Contents

Realising the benefits of mobile-enabled IoT solutions

March 2015

pwc

www.pwc.in

01

Executive summary

Intelligently-connected devices and systems are being increasingly used in all walks of life to leverage data and help make more contextualised, specific and timely decisions. Analysts forecast that there will be in excess of 27 billion connected devices globally by 2020,[1] with the potential to create value from cost reduction and expenditure on new services to the tune of 4.5 trillion USD.[2]

Commonly referred to as the internet of things (IoT), this phenomenon marks the present evolution of technology in the telecommunications sector that is enabling a new wave of life-enhancing services. Mobile networks will be fundamental to enabling the IoT across disparate, physically unconnected and remote 'things', be they homes and home appliances, cars or other modes of transportation, hospitals, schools, factories, office equipment, other 'things', and between such things and people. Several IoT-enabled services will be transformational, driving impacts by connecting different elements of various industries together in new ways.

Provided there is an environment conducive to growth on a global scale, the IoT has the potential to bring substantial social and economic benefit to governments, citizens, end-users and businesses through the creation of new jobs, increase in productivity and competitiveness, improvements in service delivery and personalisation, and more efficient use of scarce resources.

The IoT ecosystem offers a new wave of opportunity for the telecommunications industry to extend their core capability into new areas, as current horizons of growth from mobile voice and data mature. In order to do so, operators will play the role of innovators who acquire new skills and create new opportunities, thereby contributing to realising the socio-economic potential of IoT services.

Through four key themes, this report underlines the ways in which the IoT heralds a new world of possibilities. Real-life examples and key implications for policymakers, regulators and governments illustrate each theme.

The IoT is transformational.

- The IoT will generate significant socio-economic benefits to our society.
- The IoT will enable innovation through the creation of new services, thereby enhancing the functionality of existing ones, and the smarter and more efficient use of resources.
- The IoT will introduce an unprecedented scale of connected devices on a global basis.

The IoT will impact business model evolution.

- The IoT value chain is complex and highly competitive.
- IoT-enabled services comprise of a global production and distribution model.
- In the IoT world, the customer relationship will become more contestable.

The IoT presents new business opportunities.

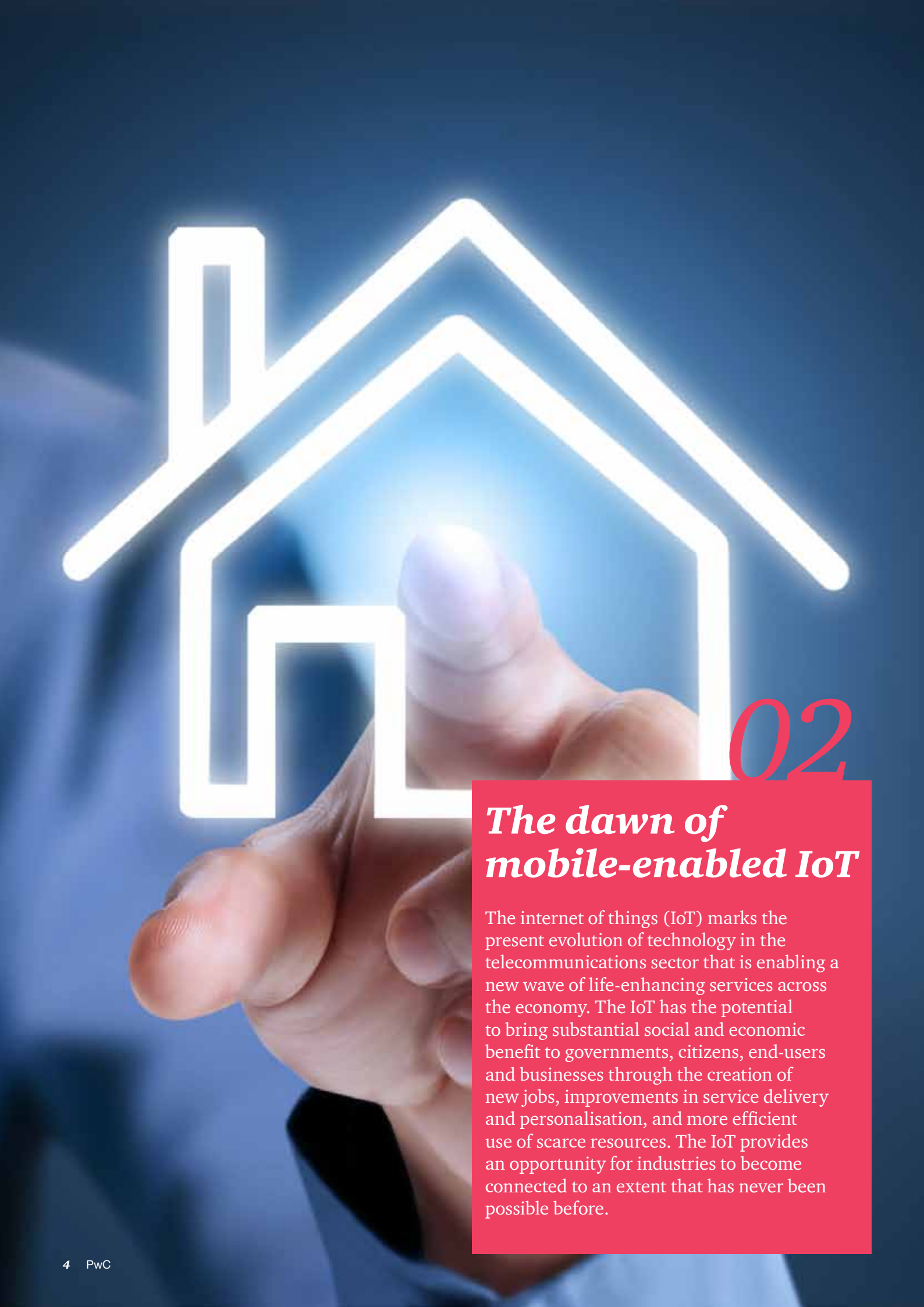
- The IoT presents the telecommunications industry with new opportunities for growth.
- The IoT opens new opportunities for small and medium enterprises (SMEs) to reach more markets and customers.
- The IoT enables large business to operate more efficiently, improve distribution and reduce costs.

The IoT requires a technology- and service-neutral approach.

- Governments must create an investment-friendly environment for the IoT to scale.
- Policymakers must allow alternative IoT technology and service models to thrive.
- Policymakers must work together to ensure consistency and clarity on legal, data protection and privacy regulation across verticals and jurisdictions.

Ashish Sharma

Director
Telecom, Media and Technology
Strategy&



02

The dawn of mobile-enabled IoT

The internet of things (IoT) marks the present evolution of technology in the telecommunications sector that is enabling a new wave of life-enhancing services across the economy. The IoT has the potential to bring substantial social and economic benefit to governments, citizens, end-users and businesses through the creation of new jobs, improvements in service delivery and personalisation, and more efficient use of scarce resources. The IoT provides an opportunity for industries to become connected to an extent that has never been possible before.

Mobile-enablement creates specific value for realising the benefits of the IoT:

- Mobile penetrates most parts of the inhabited world through wireless technology.
- With 7 billion connections[3] and growing, most adults on earth are connected individually over mobile.
- Connected mobile devices are used for information collection and decisionmaking.
- Mobile networks interconnect nationally and globally through established sharing and connection protocols.
- The mobile industry has an established ecosystem to manage data and messaging on a mass scale in a secure manner.
- The mobile industry has proven systems for billing, charging and customer care.

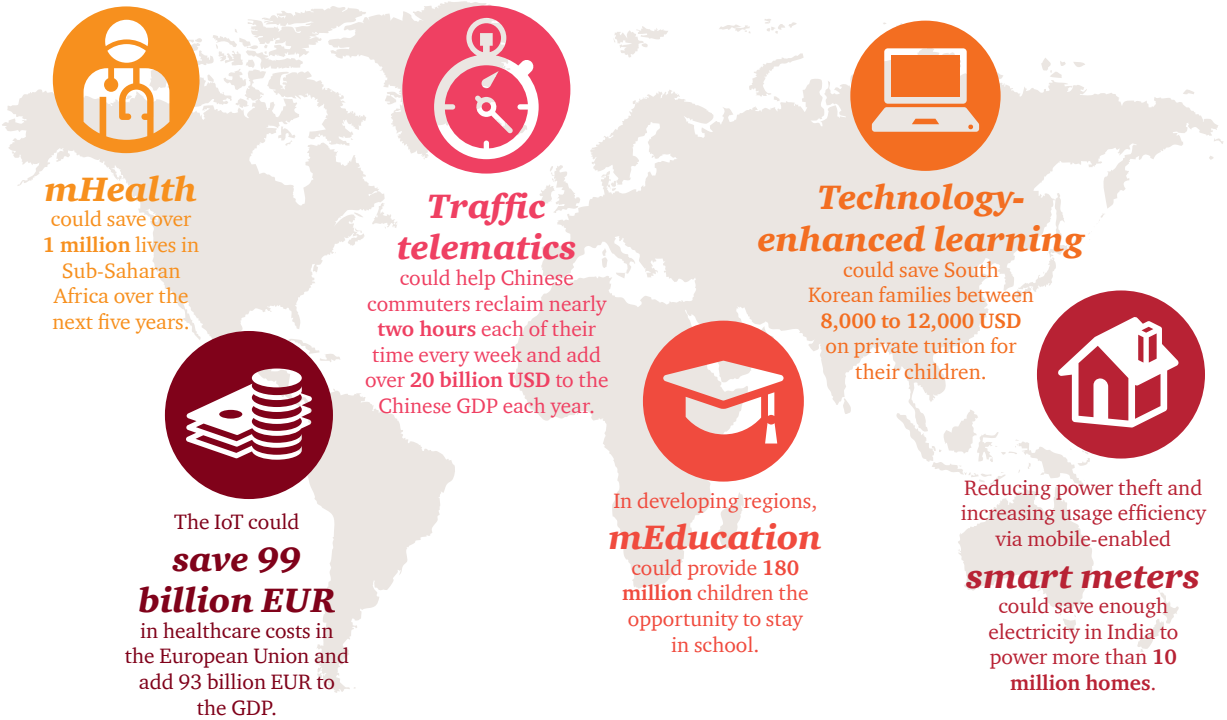
Mobile is not the only communication enabler. There will be instances where other communications technologies will combine with or complement mobile to deliver an IoT-enabled service. However, the mobile industry today finds itself at the core of the nascent IoT ecosystem, with an opportunity to play a positive role in shaping its future. For the mobile industry to fulfil this role, it too must be ready to adjust to new business models and forms of usage, which will ultimately create industry structures significantly different to what we have today.

While the IoT creates an unfathomable range of new opportunities, it brings with it new challenges. A common understanding of this opportunity is therefore needed to tune appropriate industry, policy and regulatory responses. The purpose of this paper is to illustrate the breadth of the IoT and why it is different, to describe how the IoT is evolving by illustrating selected real-life examples, and how this is resulting in increasing the intensity of competition as well as opening new routes for companies to directly access customers.

Understanding the IoT

The IoT formally refers to the use of intelligently-connected devices and systems to leverage and analyse data gathered by embedded sensors and actuators in machines and other physical objects to help take decisions.[2] Machine-to-machine (M2M) is often mentioned in conjunction with the IoT and is in fact a subset of it, referring to innovations in micro computing and wireless technology that allow embedded devices to collect and distribute real-time data without the intervention of humans, and already connects millions of machines today.

The IoT is transforming everyday physical objects that surround us into a connected system of assets which generate information designed to enrich our lives. From electricity meters to parking spaces to homes, the IoT is bringing more and more things into the digital fold. The wide range of socio-economic impact that the IoT could create draws upon recent analysis conducted by PwC with respect to the potential of IoT for the year 2017:[4, 5, 6]



IoT-enabled services enable access, increase efficiency and drive greater personalisation.

The key benefits generated by most IoT use cases are broadly classified into three categories:

- ***Enabling access:*** Mobile-enabled IoT can ensure the delivery of services in remote and previously unconnected geographies.
- ***Increasing efficiency:*** Through the IoT, business can benefit from insights, visibility and control by real-time tracking of machinery, equipment and employees. This can cut wastage, increase productivity and safety and extend asset life.
- ***Personalisation:*** Through customer analytics, businesses will be able to understand and profile their customers better in order to be able to deliver more customised services at an individual level, thereby transforming the customer experience.

The IoT offers significant value to both emerging markets and advanced countries.

Emphasising the value of mobile data connectivity alone, a World Bank study estimates that a 10% increase in 3G or broadband subscribers has an incremental impact of nearly 1% point on GDP.[7] The positive impact of the IoT, however, will be even more widespread and significant. According to Machina Research, the global business impact of M2M through cost reduction and improved quality of service can be as much as 4.5 trillion USD in 2020.[2] Analysts have estimated that business efficiencies achieved through the IoT will be valued at approximately 2 trillion USD by 2020, 1 trillion USD from cost reduction and 1 trillion USD from service improvement.[2] This impact will be the result of major social and environmental benefits, such as improved healthcare, safer and efficient transportation and logistics, better education and efficient use of energy. Such benefits will be observed across both advanced as well as developing economies.

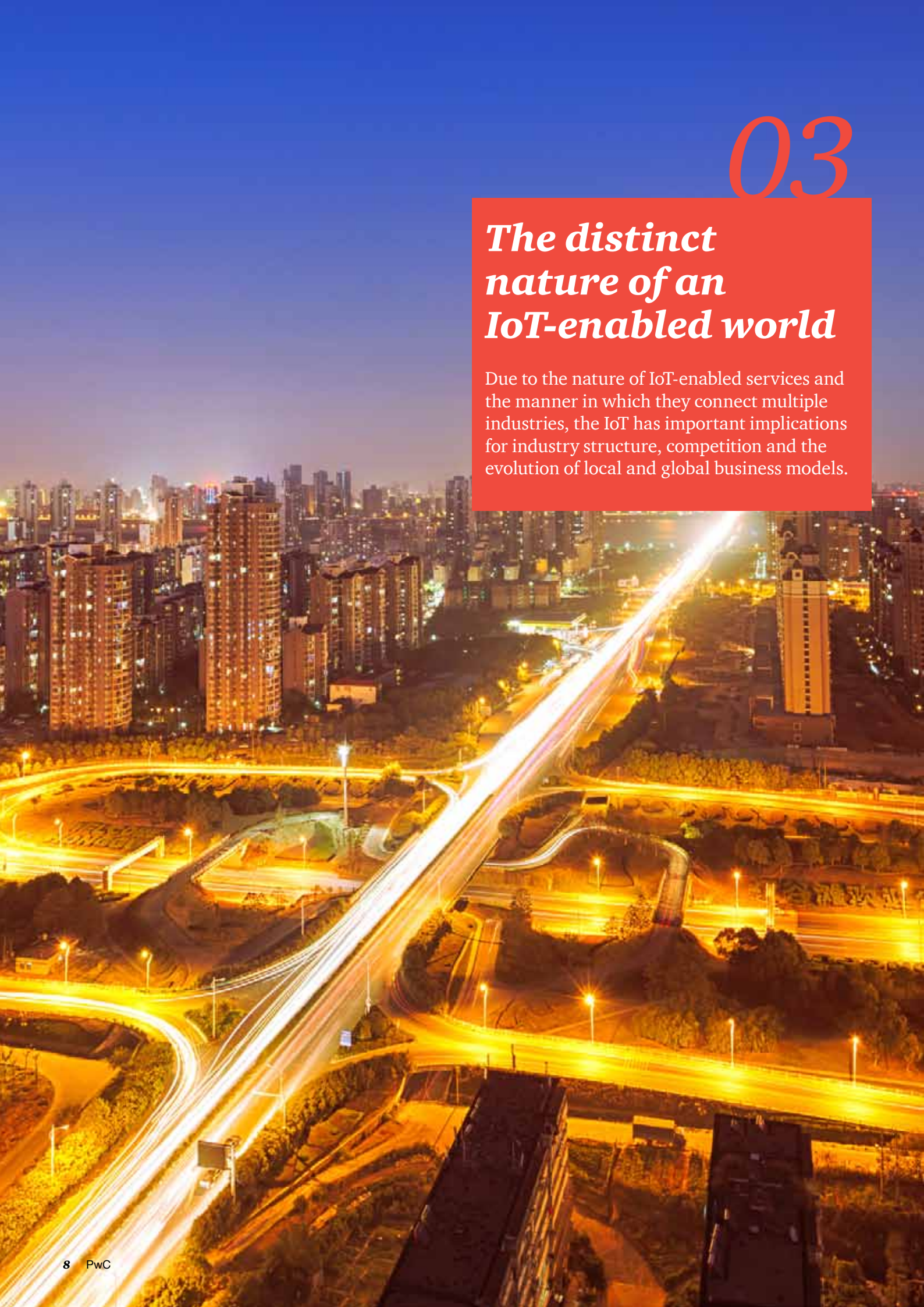
In advanced economies, the IoT will predominantly improve efficiency and enable personalisation. For example, the healthcare sector in these regions has to deal with the rising cost of care due to an ageing population and an elevated prevalence of chronic diseases. For patients suffering from chronic diseases, frequent hospital stays and clinic visits will be reduced through a revolution in remote monitoring enabled by sensors collecting medical data, connected devices transmitting the data to the healthcare provider, and analytics which track the patient's progress remotely. Thus, mHealth solutions will enable these countries save billions on healthcare costs, not just for chronic disease management but across the board, through remote diagnosis and monitoring, thereby enhancing the effectiveness as well as the efficiency of care.

The IoT will also create public value to both advanced as well as developing economies through efficient use of scarce public resources, smarter cities, lower urban congestion, safer roads, improved provision for healthcare, targeted and personalised learning. Establishing the ecosystem to support IoT services will in itself create significant new business opportunities for mobile operators, equipment vendors, IT solution providers as well as other players in adjacent industries.

In developing economies, services such as basic healthcare, citizen's information, money transfer or education are not widely available due to a lack of physical facilities, poor logistics infrastructure and lack of affordability. An example from healthcare serves to illustrate this. A mother in a remote village is unable to verify whether her child has a potentially harmful skin condition because there are no specialists in her area. To visit a dermatologist, she has to spend to travel to a city to see one, then pay the doctor's fees, and forego a day's earnings.

In the IoT-enabled world, her journey and most of the costs associated with it can be avoided. With the assistance of a local community health worker or a pharmacist, she can share images of the child's skin condition and discuss it with a specialist, narrowing down the need to travel only to those cases where there is a need for a physical examination. IoT-enabled services such as these will enable the poor to access and afford services, not attainable today, 'leapfrogging' them to overcome current infrastructure shortages which prevent them from using such services. In this way, IoT-enablement optimises the use of scarce resources by connecting them more intelligently and remotely. This will enable governments to prioritise investment on essential areas, and reduce the need to focus solely on building new hospitals and clinics.

In developing countries, the IoT will also act as a vehicle for employment generation and inclusive growth, by creating new services at the local level which will require skilled as well as semi-skilled workers to deliver them. Leapfrogging will take place across several sectors since it creates extensions and enhancements to existing assets through technology, which in turn enables such assets to be productive for customers who are far away, or who cannot afford them in the form they are offered today.



03

The distinct nature of an IoT-enabled world

Due to the nature of IoT-enabled services and the manner in which they connect multiple industries, the IoT has important implications for industry structure, competition and the evolution of local and global business models.

The IoT is transformational.

The IoT will generate significant socio-economic benefits to our society.

The IoT is likely to have a compelling impact on the global economy, through the transformation of various industries. The transformation is already taking place across myriad avenues.

- In **mHealth**, connected smart devices are helping improve access to care and enable remote monitoring of chronic diseases and age-related conditions. In doing so, the connected device will improve the quality of care, reduce response time, prioritise interventions, reduce clinic visits and cut costs. This will reduce the strain on the wider healthcare system, so that its resources can be more focussed on emergencies and cases requiring immediate attention.
- In **smart cities**, integration of connected smart devices and cloud-based services are beginning to have a far-reaching impact. Towards this, IoT applications which address challenges in areas such as security, traffic congestion, waste management and energy efficiency will help cities become safer, sustainable, comfortable and efficient. This will have social as well as economic impacts on city life: bringing citizens closer to municipal authorities, and increasing the transparency and accountability of government.
- In **learning**, mobile-enabled solutions can tailor the education process to each student's need to a degree that has never been achieved before, thereby improving proficiency levels across a wide section of the people. The IoT has the potential to enable learners and educators worldwide to access relevant content anywhere, anytime while at the same time being more cost-effective.
- In the **automotive** sector, services are being introduced to improve logistics and vehicle safety, cut journey times, reduce vehicle maintenance and ownership costs, and provide infotainment services. Towards this, mAutomotive and telematics-enabled applications are already being introduced which assist with stolen vehicle recovery, for insurers, to monitor vehicle driving habits for pay-as-you-drive arrangements and automatic crash notification, resulting in fewer fatalities and injuries as well as lower insurance claims and premiums.

Telefonica, in collaboration with the Santander City Council of Spain and 24 ecosystem partners, has installed more than 20,000 sensors across the city in order to capture and transmit real-time data for managing traffic jams, parking space availability, air quality measurement and remote street lights dimming.[11] This is an EU project led by Telefonica with technical support from the University of Cantabria and illustrates how the IoT-enabled world can create significant socio-economic impact across cities.

The IoT will enable innovation through the creation of new services, thereby enhancing the functionality of existing ones, and the smarter and more efficient use of resources.

In impacting a large number of industries, the IoT will result in significant innovation to create new services, higher functionality and more efficiency. Such innovations will be critical in creating the envisaged global socio-economic impact.

IoT solutions across sectors

Source: PwC analysis

Implication: Governments in developing as well as advanced economies need to identify steps required to maintain an investment-friendly environment that fosters innovation in the IoT broadly across the economy.

The IoT will introduce an unprecedented scale of connected devices on a global basis.

With the forecast that there will be some 27 billion IoT-enabled assets by 2020, we have entered an era of concentrated and exponential growth in the proliferation of connected devices around the world.[1] The telecom industry is already accustomed to rapid scale expansion, having grown to around 7 billion mobile subscriptions worldwide in a span of 20 years.[3] In order to manage the growth of the IoT, the industry will have to manage supporting even greater scale and in a shorter span of time.

The first wave of mobile connections growth had to manage the scaling of voice minutes traffic, and then exponential growth in packet data. With the IoT, new patterns of network usage as well as behaviour will emerge, which are not extensions of the present use of networks for consumer voice and data. Now, billions of connected devices will generate frequent data transmission on a constant but low-intensity basis (a few kilobytes a day, for example), a large number of instances of data collection will take place through sensors and actuators, and multiple end-point technologies (such as Wi-Fi and Bluetooth) will connect disparate devices to commonly interconnected telecommunications networks. Most of the traffic will be sporadic, but frequent, and non-human in nature. Since IoT-enabled devices will behave in a different way to humans using the network, they will pose novel challenges for network coverage, adaptability, resilience and security.

Implication: Managing the scale of IoT deployment will require telecom operators to adapt and invest, as well as enter into research and innovation activities with technology partners and equipment manufacturers.

Singapore's Intelligent Route Information System (IRIS)[8] illustrates both new service innovation as well as new patterns of network usage associated with the IoT. IRIS informs passengers of the next bus arrival time using satellite positioning technology and traffic flow analytics. Buses' precise locations are tracked by an operations centre through information uploads of 5 to 10 KB on a minute-to-minute basis, and next bus arrival times delivered through a user app which provides information-intensive data feed to users' mobile handsets using a 3G or LTE signal. Video surveillance of road junctions and traffic hotspots is undertaken with a mix of mobile and fixed communication, via a live feed of several MB per minute. By contrast, emergency response systems in vehicles such as buses or cars, communicate data only at the time of accidents, which can be once every five years.

The IoT will impact business model evolution.

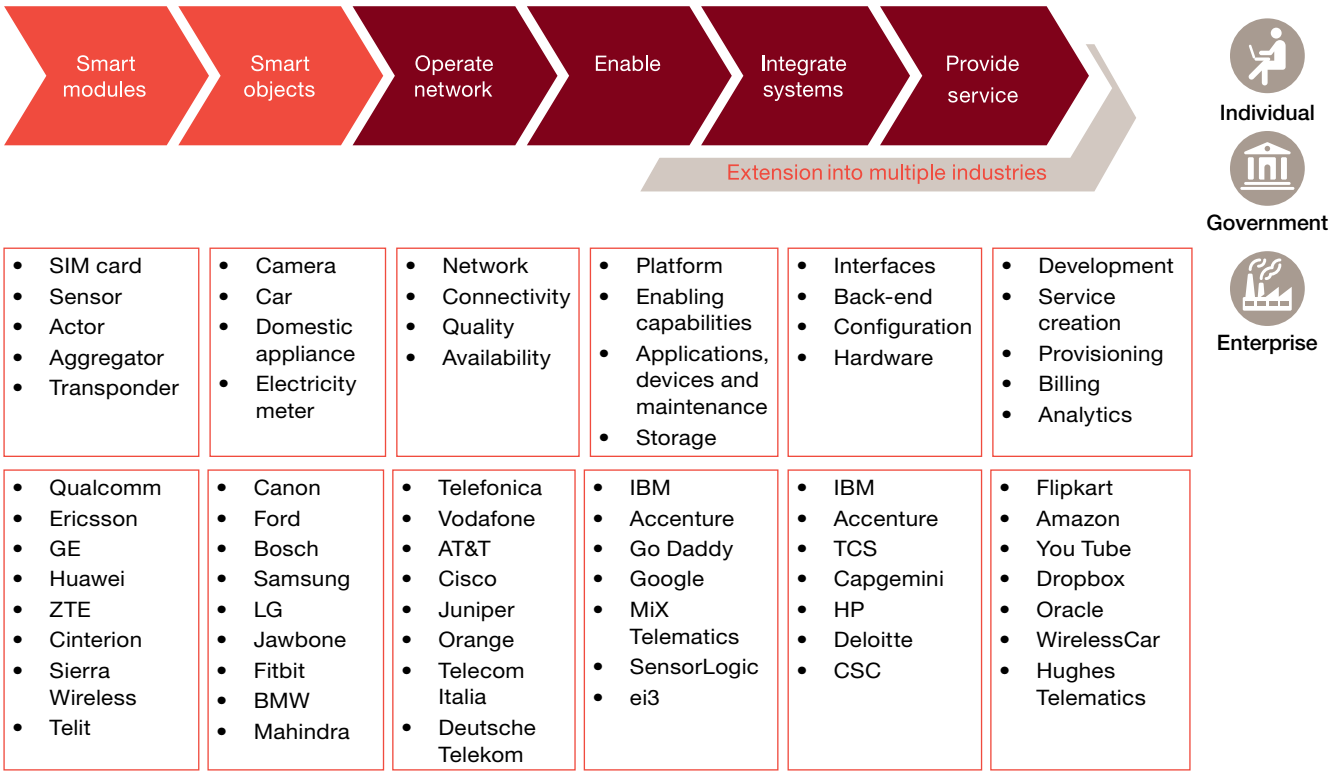
The IoT value chain is complex and highly competitive.

The IoT is transforming everyday physical objects that surround us by connecting them into a system that combines to deliver new and innovative types of services. This creates new forms of interaction between players in the value chain, resulting in greater complexity in service creation, distribution and delivery, and as a result, higher intensity of competition. Towards this, the communications value chain reflects the addition of two 'smart' elements to the other aspects prior to the IoT:[9]

Smart module: The generic name for modems, wireless modules, gateways and other components that connect the smart object to a network.

Smart object: Products or devices designed to communicate with others through a smart module or a network. Examples range from light bulbs, cameras, cars, to printers. Automotive manufacturers and appliance manufacturers are examples of companies that produce smart objects.

Value chain for smart, IoT-enabled solutions



Source: Arthur D Little research, PwC analysis and modification

The introduction of smart objects and modules results in new complexity due to the endless array of new partnerships that can now combine to service a customer's needs. The new ecosystem includes telecom players such as AT&T, Orange, Telefonica and Vodafone, product manufacturers such as Bosch, Canon and Samsung, hardware and system integrators such as Ericsson, Siemens and IBM along with other technology players such as Google.

The emergence of pay-as-you-drive insurance illustrates how competition and complexity in the motor insurance market is increasing as a result of the IoT. Various insurance providers have started providing telematics-based 'pay-as-you-drive' insurance using wireless connectivity to capture and transmit vehicle data in real time.[10] Auto manufacturers, insurance companies and telecom operators are partnering in different combinations to create these services, with services provided to the customer either by the auto manufacturer, the dealer at the time of sale of the vehicle, or by the insurance company at the time of taking out a policy. While this creates new a functionality for car owners, it creates new fields for competition for insurance companies, car manufacturers, auto dealers and mobile operators.

Implication: Competitive dynamics are changing in the mobile and telecom sector as a result of the IoT, due to the emergence of alternative technologies and platforms, and the entry of new players and products.

IoT-enabled services comprise of a global production and distribution model.

Many IoT-enabled services are delivered through global distribution models, with distinct elements of the value chain being performed across various geographies or regions, and with services and products being offered in many markets. For example, the automobile manufacturer will have to ensure that a car equipped with a smart module can have the device enabled for services in markets where the car will be sold. To do so, the manufacturer may first need to integrate the installation of smart modules into the assembly process. It will also have to create separate arrangements with network operators in order to ensure that local connectivity is provided, as well as supporting elements such as connectivity provisioning, customer care, security, data protection, privacy and billing. The manufacturer and its partners may investigate alternative models for service provision which create scale economies across markets, and respond to in-market customisation needs.

Ooredoo has partnered with the British Council to launch the 'Learn English' programme across multiple geographies, including Palestine and Myanmar.[12] The programme offers a mobile quiz which sends English language questions to users by SMS, and then sends follow-up explanations, and the word of the day service, which sends users a word or phrase in English, along with its meaning and an example of its use. While content is produced centrally, the service is distributed across different geographies in order to cater to the demand to learn English on the move.

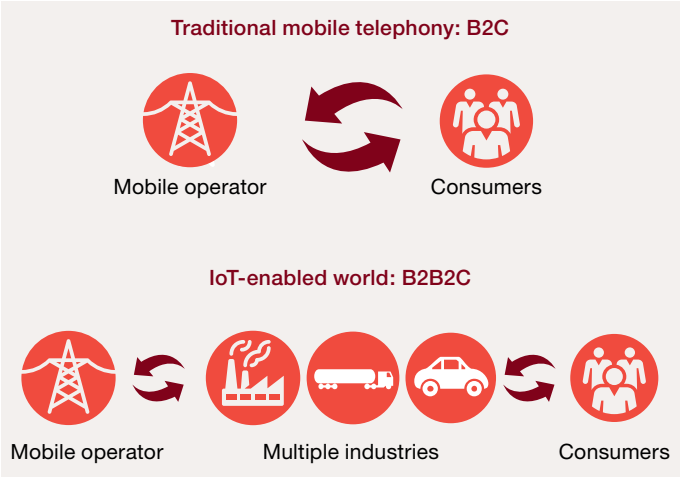
AT&T Cargo with FlightSafe® uses sensors to track valuable cargo by collecting information details such as location, humidity, temperature and light.[13] For the product to work seamlessly, the cargo is tracked on a real-time basis across as many as 200+ countries through partnerships that AT&T has created with 28 airlines.

Implication: As business models evolve, organisations need to have the flexibility to adopt innovative service models and provide platforms that enable the deployment of high-quality services worldwide, in line with their requirements for consistency and economies of scale.

In the IoT world, the customer relationship will become more contestable.

With multiple players involved in the delivery of IoT services, customer relationship is becoming more contestable. Telecom operators have traditionally enjoyed direct access to the end-user for connectivity-related services. Often referred to as business-to-customer (B2C) or business-to-business (B2B) services, in each case, it has usually been the telecom operator that has established a direct relationship with the end-user. In the IoT ecosystem, however, telecom operators will also act as enablers to companies where the final connectivity-related service is delivered by others in a business-to-business-to-customer (B2B2C) model.

Comparison of traditional mobile telephony and the IoT-enabled world



Source: GSMA

As the competitive intensity of the IoT ecosystem increases dramatically, connectivity relationships with the customer are being contested by various players such as service providers, system integrators (particularly for B2B enterprise customers) and original equipment manufacturers (OEMs). For example, IT and communications equipment players are now deeply involved in building smart cities and in doing so, deal directly with government entities, utilities and municipalities. In the future, smart-city-connected services may be provided not only by telecom operators but by solutions or service providers who bundle connectivity as part of a wider solution or service. In many cases, the telecom operator will not have a direct relationship with the final customer, even where it provides the connectivity service.

MobiSante has developed a compact ultrasound machine which enables patients to be diagnosed by specialists remotely from across the world.[14] *The company promotes this product to hospitals, and makes arrangements directly with network operators for connectivity. A host of other service providers provide ancillary services such as data storage, software and applications development. This illustrates a B2B2C use case, with a smart device manufacturer bundling connectivity with its product and establishing a direct relationship with its customers (hospitals).*

Implication: Competition for the customer relationship is intensifying as a result of the IoT, due to the emergence of alternative technologies and platforms, and the entry of new players and products.

The IoT presents new business opportunities.

The IoT presents the telecommunications industry with new opportunities for growth.

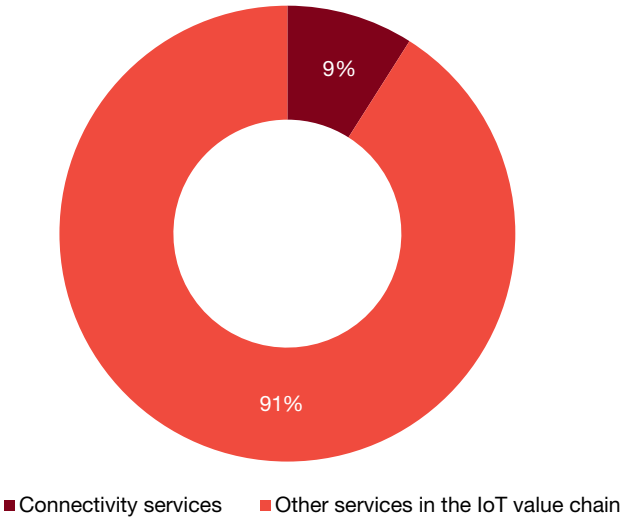
The IoT ecosystem offers a new wave of opportunity for the telecommunications industry to extend its core capability into new areas, as current horizons of growth from mobile voice and data mature. In order to do so, operators will play the role of innovators who acquire new skills and create new opportunities, thereby contributing to realising the socio-economic potential of IoT services.

This role is important for the success of the IoT because a number of core features of intelligent mobile connectivity are critical to enabling IoT solutions to be successful. These features include ubiquity and quality of connectivity, networks' ability to deal with highly differing patterns and regularity of usage, privacy and security, requirements to bill and charge for use and the ability to manage all of this on a mass scale of billions of connections, often communicating across regions and multiple territories.

The IoT opportunity comes at a time when the mobile industry is looking out for new growth avenues. In developed markets, after years of growth in the early 2000s, the industry has been experiencing declining or negative growth in more recent years. After a decade of phenomenal growth, most emerging markets will stabilise over the next few years. The highly successful horizons of growth in mobile have come on the back of increasing penetration and maturity of voice and data services. In this context, the IoT-related opportunity will represent a key opportunity for the industry to grow as consumer voice and data services saturate.

Machina Research estimates that within the IoT, connectivity services alone may amount to 39 billion USD by 2022.[2] Interestingly, IoT connectivity revenue will be only 9% of all IoT-enabled revenues. Given the significant scope of the IoT beyond connectivity, some telecom operators may decide to focus to leverage their role in the avenue of connectivity to also move to other aspects of service revenue in the IoT.

M2M total service revenue split, 2022



Source: Machina Research

Operators will have to drive innovation by acquiring skills and formulating new partnerships in order to compete in new areas which are an extension to their traditional business model. Vodafone, for example, has partnered with Advanced Metering Services (AMS) in order to provide smart metering solutions in New Zealand, combining a bespoke technical solution with new price plans that ensure smart metering meets the needs of energy retailers, consumers and distribution companies.[15] Such association will enable operators to efficiently offer innovative IoT services whilst competing with diverse players.

MyDoctor@Home is a remote monitoring service that allows patients suffering from chronic illnesses to monitor blood pressure, heart rate, oxygen levels and electrocardiogram directly from their home.[16] Telecom Italia provides the connectivity services but in a bid to increase its revenue opportunity the operator has also developed extensions, including a cloud computing solution delivered through scalable, on-demand data centre capacity.

Implication: Mobile operators will have to invest in skills development, partnerships and alliances, as well as strategic acquisitions. Governments need to ensure that operators are not disadvantaged in extending to broader roles across the industry due to existing sector guidelines.

The IoT opens new opportunities for SMEs to reach more markets and customers.

The IoT-enabled world creates significant new opportunities for small and medium sized enterprises. Two features of the IoT-enabled world will drive the SME opportunity. Firstly, the emergence of a global production and distribution model will open up new avenues for small businesses to participate in opportunities across markets which they have not accessed before. For example, a diabetes monitor manufacturer will be exposed to opportunities across multiple markets if it partners with a global healthcare services provider. Secondly, with IoT services creating new ways to access customers, SMEs have new opportunities to compete for customer access once reserved for larger companies. For example, consumer applications providing IoT-enabled services are now able to scale globally at a pace which has not been seen before. SMEs are likely to participate in the IoT across the value chain, not only in apps but also in areas such as smart device manufacture, data analytics, cloud services and storage. The emergence of IoT services provides a platform for governments to ensure that SMEs are sufficiently exposed to IoT opportunities, meaning that export growth and employment impacts from the IoT are maximised.

The IoT enables large business to operate more efficiently, improve distribution and reduce costs.

The large business benefit from the IoT is likely to be significant across many industries, and will be felt through cost reduction and operating efficiency, as well as through access to new revenue opportunities. Participation in the IoT opportunity will be critical to large businesses in order to protect current customer relationships, as well as to build new value. Governments have a role to play in ensuring that larger businesses also understand the global IoT opportunity.

Implication: Governments must encourage local SMEs as well as larger businesses to participate in the global IoT opportunity.

The IoT requires a technology- and service-neutral approach.

The IoT needs an investment-friendly environment to scale to its full potential.

While IoT services hold the promise of a major impact on the economy as well as society, such services are at a nascent stage of development characterised by experimental business models and exploratory alliances. It is critical for policymakers to identify the specific actions required within their local market so as to capture the IoT opportunity. While the IoT democratises access to customers and opportunities through digital technology, it is likely that those countries which are able to grasp the opportunity quickly will benefit more. Therefore, it is important for governments to encourage SMEs as well as large businesses to participate in technological and disruptive innovation so that they can take their fair share of growth from IoT services.

Policymakers must allow alternative IoT technology and service models to thrive.

In the next few years, IoT-enabled services will pass through a variety of different models, and alternate solutions will emerge which will utilise different technologies. In adopting a technology-neutral stance, it is important that policymakers allow different models to thrive, supporting the development of alternative technical solutions and service models. Such neutrality will allow competitive forces to have as much freedom as possible in order to shape the market.

Policymakers must work together to ensure consistency and clarity on legal, data protection and privacy regulation across verticals and jurisdictions.

Several IoT services will cut across multiple verticals, thereby connecting telecommunications to sectors such as healthcare, education, utilities, transportation and many other industries. In such cases, policymakers as well as regulators from different industries (and countries) may need to collaborate on common themes (such as pricing, bundling and security) to encourage growth and progress on a global dimension. It is important that there is regulatory clarity and legal certainty around the IoT service, so that privacy and data protection regulations are applied consistently across all IoT service providers in a service- and technology-neutral way. This is particularly the case where IoT services involve more parties than simply mobile operators, such as device manufacturers, online platforms or public services providers.

Telemedicine in South Korea was restricted by the medical practice laws of the country that only permit consultations when the doctor is able to examine the patient in-person.[17] In order to encourage telemedicine within the country, authorities passed a bill allowing doctors to utilise tele-health technology to diagnose and treat patients, restricting the permission to certain conditions such as hypertension, diabetes and mental disorders. The South Korea case illustrates that a flexible approach to regulatory formulation can allow disruptive technologies to flourish.

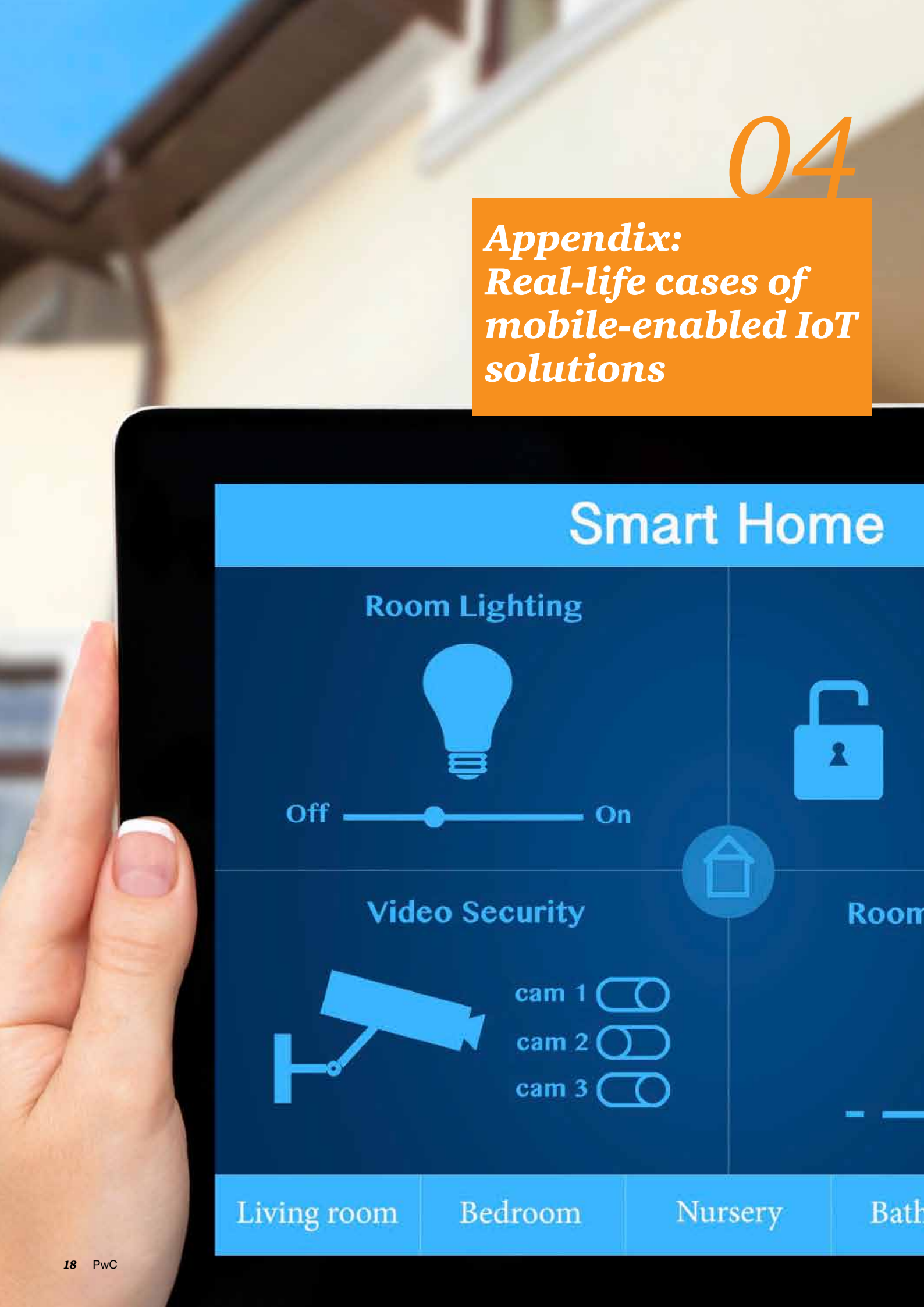
Implication: Policies must allow and incentivise the development of different models for IoT services, and must maintain a liberal stance towards technology and service neutrality. It is important that there is regulatory clarity and legal certainty such that privacy and data protection regulations in the IoT apply consistently to service providers in a service- and technology-neutral way.

Summary implications

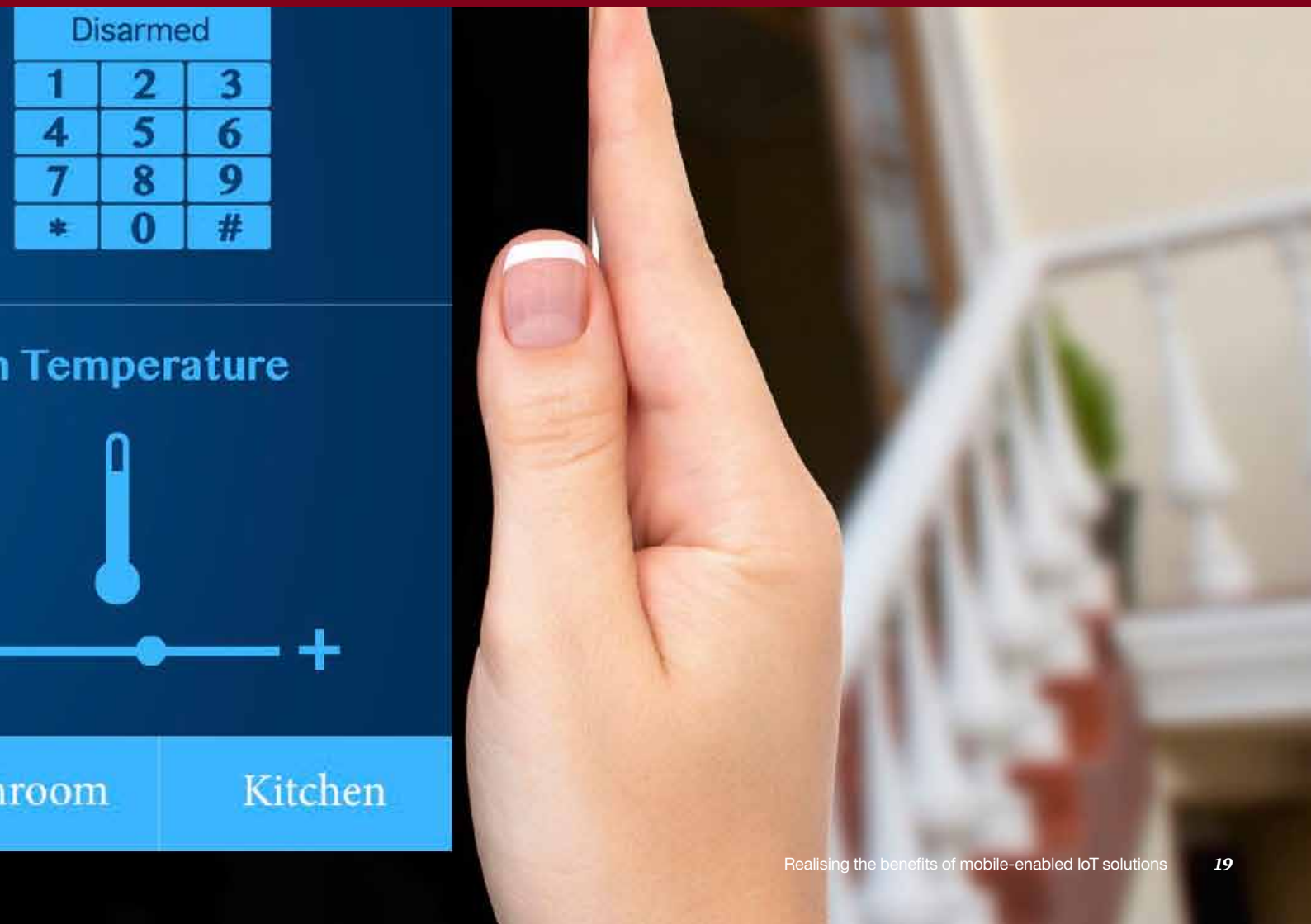
Themes	Key implications
The IoT is transformational.	
• The IoT will generate significant socio-economic benefits to our society. • The IoT will enable innovation through the creation of new services, thereby enhancing the functionality of existing ones, and the smarter and more efficient use of resources. • The IoT will introduce an unprecedented scale of connected devices on a global basis.	• Governments in developing as well as advanced economies need to identify steps required to maintain an investment-friendly environment that fosters innovation in the IoT broadly across the economy. • Managing the scale of the IoT deployment will require telecom operators to adapt and invest, as well as enter into research and innovation activities with technology partners and equipment manufacturers.
The IoT will impact business model evolution.	
• The IoT value chain is complex and highly competitive. • IoT-enabled services comprise of a global production and distribution model. • In the IoT world, the customer relationship will become more contestable.	• Competition for customer relationship is intensifying as a result of the IoT, due to the emergence of alternative technologies and platforms, and the entry of new players and products. • As business models evolve, organisations need to have the flexibility to adopt innovative service models and provide platforms that enable the deployment of high-quality services worldwide, in line with their requirements for consistency and economies of scale.
The IoT presents new business opportunities.	
• The IoT presents the telecommunications industry with new opportunities for growth. • The IoT opens new opportunities for SMEs to reach more markets and customers. • The IoT enables large business to operate more efficiently, improve distribution and reduce costs.	• Mobile operators will have to invest in skills development, partnerships and alliances, and strategic acquisitions. • Governments need to ensure that operators are not disadvantaged in expanding to broader roles across the industry due to existing sector guidelines. • Governments must encourage local SMEs to participate in the global IoT opportunity.
The IoT requires a technology- and service-neutral approach.	
• Governments must maintain an investment-friendly environment for the IoT to scale. • Policymakers must allow alternative IoT technology and service models to thrive. • Policymakers must work together to ensure consistency and clarity on legal, data protection and privacy regulation across verticals and jurisdictions.	• Policies must allow and incentivise different models to develop IoT services, and must maintain a liberal stance towards technology and service neutrality. • It is important that there is regulatory clarity and legal certainty such that privacy and data protection regulations in the IoT is applied consistently to service providers in a service- and technology-neutral way.

04

Appendix: Real-life cases of mobile-enabled IoT solutions



No	Title	Description
1	MobiSante: Portable ultrasound	This product increases access to ultrasound by reducing the cost and size of the ultrasound machine, enabling remote communication of scans to physicians.
2	MyDoctor@Home	This service allows for savings of upto 80% by improving the quality of life of patients and saving up the doctor's time as well as public financial resources.
3	Intelligent Route Information System, Singapore	This solution will enable efficient road traffic management that will help commuters save time by optimising the travel experience.
4	SmartSantander	The solution provides multiple benefits to the city as well as its citizens such as traffic management and pollution monitoring. Also, greater involvement of the citizens represented by a 500% increase in interaction between citizens and the city council.
5	Learn English, Palestine	This programme enables people to learn English by providing on-the-go access to resources.
6	Telematics-based insurance	This service redefines the automobile and insurance industry by capturing and transmitting vehicle data.
7	AT&T Cargo View with FlightSafe	Real-time tracking of the cargo (location, temperature and safety), AT&T Cargo View will impact the logistics industry.
8	Telemedicine in South Korea	The use of telemedicine is optimising healthcare resources in the country, thus reducing costs.



Mapping key messages to real-life case studies

			1	2	3	4	5	6	7	8
#	IoT : Main points		MobiSante	MyDoctor@ Home	IRIS, Singapore	SmartSantander	Learn English	Telematic insurance	AT&T Cargo View	Telemedicine in South Korea
1	The IoT is transformational.	The IoT will generate significant socio-economic benefits to our society.	☑	☑	☑	☑	☑	☑	☑	☑
		The IoT will enable innovation through the creation of new services, thereby enhancing the functionality of existing ones, and the smarter and more efficient use of resources.	☑	☑	☑	☑	☑	☑	☑	☑
		The IoT will introduce an unprecedented scale of connected devices on a global basis.	☑	☑	☑	☑		☑	☑	☑
2	The IoT will impact business model evolution.	The IoT value chain is complex and highly competitive.	☑	☑	☑	☑		☑	☑	
		IoT-enabled services comprise of a global production and distribution model.	☑	☑			☑	☑	☑	
		In the IoT world, the customer relationship will become more contestable.	☑	☑	☑			☑	☑	
3	The IoT presents new business opportunities.	The IoT presents the telecommunications industry with new opportunities for growth.		☑	☑	☑		☑	☑	
		The IoT opens new opportunities for SMEs to reach more markets and customers.	☑	☑	☑	☑	☑	☑	☑	☑
		The IoT enables large business to operate more efficiently, improve distribution and reduce costs.	☑	☑	☑	☑	☑	☑	☑	☑

			1	2	3	4	5	6	7	8
#	IoT : Main points		MobiSante	MyDoctor@ Home	IRIS, Singapore	SmartSantander	Learn English	Telematic insurance	AT&T Cargo View	Telemedicine in South Korea
4	The IoT requires a technology- and service-neutral approach.	Governments must create an investment-friendly environment for the IoT to scale.				☑				☑
		Policymakers must allow alternative IoT technology and service models to thrive.				☑				☑
		Policymakers must work together to ensure consistency and clarity on legal, data protection and privacy regulation across verticals and jurisdictions.				☑				☑

☑ Direct mapping | Used in the report | Not used

MobiSante: Portable ultrasound[14]

Ultrasound imaging is safe, effective and can save lives. However more than 70% of the world's population does not have access to ultrasound because it is expensive and not portable. Mobile ultrasound imaging is a non-invasive diagnostic tool that has the potential to greatly improve access to quality healthcare in more remote areas. MobiSante has built the world's first smartphone-based ultrasound imaging system, the MobiUS SP1 Ultrasound System. The design of this award-winning system has been personalised, it fits in your pocket and can be taken to patients no matter where they are. It is accessible, wherein mid-level professionals can easily operate it, can be easily connected, wherein ultrasound images can be easily and securely shared for archival, second opinion, or remote diagnosis using a cellular or Wi-Fi network, and is affordable since clinics and medical professionals in resource limited settings can afford it.

Several studies have been conducted to demonstrate that images can be created, and then pushed to a remote location to be analysed by the ultrasound specialist. Examples of such studies include, broad screenings of 100+ patients in Sierra Leone conducted with over-read services provided by a radiologist in Seattle, short studies conducted with the MobiUS SP1 system in Nepal, Philippines and India.

MyDoctor@Home[16]

MyDoctor@Home is a remote diagnostics service that allows patients suffering from cardiac, diabetic or lung ailments to measure their clinical parameters from their homes. Telecom Italia and the Piedmont Region signed an agreement in October 2010 for this service to be adopted at the San Giovanni Battista University Hospital in Turin, Italy. Subsequently, the product was adopted by other health units in the Italian region. There are multiple devices that are currently available, such as glucose monitor, heart-rate monitor or ECG, spiro + oximeter, that record results that are transmitted from the connected medical device to a gateway which automatically uploads the data to the eHealth Connecting Platform over any network. There is a portal to the platform that can be accessed by patients and medical staff to view data via their smartphones and PCs. The system can be configured to provide measurement timings and reminders, drug therapy and thresholds, alerts to take medication, or escalation notifications if any measurements are outside the pre-configured safe range.

The system reduces the inflow of the number of patients to hospitals for chronic conditions, increases health data quality, makes available health data on a real-time basis and reduces costs for the healthcare provider. This service will allow considerable improvement to be achieved in the quality of life of patients and savings of up to 80%to be achieved by the healthcare system on hospitalisation costs. In addition, doctors have more free time to consult with critical patients.

Intelligent Route Information System[8]

Singapore was one of the first cities in the world to make use of an electronic road pricing (ERP) system for managing road congestion. Recently, the country has installed a number of user-friendly public transport facilities, such as air-conditioned integrated transport hubs and the Intelligent Route Information System (IRIS), to facilitate the use of public transportation.

IRIS was launched by SBS Transit in 2007 as a free-travel information service for passengers. SBS Transit offers two IRIS applications so as to help improve the commuter's travel experience: the IRIS Journey Planner and the IRIS Next Bus.

IRIS Journey Planner helps passengers plan the best way to get to the destination by providing travel solutions on the SBS Transit bus, MRT or light rail transit, based on the shortest walking distance or travelling time. IRIS NextBus offers estimated next bus arrival time on a real-time basis. In so doing, passengers benefit from the convenience of knowing how many minutes away the bus is from the bus stop.

All SBS Transit buses are equipped with in-house developed automatic vehicle management system tracking devices. Their exact locations can be tracked on a real-time basis and, together with relevant route conditions or patterns, IRIS NextBus can provide the estimated next bus arrival time.

Both the IRIS Journey Planner and the IRIS NextBus are available on a number of mobile devices through short messaging service, GPRS and WAP sites. Smartphone users can also download the IRIS iPhone app and IRIS Android app for accessing these services.

According to SBS Transit, it has received favourable response for its IRIS applications against the background of widespread proliferation of smartphones. In 2012, the IRIS NextBus application received an average of three million queries for the next bus arrival time per day, over double the number from the previous year. Motivated by the popularity of its IRIS applications, SBS Transit is working with the government on a trial project to provide commuters with bus loading information in addition to next bus arrival time.

SmartSantander[11]

The city of Santander, Spain started an initiative called 'SmartSantander' in order to improve city operations and the overall quality of life for its citizens. SmartSantander is an EU project headed by Telefonica, with the technical support of the University of Cantabria and collaboration with the Santander city council, which has turned this municipality into the first comprehensive smart city in Europe.

The objective was to create a sustainable, efficient city, with smart management, in which citizens can interact dynamically with the local government and with the services themselves. This was achieved by rolling out over 20,000 devices in Santander (sensors, repeaters, gateways, informative screens, mobile handsets) enabling various applications in areas such as public transport and mobility, traffic, environment, pollution, waste management, noise control, climatology, security, water management and healthcare. A central computer compiles the data into one big picture that is constantly updated, enabling multiple services such as real-time view of traffic jams and available car parking, remote dimming street lamps on an empty street and optimisation of the amount of watering in city parks so that no water is wasted.

The city as well as the citizens both benefit from the real-time information that can lead to better management of resources and time. Also, with easy access to data, the city becomes more accountable.

Learn English[12]

The 'Learn English' service for the mobile was launched by Wataniya Mobile in Palestine, part of Ooredoo Group, in 2014, in partnership with mobile venture Souktel and the British Council, a leading English language training provider. The service is aimed at young people across the country.

The interactive mobile programme offers two options, a mobile quiz service and a 'word of the day' service. The mobile quiz sends English language questions to users by SMS, with a choice of answers, and then sends follow-up explanations to help young people learn more about the correct response. The word of the day service sends users a word or phrase in English, along with its meaning and an example of its use. The service looks to cater to the emerging demand for ways to learn English for people who are on the move, outside of schools and colleges.

Given the success of the programme, Ooredoo has extended this initiative to Myanmar.

Telematics-based insurance[10]

Pioneered by insurance providers such as Progressive almost a decade ago, more than half of the leading insurance providers in the UK and the US have a telematics insurance programme today. In the US, Progressive has implemented a usage-based insurance (UBI) product called Snapshot in over 40 states. Insurance providers such as Allstate, Hartford, GMAC, AAA, Travellers, Safeco and State Farm Insurance are actively conducting their own respective market trials and offerings. European insurance providers such as Allianz, AXA, Norwich Union and many innovative brokers have launched UBI programmes and installed more telematics units than in the US.

Ptolemus Consulting expects telematics-based insurance to cover 100 million vehicles by 2020, generating premiums of 60 billion USD globally. The number of insurance telematics users is projected to reach 89 million globally by 2017, growing from the approximately 2 million estimated in 2010.

AT&T Cargo View with FlightSafe®[13]

There is no doubt that supply chains are complex, and this complexity creates vulnerability. Cargo security becomes of paramount importance when any high-value cargo (ranging from artwork to equipment) is in transit. CargoNet estimated that cargo related theft loss value in the US in 2011 was approximately 130 million USD. Another study shows that 25 million bags are mishandled during transit, costing 2.5 billion USD annually. Given these risks, there is a need for a global, real-time tracking and monitoring service. The M2M application is solving this issue by minimising the risk associated with cargo in transit.

AT&T Cargo View with FlightSafe® employs a small, light-weight sensor-based device in order to track location, humidity, temperature, light, drop, and other sensor data in air, sea and land cargo. The device is placed in shipments to monitor the cargo and transmit status continuously on a real-time basis.

AT&T Cargo View with FlightSafe® is the first tracking device safe for aircraft travel and can be used regardless of transit mode. FlightSafe® makes it possible for a device to automatically transition to airplane mode and remain FAA compliant during air travel, resuming its communications upon landing. A multitude of control options and a comprehensive, real-time dashboard provide users with visualised data and graphics about the conditions surrounding the valuable goods throughout the shipment life cycle.

This technology can be employed by manufacturers and shippers of goods and commodities across the globe in order to deal with issues of pilferage, spoilage and delays.

Scania Fleet Management[18]

Smart-connected fleets can help fleet operators optimise utilisation and at the same time, save cost and cut emissions. Telenor Connexion and Scania Fleet Management are connecting vehicles with the head office and making trucking smarter. Scania Fleet Management offers a set of services by connecting and allowing for real-time access to data on fuel consumption, vehicle diagnostics and positioning, making it a vital tool in daily fleet operation.

Another key aspect for fleet operators is vehicle uptime. With the new Streamline, Scania is introducing several new services that boost uptime and facilitate interaction with the workshop. Since the truck is always connected, it can automatically report pending faults or key diagnostic data. With this information, service planning is facilitated, and both the workshop as well as Scania Assistance can prepare for servicing the vehicle, at the roadside or in the workshop, with minimum downtime for the customer.

Readily accessible vehicle information can be turned into actions that provide tangible results such as reduced fuel cost for the fleet owner and reduces CO2 emissions. With the available information on vehicle and driver behaviour combined with suitable driver coaching, fleet owners can cut fuel consumption by as much as 10%. This reduces costs and emissions.

Telemedicine in South Korea[17]

Despite its advanced ICT infrastructure set up, South Korea was the only country that legally allowed medical consultations only when the doctor was able to examine the patient in person. The key inhibition from the doctor's point of view was the quality of medical care delivery in technology-enabled solutions. However, this changed when concerned authorities took a balanced stand by passing a bill allowing doctors to utilise tele-health technology to diagnose and treat patients while restricting the nature of monitoring to non-critical conditions. For instance, the list of patients eligible for telemedicine services includes those diagnosed with hypertension, diabetes and mental disorders. Gradually, the category of patients will be expanded with the growing maturity of the service.

References

1. Machina Research. Retrieved from https://machinaresearch.com/forecasts/
2. GSMA. (2014). *Understanding the Internet of Things (IoT)* Retrieved from www.gsma.com/connectedliving/wp-content/.../cl_iot_wp_07_14.pdf
3. GSMA. (2014). *Measuring mobile penetration*. Retrieved from https://gsmaintelligence.com/research/2014/05/measuring-mobile-penetration/430/
4. PwC. (2013). *Socio-economic impact of mHealth: An assessment for the European Union*. Retrieved from http://www.pwc.in/en_IN/in/assets/pdfs/consulting/strategy/socio-economic-impact-of-mHealth-the-European-Union.pdf
5. PwC. (2013). *Connected Life: The next five years in Asia*. Retrieved from http://www.pwc.in/en_IN/in/assets/pdfs/publications/2013/connected-life-the-next-five-years-in-asia.pdf
6. PwC. (2013). *Connected Life: The impact of the Connected Life over the next five years*. Retrieved from http://www.pwc.in/en_IN/in/assets/pdfs/publications/2013/connected-life-210213.pdf
7. World Bank. (2009). *Economic Impacts of Broadband*. Retrieved from http://siteresources.worldbank.org/EXTIC4D/Resources/IC4D_Broadband_35_50.pdf
8. Legislative Council Secretariat. (2013). *Public transport facilities and traffic control measures in Singapore*. Retrieved from http://www.legco.gov.hk/yr13-14/english/sec/library/1314in08-e.pdf
9. Arthur D. Little. (2011).*Smart market-makers for the Internet of Things* Retrieved from http://www.adlittle.com/downloads/tx_adlprism/ADL_Smart_market-makers.pdf
10. Cognizant. (2012). *The New Auto Insurance Ecosystem: Telematics, Mobility and the Connected Car*. Retrieved from http://www.cognizant.com/InsightsWhitepapers/The-New-Auto-Insurance-Ecosystem-Telematics-Mobility-and-the-Connected-Car.pdf
11. Telefonica. (2013). *Telefonica's role in 'SmartSantander'*. Retrieved from http://blog.digital.telefonica.com/2013/07/15/m2m-case-study-telefonica-smartsantander/
12. Souktel. (2014). *British Council, Souktel, and Wataniya Mobile to Launch New "Learn English" Services*. Retrieved from http://www.souktel.org/media/news/british-council-souktel-and-wataniya-mobile-launch-new-learn-english-services
13. AT&T. (2014). *How to Minimise Your Risk with Cargo Tracking*. Retrieved from http://networkingexchangeblog.att.com/global/minimize-risk-cargo-tracking/#fbid=3uJNc_4CmJH
14. GSMA. (2012). *Ultrasound Imaging at the Point of Care*. Retrieved from http://www.gsma.com/connectedliving/wp-content/uploads/2012/03/mobisantefinal.pdf
15. Vodafone. (2010). *AMS chooses Vodafone's network for smart metering*. Retrieved from https://www.vodacombusiness.co.za/cs/groups/public/documents/document/pocm01-542124.pdf
16. Telecom Italia. (2011). MyDoctor@Home. Retrieved from http://www.telecomitalia.com/content/dam/telecomitalia/documents/Sostenibilita/en/stakeholders/customers/MyDoctorENG.pdf
17. Lacktman. M. N. (2014, April 2). Telehealth Opportunities Arise as South Korea Opens Door to Telemedicine. *Healthcare Law Today*. Retrieved from http://www.healthcarelawtoday.com/2014/04/02/telehealth-opportunities-arise-as-south-korea-opens-door-to-telemedicine/
18. Telenor. *Rolling Along Smoothly*. Retrieved from http://www.telenorconnexion.com/stories/scania

About PwC

PwC helps organisations and individuals create the value they're looking for. We're a network of firms in 157 countries with more than 195,000 people who are committed to delivering quality in Assurance, Tax and Advisory services. Tell us what matters to you and find out more by visiting us at www.pwc.com.

In India, PwC has offices in these cities: Ahmedabad, Bangalore, Chennai, Delhi NCR, Hyderabad, Kolkata, Mumbai and Pune. For more information about PwC India's service offerings, visit www.pwc.in

PwC refers to the PwC network and / or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details.

You can connect with us on:

facebook.com/PwCIndia

twitter.com/PwC_IN

linkedin.com/company/pwc-india

youtube.com/pwc

Contacts

Contact Us

Mohammad Chowdhury
Advisor, Telecom, Media and Technology Sector
PwC India
Email: mohammad.chowdhury@in.pwc.com
Phone: +61 405620733

Neeraj Katariya
Managing Consultant
PwC | Strategy | Telecom
Email: neeraj.katariya@in.pwc.com
Phone: +91 9910024512

Diwakar Gupta
Principal Consultant
PwC | Strategy
Email: diwakar.gupta@in.pwc.com
Phone: +91 9810902746

Ashish Sharma
Director, Telecom, Media and Technology Sector
Strategy &
Email: sharma.ashish@strategyand.pwc.com
Phone: +91-9899978128

Rachit Raj
Senior Consultant
PwC | Strategy
Email: rachit.raj@in.pwc.com
Phone: +91 - 9686647474

pwc.in

Data Classification: XYZ123

DJ 340 - March 2015 Realising the benefits of mobile IoTsolutions.indd
Designed by Corporate Communications, India