qatar. Assuming this applies throughout the region, this gives approximately $6 billion spent on travel, which is about 3.4 percent of the $175 billion offline (Total) travel market. Source: "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

312. The region's online travel market is 3.4 percent of offline (total) travel revenues in the region. This was assumed to also apply to the region's Muslim spend on travel in the region (see earlier few endnotes). The offline market for Muslim travelers in the Middle East region is estimated to be over $54 billion. Middle East Muslim spend for the offline (total) travel is extrapolated from country-specific Muslim consumption figures, which were only given for Middle East countries with the highest Muslim travel consumption levels. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

313. Estimates of Muslim consumer spend on travel is focused on Muslim lifestyle spend. Dedicated travel spend on pilgrimage (i.e. on Hajj and Umrah travel) is therefore not included in our estimates, in line with industry reports. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

314. Online travel industry growth in the Middle East region at 22 percent in 2014, in line with PayPal projection for e-commerce growth at over 21 percent. We have assumed this growth will sustain if not increase through till 2019. Source: "The Year Ahead in Digital Travel", Phocuswright (2015): http://www.phocuswright.com/Free-Travel-Research/The-Year-Ahead-in-Digital-Travel#.VP7mjk0cQv4 ; "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

315. The final estimate factors in Deloitte's digital services maturity assessment, which places Digital Islamic Services at the beginning peaking stage of the maturity curve. Estimated online market growth between 2013, 2017 and 2019 is estimated accordingly.

316. Estimates of Muslim consumer spend on travel is focused on Muslim lifestyle spend. Dedicated travel spend on pilgrimage (i.e. on Hajj and Umrah travel) is therefore not included in our estimates, in line with industry reports. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

317. "Succeeding in tomorrow's global fashion market", McKinsey & Company (Sep 2014): http://mckinseyonmarketingandsales.com/succeeding-in-tomorrows-global-fashion-market

318. The Middle East region's offline Muslim Modest Fashion market in 2013 is estimated to be just under $40 billion (assuming 43 percent of total Muslim spend on Fashion is on Modest Fashion). Middle East Muslim spend on Fashion for the offline (total) market is extrapolated from country-specific Muslim consumption figures, which were only given for Middle East countries with the highest Muslim Fashion consumption levels. The online $0.6 billion in Modest Fashion spend in 2013 is derived from total online Fashion spend, which is 1.6 percent of $40 billion. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013 edition, 2014-2015 edition)

319. Global Muslim consumer spend on Modest Fashion is estimated to be 43 percent of Muslim consumer spend on all Fashion products. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013)

320. Muslim consumer spend online on Fashion (Clothing & Footwear) in the Middle East region is given as $1.496 billion in 2013 (excluding Iran and assuming Sudan and Mauritania are negligible). Assuming 43 percent of regional Muslim consumer spend on Fashion, this gives over $0.6 billion. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2013 edition, 2014-2015 edition)

321. Deloitte estimates the offline (total) Fashion market to grow at 4.8 percent globally and 6.2 percent in the Middle East until 2019. This difference in growth between global and Middle East is applied to the growth in global Muslim consumer spend offline (in total) on Fashion, given as 11 percent. This gives a corresponding growth in Middle East Muslim spend offline (in total) on Fashion to be 13.6 percent.

322. Online Fashion sales globally have been growing 17.5 percent according to McKinsey. Deloitte estimates the overall Middle East offline Fashion market to be growing 1.4 percent faster than global (see previous endnote), implying 22 percent growth in the overall Middle East online Fashion market. This is assumed to be the same for Muslim consumer spend in the region. Source: "Succeeding in tomorrow's global fashion market", McKinsey & Company (Sep 2014): http://mckinseyonmarketingandsales.com/succeeding-in-tomorrows-global-fashion-market

323. The final estimate factors in Deloitte's digital services maturity assessment, which places Digital Islamic Services at the beginning peaking stage of the maturity curve. Estimated online market growth between 2013, 2017 and 2019 is estimated accordingly.

324. See: "Modest Fashion, "The Digital Islamic Services landscape", Deloitte (2015)

325. Deloitte estimate (conservative).

326. Middle East region offline (total) Halal Food market is estimated to be worth $315 billion in 2013. Applying 0.1 percent share of online gives $368 million. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015)

327. Estimate is based on multiple growth factors. Offline Halal Food market growth is given as 11.9 percent globally, assumed to be the same for the region. The share of online retail for Food & Beverage (F&B) in the region is estimated to grow from 0.1 percent to 0.4 percent, in line PayPal e-commerce growth projection for the region at over 21 percent. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015) ; "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

328. The final estimate factors in Deloitte's digital services maturity assessment, which places Digital Islamic Services at the beginning peaking stage of the maturity curve. Estimated online market growth between 2013, 2017 and 2019 is estimated accordingly.

329. The region's Muslim offline market for Pharma & Cosmetics is estimated to be under $27 billion in 2013. Middle East Muslim spend for the offline (total) Pharma & Cosmetics is extrapolated from country-specific Muslim consumption figures, which were only given for Middle East countries with the highest Muslim Pharma & Cosmetics consumption levels. The share of retail e-commerce in the region is under 1 percent (estimated at 0.9 percent), which gives a regional online Muslim market of under $242 million. Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015) ; "Ecommerce Insights", ETC Digital Portal (2014/2015): http://etc-digital.org/digital-trends/ecommerce/ecommerce-insights/regional-overview/middle-east/

330. The region's online e-learning market is worth 443 million in 2013. With 443 providers this averages to $1 million per provider. The ratio is the same for the global e-learning market. There are 18 e-learning programs for Islamic Finance around the world. With the region representing 30 percent of all Islamic Economy education providers, this gives 3.4 online e-learning providers in Islamic Finance. At an average of 1 million per provider, this gives $3.4 million as the rough size of the online Islamic Economy Education market, which is primarily Islamic Finance orientated. Source: "E-Learning Market Trends & Forecast 2014 - 2016 Report", Docebo (Mar 2014) ; "Islamic Finance Education Report", Yurizk (2013)

331. Sales of Islamic Art globally are estimated to be around $80 million globally. Actual figures are $78.9 million as of 2011 according to Christie's and Sotheby's (who represent the majority of the art market) but a more conservative estimate was taken to obtain 2013 figures given recent reports of stagnated growth. Industry interviews confirm that the Middle East region is the largest market for Islamic Art & Design. It is therefore assumed the Middle East share of Islamic Art is the same as the majority 35 percent share of global Islamic economy lifestyle spend, which gives an offline Islamic art market value of around $28 million. The online art market according to Hiscox represents 2.5 percent of all art sales, which gives about $0.7 million worth in online Islamic art sales in the region. Source: TEFAF Art Market Report (2013, 2014) ; "The Hiscox Online Art Trade Report", Hiscox (2014) ; Christie's ; Sotheby's ; Deloitte research and analysis

332. "Islamic Finance Education Report", Yurizk (2013)

333. TEFAF Art Market Report (2013, 2014) ; Christie's ; Sotheby's ; Deloitte research and analysis

334. The region's offline Muslim consumer Pharmaceutical market is projected to grow 6.1 percent (in line with global growth given) and offline Cosmetics market at 9.7 percent (in line with proportionally higher growth between the total regional and total global Cosmetics market). This yields a combined growth of 7.4 percent in the offline Pharmaceutical and Cosmetics Muslim consumer market in the region. The regional share of retail e-commerce is projected to grow to 2.8 percent by 2019, translating to 30 percent online market growth (in revenues). Source: "State of the Global Islamic Economy", DIEDC, Thomson Reuters & Dinar Standard (2014-2015) ; "Ecommerce Insights", ETC Digital Portal (2014/2015): http://etc-digital.org/digital-trends/ecommerce/ecommerce-insights/regional-overview/middle-east/ ; "PayPal Insights: ecommerce in the Middle East 2012-2015", PayPal & Ipsos (24 Sep 2013): http://static.wamda.com/web/uploads/resources/24-09-2013_FINAL-low_res.pdf

335. The online market (number of e-learning platforms) for Islamic Economy Education is projected to grow by 20 percent, mainly in Islamic Finance. From a base of $3.4 million in online market value in 2013, this yields $7.8 million by 2017 after applying maturity curve analysis. Source: "Islamic Finance Education Report", Yurizk (2013)

336. Deloitte estimates the global online share of the visual arts market will to grow to 4.6 percent through till 2019, assumed to be the same for Islamic Art & Design, translating to over 21 percent online revenue growth. On a base of $0.7 million in online Islamic Art sales in 2013, this yields $1.6 million by 2017 after applying maturity curve analysis. Source: "The Hiscox Online Art Trade Report", Hiscox (2014) ; Deloitte research and analysis

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356. This would be similar to how music channels on TV are often used, as an alternative to listening to music radio.

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359. YouTube is the majority of short-form viewing, with six billion hours viewed monthly. See: Statistics, YouTube, as accessed on 8 December 2014: https://www.youtube.com/yt/press/en-GB/statistics.html

360. In most markets viewing figures are seasonal, with peaks during the winter months, and lows during the summer.

361. There are 1.6 billion households worldwide with TV sets. Assuming an average 2.5 persons per household, the global TV audience would be roughly 4 billion. Daily TV watching varies by country. In the US, it is close to five hours, but about half that (2.7 hours in China) and 3.6 hours in Brazil. The average tends to be higher in EU and North America at around four hours per day. For this prediction, we have assumed a global average of three hours per day, which is most likely a conservative estimate. See: Number of TV households worldwide from 2010 to 2014, by platform (in millions), Statista, 2014 (Subscription required): http://www.statista.com/statistics/324187/number-of-tv-households-platform/, also see: Average daily TV viewing time per person in selected countries in 2012 (in minutes), Statista, 2014: http://www.statista.com/statistics/276748/average-daily-tv-viewing-time-per-person-in-selected-countries/

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370. Deloitte's research has found that among the two-thirds of UK adults who watch short-form video, about 70 percent use a PC to do this, 35 percent use a smartphone, and only a quarter a television set. Source: Deloitte UK TV survey, July 2014, 1,941 respondents (respondents with access to a TV, tablet, PC, laptop, smartphone or MP4 video player at home); Among those who watch video clips on more than one device, about half named a computer as their preference for this activity. In comparison, 94 percent of all respondents watch television on a TV set at least weekly, a third on a computer, and just 15 percent on a smartphone. Source: Deloitte UK TV survey, July 2014, 597 respondents (respondents who watch short video clips on two or more devices); Deloitte UK TV survey, July 2014, 2,000 respondents (adults aged 16+ in Great Britain). That said, some of the highest quality video out there is available online and in short form: 4K video at 60 fps and 120 fps from YouTube. See: iPhone 6 60 FPS videos now supported on YouTube, Gotta be Mobile, 30 October 2014: http://www.gottabemobile.com/2014/10/30/iphone-6-60-fps-videos-youtube/

371. Analysts reported the Middle East region's YouTube consumption to be 14.5 million hours per day, equivalent to about 5.3 billion hours per year as of mid-2014. Source: "MBC to launch SVoD service in MENA", YouTube Statistics, IHS Technology Article (10 Jul 2014): https://technology.ihs.com/505919/mbc-tolaunch-svod-service-in-mena. Google recently reported strong growth in YouTube this year, with 50 percent year-on-year growth in viewership both in the Middle East region and globally. With 50 percent year-on-year growth on 2014, this means that 7.94 billion hours per year of YouTube content would be consumed for 2015. Source: "3 things we learnt about YouTube and Video Content in the Middle East during 2014", Damian Radcliffe (20 Jan 2015): https://damianradcliffe.wordpress.com/2015/01/20/5-things-we-learnt-about-youtube-and-video-content-in-the-middle-east-during-2014/. YouTube, as the largely dominant platform for online video, has been assumed as the driving force behind overall online video consumption estimates. This is proven by average YouTube penetration rates around 70 percent, with competitors such as DailyMotion and others collectively averaging around 10-15 percent penetration. Based on penetration, YouTube is roughly estimated to have 85 percent share of the Middle East region's online video consumption. We assume shares will not dramatically change this year. This means that overall 9.35 billion hours per year of online video content will be consumed (779 million hours per month). Source: "MENA Internet Usage & Consumption Habits", Ipsos (26 Mar 2013): http://www.slideshare.net/MaisAbuSalah/ipsosarabnetpresentation-beirut20131303250729 01phpapp02

372. Deloitte's ongoing discussions with industry experts found that around 30 percent of online video is long-form content. This has been taken as a general consensus and assumed to be the share of long-form video online. Therefore, out of the 779 million hours per month of content viewed online in 2015, short-form would represent 70 percent, which yields 545 million hours per month.

373. Estimation is based on regional television viewership patterns, which our proprietary regional media surveys and estimates show to be 3.11 hours per day. The estimate is as of 2012, but we expect this not to have changed dramatically, seeing as in prior periods viewership was almost the same at 3.10 hours in 2009. This was applied to the regional television audience, estimated from the 2015 forecasted number of TV households (almost 50 million) and the average household size, which is on average 5 people (on average 3 children per mother for 2010-2015, plus 1 mother and 1 father). Sources: "Arab Media Outlook 2011-2015", Deloitte (2012): www.arabmediaforum.ae/userfiles/EnglishAMO.pdf ; "Global TV Household Forecasts, 2005-2017", Informa Telecoms & Media (2014): data set payment, subscription required ; "The Future of the Global Muslim Population, Region: Middle East-North Africa", Pew Research Center (27 Jan 2011): http://www.pewforum.org/2011/01/27/future-of-the-global-muslim-population-regional-middle-east/

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375. "YouTube: onwards and upwards in the Middle East", Financial Times (23 Jul 2012): http://blogs.ft.com/beyond-brics/2012/07/23/youtube-onwards-and-upwards-in-the-middle-east/

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377. "MBC to launch SVoD service in MENA", YouTube Statistics, IHS Technology Article (10 Jul 2014): https://technology.ihs.com/505919/mbc-tolaunch-svod-service-in-mena

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380. Sources: "Digitizing the Middle East: Why Google thinks online advertising will change the Arab market", Al Bawaba (12 Dec 2013): http://www.albawaba.com/business/google-middle-east-540177 ; "3 things we learnt about YouTube and Video Content in the Middle East during 2014", Damian Radcliffe (20 Jan 2015): https://damianradcliffe.wordpress.com/2015/01/20/5-things-we-learnt-about-youtube-and-video-content-in-the-middle-east-during-2014/

381. Sources: "Digitizing the Middle East: Why Google thinks online advertising will change the Arab market", Al Bawaba (12 Dec 2013): http://www.albawaba.com/business/google-middle-east-540177 ; "3 things we learnt about YouTube and Video Content in the Middle East during 2014", Damian Radcliffe (20 Jan 2015): https://damianradcliffe.wordpress.com/2015/01/20/5-things-we-learnt-about-youtube-and-video-content-in-the-middle-east-during-2014/

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396. Deloitte research and analysis; based on a proprietary study of digital services (2013)

397. Digital is estimated to represent 10 percent of the Middle East region's advertising spend. Of this, Google was last estimated to have a 46 percent share of the Middle East region's digital advertising market (2012). Published interviews with regional Google leaders suggest that YouTube represents more than half of their business in the region, citing it as their number one strategic priority in their business plans. This means that YouTube, and therefore short-form revenues, must be at least 23 percent of projected Middle East digital advertising spend for 2015. With YouTube estimated to have an 85 percent share of the region's short-form viewership (see endnote on Middle East hours per month prediction), short-form overall is estimated to have $176 million in total advertising revenues. To allow for actual variances from our estimate, a range of revenues $150-200 million was kept. Sources: "Arab Media Outlook 2011-2015", Deloitte (2012): www.arabmediaforum.ae/userfiles/EnglishAMO.pdf ; "Digitizing the Middle East: Why Google thinks online advertising will change the Arab market", Al Bawaba (12 Dec 2013): http://www.albawaba.com/business/google-middle-east-540177 ; "MENA Internet Usage & Consumption Habits", Ipsos (26 Mar 2013): http://www.slideshare.net/MaisAbuSalah/ipsosarabnetpresentation-beirut2013130325072901phpapp02

398. The television market remained fairly steadily over a number of years. Our historical analysis of the market and latest forecasts of television households and pay-TV penetration show that this remains the case. We have therefore maintained our outlook based on our estimates of television revenues in the Arab Media Outlook. "Arab Media Outlook 2011-2015", Deloitte (2012): www.arabmediaforum.ae/userfiles/EnglishAMO.pdf

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408. 2.058 billion as of 10 August 2014. See: PSY - Gangnam Style, YouTube, 15 July 2012: https://www.youtube.com/watch?v=9bZkp7q19f0

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448. Total media and entertainment consumption across MENA is estimated by Wilkofsky Gruen Associates in recent regional media and entertainment publications to increase from $29 billion in 2012 to $44 billion by 2016, implying around $40 billion for 2015. If we conservatively assume that the share of media and entertainment spend by millennials is proportional to their share of the region's population (at 37 percent, although we expect this percentage should actually be higher), millennials are estimated to spend around $15 billion in 2015. If there are 123 million millennials in the region, this implies around $120 per millennial. We have assumed reported figures are already comparable to global figures, in PPP terms. Source: Wilkofsky Gruen Associates, Deloitte analysis. Millennials in the MENA region are referred to as Gen Y in the Arab Media Outlook covering 15-34 year olds, representing 37 percent of the regional population. Source: Arab Media Outlook 2011-2015, Deloitte, 2012: www.arabmediaforum.ae/userfiles/EnglishAMO.pdf

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450. See endnote 448 for the total $120 spend per millennial in the region in PPP terms. The three main spend segments are pay-TV ($11), music ($24) and computer games ($27) in PPP terms. This totals $62, meaning the combined total spend on the remaining segments (movies, books, SVOD, live sports newspapers, other media and entertainment) totals around $58. The average PPP factor across the Middle East & Africa region is around 2.44. For example, in real terms, the total attributed to MENA millennial spending is $49, however, in PPP adjusted terms it is $49 multiplied by 2.44 which gives around $120. See: http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita, and http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita

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454. The MENA population for 2015 is forecast to be 330 million. At an average of 5 people per home in the region, there are about 66 million households. 37 percent of those households are assumed to be millennial households, proportional to millennials share of the regional population (around 24.5 million households), and at a pay-TV penetration rate of about 10 percent, there are about 2.44 million millennial pay-TV households. With an average spend of $225 per year multiplied by 2.44 million millennial households, this gives total millennial pay-TV spend in 2015 to be $558 million. With 123 million millennials in the region, this implies that each millennial in the region spends only $4-5 per year on pay-TV. Multiplied by the PPP factor of 2.4, this gives annual spend per millennial on pay-TV to be $11 a year, in PPP terms.

455. The size of the music market is based on a couple of estimates, driven by a per capita analysis. Regionally, the size of the UAE music market is around $80 million. On a per capita basis, that is around $8-9, implying the MENA music market is over $2.8 billion. Source: Deloitte analysis. Globally, the music industry is estimated to be worth about $56.7 billion in 2015. Source: Wilkofsky Gruen Associates. If we assume the region's share of the global music market is proportional to its share of the global population, which is roughly 5.5 percent, this gives an estimated regional music market value of over $3.1 billion. Source: World Bank Data: http://documents.worldbank.org/curated/en/2014/10/20272046/mena-economic-monitor-corrosive-subsidies. Across these two methods, the music market is roughly estimated to be worth around $3 billion. Note that this estimate includes all spending on music in addition to recorded music, including live music concerts for example.

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543. The Middle East replacement market, at 75 percent of total regional sales, is assumed to be in line with our global industry estimates (based on Deloitte consumer surveys and publicly-available industry information). Public reports support this, where one survey in 2011 found that 70 percent of smartphone users surveyed plan to upgrade in the next 12 months. Smartphone adoption has developed fast since then, so we would expect the replacement ratio to be higher than it was in 2011. Source: "70% of MENA smartphone users plan upgrade", AppsArabia, (12 Jul 2011): http://m.arabianbusiness.com/70-of-mena-smartphone-users-plan-upgrade-410065.html

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545. Our definition of the Middle East region covers the GCC countries (Saudi Arabia, United Arab Emirates, Qatar, Bahrain, Kuwait and Oman), the Levant countries (Lebanon, Jordan, Syria, Iraq, Palestine), Yemen (part of the Arabian peninsula) and the North African countries which border along the Mediterranean (Egypt, Libya, Algeria, Tunisia, Morocco). According to this definition, Middle East region's population is estimated to be around 315 million in 2013, around 325 million people in 2014 and forecast to reach over 330 million people in 2015. Sources for individual country population figures and growth rates include but are not limited to: World Bank, Wikipedia

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549. The bottom up approach aggregated and estimated smartphone penetration rates for each Middle East country, which also gave an average 25 percent penetration rate. In countries where penetration rates were not available, we have assumed similar penetration rates to adjacent countries in the same cluster: the GCC on average has 70 percent smartphone penetration, Levant countries have similar penetration rates (except for conflict zones), North Africa countries have similar penetration rates of around 15 percent (all doubt digit, except Egypt at more than 25 percent). The more conservative average Middle East penetration figure was taken. For bottom up penetration estimates, sources include but are not limited to: Go-Gulf, Google (Our Mobile Planet Survey), Bahrain e-government Authority (market analysis in strategy documents), eMarketer, Ipsos, Deloitte estimates

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676. In the UK, the current limit is £20 ($31.3), in the European Union is €25 (US$30.8) and in Australia is A$100 (US$83.6). See: Are Contactless Payments Flawed?, TopGateways.com, 4 November 2014: http://topgateways.com/contactless-payments-flawed/; In the US, Visa has set the limit for contactless purchases at US$25. See: Visa changes contactless rules, Mobile Payments World, as accessed on 5 December 2014: http://www.mobilepaymentsworld.com/visa-changes-contactless-rules/; In Canada, the limit can be up to CAD$100 (US$87.6) See: MasterCard Paypass™ Your Wallet, Gone Digital, MasterCard, as accessed on 5 December 2014: http://www.mastercard.ca/paypass.html

677. Contactless Statistics, The UK Cards Association, as accessed on 3 December 2014: http://www.theukcardsassociation.org.uk/ contactless_contactless_statistics/index.asp

678. Total transaction value in June 2014 was £47 billion ($73 billion); total volume was 993 million purchases. See: Card Expenditure Statistics, The UK Cards Association, June 2014: http://www.theukcardsassociation.org.uk/wm_documents/June%202014%20Full%20Report.pdf

679. As of October 2015, any merchants in the US that do not support EMV credit cards with integrated circuits that enable point of sale authentication, typically via the entry of a PIN, will become liable for fraudulent use. This is likely to catalyze wide-scale upgrades of point of sale terminals by millions of merchants in the US market. New terminals are very likely to support NFC. As of mid-2014, about a quarter of a million merchants supported EMV; by mid-2015, there is likely to have been a massive spike in terminals capable of handling NFC transactions. See: 3 Trends in EMV Adoption in the U.S., BankTech, 21 January 2014: http://www.banktech.com/payments/3-trends-in-emv-adoption-in-the-us/a/d-id/1296794? As for other markets, Visa had 1.5 million contactless terminals in Europe as of mid-2014. In Canada, 75 percent of all major retailers accept contactless payment as of mid-2014. Looking ahead, Mastercard expects all new point of sales terminals to be NFC-ready as of 1 January 2016. See: Visa works on Apple Pay for Europe, Mastercard eyes NFC as standard by 2020, ZD Net, 11 September 2014: http://www.zdnet.com/visa-works-on-apple-pay-for-europe-mastercard-eyes-nfc-as-standard- by-2020-7000033564/. Also see: Why Apple Pay Should Have Launched in Canada First, TechVibes, 14 October 2014: http:// www.techvibes.com/blog/why-apple-pay-should-have-launched-in-canada-first-2014-10-14

680. See: iTunes Has 800 Million Accounts…. and 800 Million Credit Card Numbers…, Digital Music News, 24 April 2014: http://www.digitalmusicnews.com/permalink/2014/04/24/itunes800m. Also see: Google touts 1 billion active Android users per month, The Verge, 25 June 2014: http://www.theverge.com/2014/6/25/5841924/google-android-users-1-billion-stats

681. In the UK, contactless credit cards have been in circulation since 2008. But even as of mid-2013, transaction volume over contactless cards was still under 50 million per month, or an average of little over one payment per card in circulation. It took till 2014, or six years since first introduced, for usage to take off, with transaction volumes increasing 238 percent year-on-year to £158.5 million (US$262.95 million). See: Contactless Statistics, The UK Cards Association, as accessed on 3 December 2014: http://www.theukcardsassociation.org.uk/contactless_contactless_statistics/index.asp. In London, payments on buses went cashless in July 2014. As of this point, 99 percent of all journeys were paid for or authorized (in the case of season tickets) via contactless card. See: London buses go cashless, The Guardian, 6 July 2014: http://www.theguardian.com/uk-news/2014/jul/06/london-buses-cashless

682. Deloitte estimates that as of the start of 2015, the installed base of smartphones with a built-in fingerprint reader consisting of Apple iPhone 5S and iPhone 6 mobile digital devices, Samsung Galaxy S5, Motorola Atrix 4G and HTC One Max is likely to be over 180 million. We expect at least half of these will be used regularly.

683. For more detail on how fingerprint scanners work, and also for views on their ease of use, see: Galaxy S5 Fingerprint Scanner vs iPhone 5S Touch ID, Trusted reviews, 7 April 2014: http://www.trustedreviews.com/opinions/galaxy-s5-fingerprint-scanner-vs-iphone-5s-touch-id. We would expect that the availability of fingerprint-reading APIs to third party developers to increase further the usage of fingerprints in lieu of, or in addition to, passwords. For more information on APIs for Apple Touch ID fingerprint identity sensor, see: App developers are already doing amazing things with iOS 8., Apple, as accessed on 3 December 2014: https://www.apple.com/uk/ios/developer/

684. As examples, Rogers in Canada and EE in the UK offer this option. See: Rogers customers can change the way they pay with the launch of the suretap™ wallet, Newswire, 11 April 2014: http://www.newswire.ca/en/story/1337875/rogers-customers-can-change-the-way-they-pay-with-the-launch-of-the-suretap-tm-wallet; Also see: About cash on tap from EE, EE, as accessed on 3 December 2014: http://ee.co.uk/help/add-ons-benefits-and-plans/contactless-payment/cash-on-tap/about-cash-on-tap

685. For more information see: Apple Pay's Black Friday, By The Numbers, InfoScoutBlog, 1 December 2014: http://blog.infoscout.co/apple-pays-black-friday-by-the-numbers/

686. One of the launch retailers for Apple Pay mobile payments solution is the premium grocer Whole foods. See: Apple's Wallet Killer Is Already Making An Impact At Whole Foods, Business insider, 8 November 2014: http://uk.businessinsider.com/apple-pay-already-making-an-impact-at-whole-foods-2014-11

687. For example, the Rogers suretap solution plans to integrate loyalty cards into its payment app. See: Rogers customers can change the way they pay with the launch of the suretap™ wallet, Newswire, 11 April 2014. http://www.newswire.ca/en/story/1337875/rogers-customers-can-change-the-way-they-pay-with-the-launch-of-the-suretap-tm-wallet

688. Most smartphones use GPS, GLONASS, Wi-Fi hot-spots to identify where the phone is, and could log where the device's owner normally goes, and also where purchases are made.

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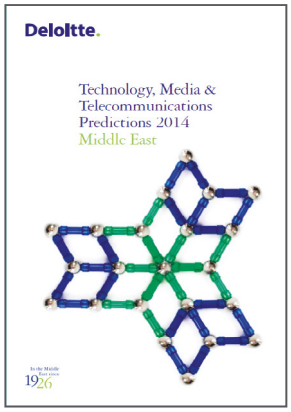

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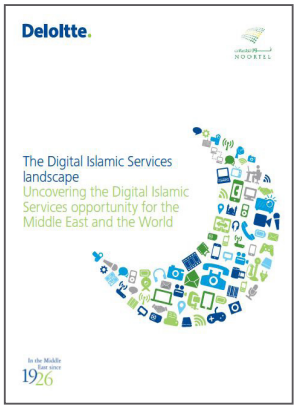

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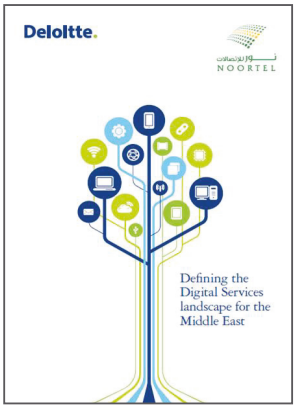

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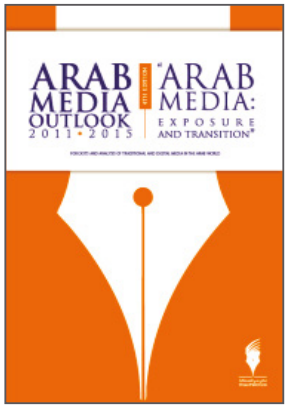

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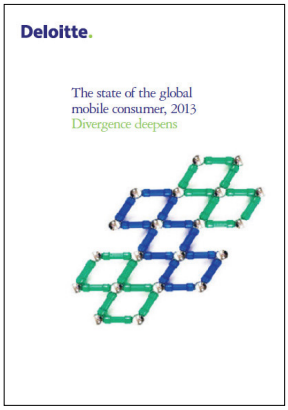

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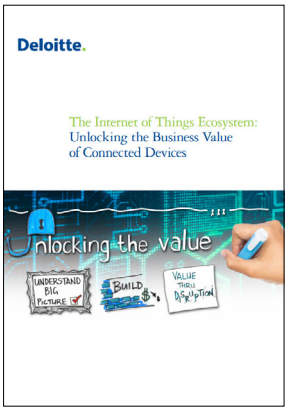

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