vmware

WHITE PAPER–JUNE 2020

A strategic C-suite playbook for navigating the 5G world

Written by

The Economist INTELLIGENCE UNIT

Contents

About the research

Today telecom operators are fortifying their 5G efforts by buying spectrum, filing patents and creating test labs to explore use cases. They are forging development partnerships with the likes of tower companies, infrastructure and cloud providers, municipal authorities, broadcasters, manufacturers and software start-ups.

Now their challenge is to move from experimenting with 5G technologies to developing viable business models. But what will the new revenue streams encompass and how will experimentation be balanced with commercial strategy? What new mindsets, cultures and attitudes will 5G engender as partnerships across diverse sectors and backgrounds are formed? And, crucially, what security implications will arise?

This briefing paper, written by The Economist Intelligence Unit and sponsored by VMware, presents a playbook for the telecom C-suite on how to harness the business opportunities that 5G will unleash and develop actionable strategies to gain a competitive edge. It draws on comprehensive desk research and expert interviews with the following telecom industry leaders and academics:

- **Alex Choi:** senior vice-president of research and technology innovation at Deutsche Telekom
- **Laxmi Akkaraju:** chief strategy officer at GSMA
- **Jennifer Gill Didoni:** head of Cloud Portfolio Management at Vodafone Business
- **Mischa Dohler:** chair professor of wireless communications at King's College London

Emily Wasik is the editor of the report. The author is Adam Green.

Foreword from VMware

SHEKAR AYYAR

EXECUTIVE VICE PRESIDENT
AND GENERAL MANAGER

TELCO AND EDGE CLOUD

While the full-scale deployment of 5G infrastructure will undeniably require significant investment from telecom companies, approximately US$1trn,[1] 5G's beneficial impact on businesses, economies and societies at large will significantly outweigh this up-front cost. In fact, the number of devices connected to the Internet of Things (IoT) alone is forecast to generate an approximate US$1.1trn in revenue by 2025.[2]

Despite the various challenges telecom providers will face along their journey to 5G implementation, not only will the end destination pay off but it will fundamentally revolutionise how people live, work and connect with one another in the coming decade.

While telecom companies have been developing and piloting 5G technology for some time, the critical task now is to build the necessary infrastructure to underpin this technology and to establish commercial strategies to support the new revenue models that 5G will unleash. Across the 1G to 4G wireless connectivity evolution, telecom firms have primarily focused on serving the needs of consumers by providing optimal data storage and voice capabilities. However 5G is slated to bring about entirely new business models and network connectivity services for enterprises and governments to add to consumer focused business models.

The demand for 5G applications for enterprises has skyrocketed given the covid-19 pandemic. Many companies have had to adapt to the new business normal and virtualise their end-to-end operations and workforce. Edge computing Edge clouds will become increasingly popular for the creation and deployment of new applications for low latency, distributed computing. In order for telecom carriers to deliver the high-speed, seamless connectivity that this new digital business landscape requires, they must shift from a siloed, "single hardware platform for single function" mindset to a more collaborative, agile, software driven approach. Pivotal to this will be partnering with other innovative players in the space—from startups to developers—to leverage application programming interface-based architectures for creating and launching cutting edge connectivity solutions at a faster rate than ever before.

Telecom companies will benefit from taking a page out of the IT sector's playbook in terms of how they approach cloud transformation—by deploying new horizontal network infrastructures that integrate industry standard hardware with software-defined application models.

In addition to economic and agility benefits, these models can also enable new policy-driven security systems to help prevent malicious influences. Carriers must ensure that security is built in as an integral part of their infrastructure rather than an additional afterthought.

In the near-term, telecom providers must decide whether they want to be industry leaders or industry followers when it comes to 5G implementation. While later adopters may well shield themselves from the forward investment that is needed to achieve 5G technology maturity, the companies that lead the transition will reap higher returns in the long term. By positioning themselves ahead of the curve, they will not only gain industry recognition but are likely to become market-makers and marketplace owners of a portfolio of monetizable applications and services.

With all the changes that companies have already had to adapt to in 2020, it is clear that the communications network infrastructure supporting telecom carriers globally is fast becoming a mission-critical architecture—not just for consumer services, but also for mission-critical business services. Utilising this infrastructure, telecom carriers must collaborate with other industry players in order to launch the most optimal 5G solutions for every customer segment. After all, their success with 5G implementation will hinge very much on how they tap their collective ingenuity to turn cutting edge ideas into real business opportunities. Fast.

1 Greensill, "Financing the Future of 5G," 2019. https://www.greensill.com/whitepapers/financing-the-future-of-5g/

2 GSMA, "Operators Must Look Beyond Connectivity to Increase Share of $1.1 Trillion IoT Revenue Opportunity," 2018. https://bit.ly/gsma-study

Introduction

A 2019 global survey of 46 chief technology officers at telecom companies found that most respondents had approved 5G piloting and technology strategies, but only 17% had a completed and approved commercial plan in place.

From tech pilots to business use cases

Telecom companies are much further along the maturity curve when it comes to developing 5G technologies than forming actual business strategies. A 2019 global survey of 46 chief technology officers at telecom companies found that most respondents had approved 5G piloting and technology strategies, but only 17% had a completed and approved commercial plan in place.[1]

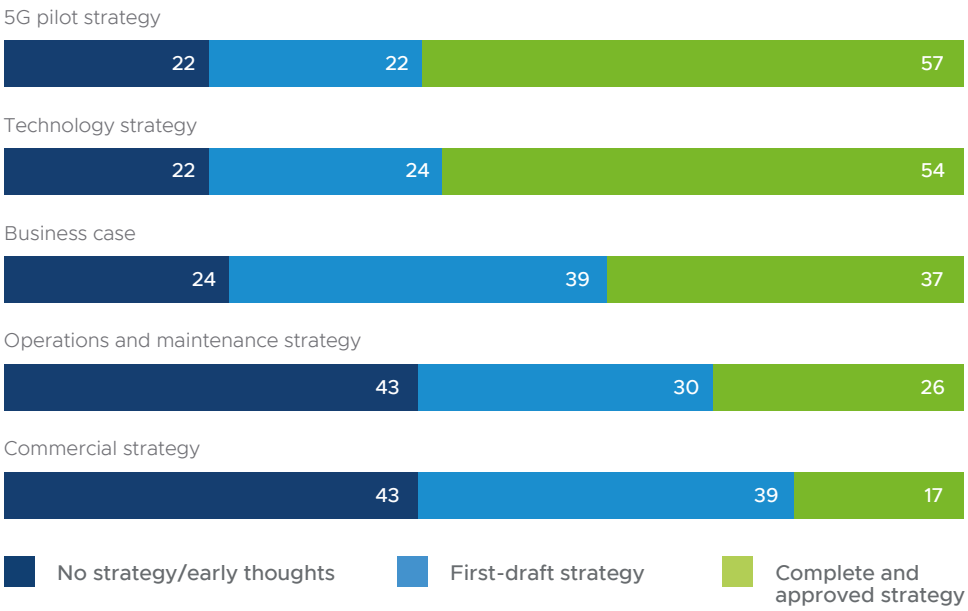

FIGURE 1: The current status of 5G development* (%)

Source: McKinsey, 2019[1]
**100% = 46 operators. Figures may not sum up to 100% because of rounding.*

The path to ubiquitous 5G implementation will require significant upfront investment to upgrade 4G networks—especially for small cells, the portable miniature base stations that provide network connections and the necessary large-scale fiberisation. Most of the 46 operators surveyed by McKinsey (72%) believe the shift to 5G will be expensive.[2]

Despite the industry's already-constrained budgets, the pressure to invest upfront means companies need to move quickly from creating tests and pilots to actually developing business models and strategies.

1 McKinsey, "A 5G manifesto for the CEO", February 2019. Available at: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/a-5g-manifesto-for-the-ceo

2 Ferry Grijpink, Alexandre Ménard, Halldor Sigurdsson, and Nemanja Vucevic, "The road to 5G: The inevitable growth of infrastructure cost", McKinsey February 2018. Available at: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/the-road-to-5g-the-inevitable-growth-of-infrastructure-cost

Chapter 1

Unlocking 5G's revenue potential

The telecoms industry has suffered several years of squeezed margins and stagnant revenues (see Figure 2). According to business consulting firm BearingPoint, mobile operators could have to wait between five and seven years before seeing 5G revenue streams.[3]

While 5G handsets are already slated to launch within the next year, consumer revenue from these will not be enough to support business growth as companies must keep the costs of these handsets affordable enough to incentivise buyers to upgrade. Developing entirely new markets and business models are now mission-critical.

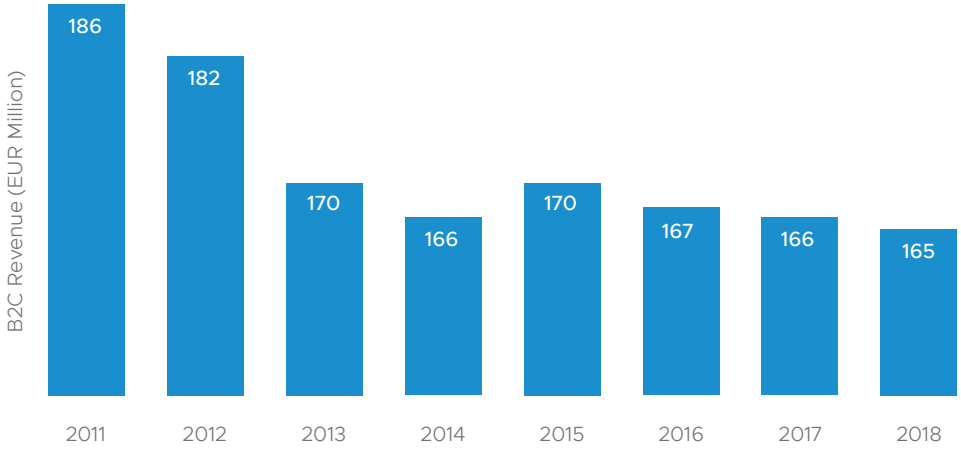

FIGURE 2: Telecom companies have faced stagnating revenues
Revenue growth in consumer services (ETNO perimeter), 2011-2018 (forecast)

Source: European Telecommunications Network Operators Association, 2019[4]

Fortunately, viable revenue and cost reduction models are attainable. "You cannot get around the investment that is needed to enable transition," says Professor Mischa Dohler, chair professor of wireless communications at King's College London. But he sees top- and bottom-line opportunities to recoup and profit, citing Japanese telco NTT Docomo and Finnish operator Elisa as two telecoms companies that have already reaped benefits from upfront investments in terms of cost-savings and new business opportunities.

"In countries like China, the US and South Korea we are seeing companies move from use cases to launching them live," says Laxmi Akkaraju, chief strategy officer at GSMA, the global mobile industry body. "Last year, they weren't looking at revenue models yet. They were just trying to get use cases to work. Now, we're seeing operators build proper business models."

Legacy telecom companies should now be positioning themselves as leading innovators of the 5G applications of tomorrow.

In fact, one key revenue opportunity lies in the enterprise and business-to-business (B2B) sector[5] as 5G will inevitably catalyse the emergence of new markets—from smart cities to connected vehicles. In the past, the role of telecom companies has been limited to mere infrastructure provision with start-ups creating disruptive business models "on top", like Skype and WhatsApp.[6] However, legacy telecom companies should now be positioning themselves as leading innovators of the 5G applications of tomorrow.

3 Markus Aqua, "Bridging the gap to 5G revenue streams", BearingPoint. Available at: https://www.bearingpoint.com/en/our-success/insights/5g-revenue-streams/

4 European Telecommunications Network Operators Association, "State of Digital 2019", 5 May 2019. Available at: https://etno.eu/library/reports/22-annual-economic-reports.html

5 https://www.ericsson.com/en/blog/2019/10/monetize-5g-and-iot-business-models

6 https://www.bdo.global/en-gb/blogs/tech-media-watch-blog/september-2019/how-safe-is-telecommunications-companies%E2%80%99-trillion-dollar-5g-investment

"For us, it is really about identifying key use cases for our customers and making sure that they are aware of the change that's coming along with the new possibilities that they could bring to life with 5G capabilities."

JENNIFER DIDONI
HEAD OF CLOUD PORTFOLIO MANAGEMENT
VODAFONE BUSINESS

This will require looking closely at current and existing customer bases and educating them about what 5G means for their business. They should also identify ways to help companies realise the new revenue and cost control possibilities based on specific 5G advantages, whether it be near real-time data transmission (low latency), high throughput, device density or network flexibility.

"For us, it is really about identifying key use cases for our customers and making sure that they are aware of the change that's coming along with the new possibilities that they could bring to life with 5G capabilities," says Jennifer Didoni, head of Cloud Portfolio Management at Vodafone Business. That outreach effort has led them into some surprising areas. "An insurer might have no interest in low latency in the abstract, but if it's tailored to their reality they can better see the benefit, such as telematics technology at the 'edge' that can intercept to avert car incidents," says Ms Didoni.

Engaging the market might also require commercial reorganisation so that teams can go after the most promising revenue opportunities. This stands in contrast to previous eras when the telecom companies saw themselves as responsible for simply building the infrastructure. "3G brought the introduction of the internet to mobile and 4G brought the ability to consume video," says Ms Didoni. "The incremental uplift from 5G is targeted at specific verticals and use cases."

This could also require shifting sales teams towards more "verticalised" approaches. "5G is a step-change in specific applications. That alters the way we drive awareness among our customers, but also how we ourselves go to market with sales teams and organise around specific industry verticals," says Ms Didoni.

The quest for revenue should not just hinge on specific use cases, though. Just as 3G and 4G created new business models—from streaming and on-demand services to the app economy—5G will lead to entirely new market structures, says Alex Choi, senior vice-president of research and technology innovation at Deutsche Telekom. Of all 5G's advantages, he believes the low latency benefits in themselves could spur new business models.

"Currently we have two marketplaces," he explains. "One is the device and software platform operating system on top, like [Google] Android and [Apple] IoS. The other is the public cloud, led by the likes of Amazon Web Services, Microsoft and Google. Are these two marketplaces enough? Is there a possibility to create a new one for 5G?" Mr Choi says there is a "high chance" that a third market will be established for mission-critical real-time applications and smart markets that leverage low latency along with domains in which everything is "intelligent and real-time".

REVENUE: Actionable strategies:

- **Spend in the short term to generate return on investment (ROI) in the long term.** 5G is costly at a time when the industry is struggling with tight margins and competitive market conditions, but there is no way around the investment. Companies can make up for the outlay by reaping both top and bottom-line benefits.
- **Carefully target industry verticals based on specific 5G benefits.** Consumers will not constitute enough of a new revenue stream to make 5G a profitable chapter: finding new models in the enterprise and public sectors is needed. Develop a methodology to calculate how each of 5G's benefits—low latency, network flexibility and device density—could address challenges or opportunities within verticals. This might require changing corporate structures, such as organising sales teams around specific verticals like smart cities or manufacturing.
- **Avoid fixating on specific use cases. Discover or create new marketplaces.** Identifying viable revenue models will require telecom companies to look beyond their usual field of vision as mere infrastructure providers and to become instead co-developers of tomorrow's disruptive innovations. What will be the "streaming" or "App store" of the 5G era, and might telecom companies be the ones to build it?

Chapter 2

Moving towards a 5G-ready culture

As 5G will considerably impact specific verticals like manufacturing, mobility, cities and healthcare, telecom companies need to shift their mindsets and company cultures at-large.

Firstly, they will have to work with partners with whom they have had limited previous engagement and whose culture might be quite different. Start-ups, for instance, are set to play a larger role in 5G because software—the entry barriers to which are lower than hardware—will play a much bigger role in delivering tools and services.

"The telco ecosystem [now] resembles the computing industry where it is layered up," says Mr Dohler. "In computing, you have the laptop, hardware, the operating system and applications running on top. These layers are decoupled and everyone is innovating on there. It is the same with 5G. A start-up could come up with a new feature and roll it out as a service in the ecosystem."

Yet telecom companies are struggling to transform their company culture enough to capture value from start-ups due to risk aversion, slow decision-making, rigid processes and tight governance mechanisms.[7] However, it is imperative that they refresh their culture, embrace re-invention and experimentation and loosen their procurement and tendering protocols. The culture of start-ups, from product development cycles to agile methodologies, is a far stretch from that which has typified telecom companies.

One helpful approach is creating "5G labs" which operate like innovation workshops by adopting the start-up spirit of tinkering, hacking and co-creation. For example, Vodafone built a 5G lab in Manchester, UK, to help start-ups build and design applications for 5G, says Ms Didoni. "It gives start-ups and tech companies access to 5G, Internet of Things (IoT), high-speed fibre and technical support so that they can start playing around with how the technology could benefit them."

Other market leaders have formed their own venture units. Deutsche Telekom created a spin-off called MobiledgeX, headquartered in San Francisco, where mobile operators make edge infrastructure accessible to third parties.[8]

"We are implementing an approach of joint creation and piloting services with customers so that we are both building as we go, rather than selling them a fully productised, scalable version [like before]."

JENNIFER DIDONI
HEAD OF CLOUD PORTFOLIO MANAGEMENT
VODAFONE BUSINESS

Collaboration also means that telecom companies must reposition their view of themselves. "We are implementing an approach of joint creation and piloting services with customers so that we are both building as we go, rather than selling them a fully productised, scalable version [like before]," says Ms Didoni.

"Operators are moving from a mono-product to a multi-product model," says Mr Akkaraju at GSMA. "In the past they were focused on connectivity. Now, they are having to look at the services on top of that connectivity, which means moving from a consumer-based model to getting closer to enterprises. This requires a change in the DNA of their normal operations."

Mr Choi sees 5G as inciting a full-scale transformation that includes culture and processes. "We are looking at the supplier landscape and trying to shape it in such a way that we lower the entrance barriers for innovators," he says. "We have to go through this re-invention across many aspects—skills, organisational shifts, procurement and the way we treat third parties. The whole business process has to be completely turned on its head."

7 https://www.adlittle.com/sites/default/files/viewpoints/adl_telecoms_operators_and_startups_rethink_and_reinvent-min.pdf

8 MobiledgeX, "Deutsche Telekom Completes World's First Public Mobile Edge Network, Powered By MobiledgeX Edge-Cloud R1.0", February 19th 2019. Available at: https://mobiledgex.com/press-releases/2019/02/19/deutsche-telekom-completes-worlds-first-public-mobile-edge-network-powered-by-mobiledgex-edge-cloud-r1-0

CULTURE: Actionable strategies:

- **Refresh your company culture and instil a more entrepreneurial spirit.** Software will constitute a thicker slice of the 5G market than hardware and basic infrastructure. To provide the rich services and user engagements to come, companies need to shift from "telco" to "tech-co" approaches, such as through internal innovation units and external partnerships with start-ups and software firms like test labs. This means adopting cultural attributes of the software world including quicker decision-making, more research and development (R&D) agility, more experimentation and more flexible protocols in areas like procurement and tendering.
- **Shift to a "co-creation" mindset.** In the past, telecom companies focused on selling fully-developed products to market. For 5G, the breadth and range of use cases and models will only emerge through tinkering and experimentation. This requires companies to engage in more co-creation with partners.

Chapter 3

"Enterprises want to apply and use cellular network-based automation or shop floor automation using edge computing, so this is a clear area of demand."

ALEX CHOI
SENIOR VICE-PRESIDENT OF RESEARCH AND TECHNOLOGY INNOVATION
DEUTSCHE TELEKOM

The agility effect

5G offers the potential to configure networks that deliver specific benefits at specific times for specific users, providing new levels of agility for users. Network slicing, for instance, allows operators to provide dedicated virtual networks tailored to the service or customer, with multiple networks created over a common infrastructure. This allows different advantages of 5G to be leveraged. For instance, full 5G power can be brought to a stadium just for the filming of a live sports event. In other contexts, not everything in the 5G toolbox may be needed. For instance, autonomous vehicles require low latency, but not necessarily high throughput.

The 5G era will also foster agility by enabling the rise of edge computing, which brings computation and data storage to the device itself, rather than being routed to another location and back again. By 2023, when 5G will make up around one-fifth of all mobile data traffic, 25% of use-cases will depend on edge capabilities.[9] Edge computing will radically improve companies' agility as data will no longer need to be sent to data centres or the cloud. Manufacturers, for instance, will have full computing power at their plant, with data acted upon immediately, like the rapid detection of an equipment failure or a real-time shutdown.

Edge networks mean enterprises can quickly shut down and isolate portions of the network that come under attack. This kind of nimbleness reduces downtime, improves asset performance and lowers maintenance costs. In turn, this frees up resources to drive innovation and revenue-generation that could allow telecom partners to be part of new business models.[10] "Enterprises want to apply and use cellular network-based automation or shop floor automation using edge computing, so this is a clear area of demand," says Mr Choi.

Agility also benefits the supplier ecosystem as a growing community of innovators can compete to offer a richer array of products and services. To make this possible, common foundations must be synthesised in areas like interoperability and openness, both of which telecom companies are well-positioned to spearhead. Some industry participants are advocating a conversion of the radio access network (RAN)—the system which connects devices to the internet through elements like antennae—from a "closed" vendor environment to a standardised structure with less proprietary hardware. This would allow multiple vendors to enter the fray and foster a more competitive vendor landscape by enabling greater network customisation and driving the integration of machine learning and advanced analytics as part of the evolution of a more dense, dynamic system.

"It will be impossible to bring service agility and cloud-scale economics to the RAN without openness," says Mr Choi. "Open interfaces are essential to enable smaller vendors and operators to introduce their own services or customise the network to suit their unique needs. Open interfaces also enable multi-vendor deployments, facilitating a more competitive and vibrant supplier ecosystem." Today, many 5G interfaces are proprietary, Mr Choi explains. "Our idea is to remove this roadblock so smaller companies can come with their building blocks without worrying about interoperability."

The initiative, called the ORAN Alliance,[11] brings together global mobile operators and technology companies to create an open, interoperable and autonomous RAN. "We formed this alliance as a joint approach among the whole telecom community, providing one overarching message: we are opening our doors," says Mr Choi. "It is a strong commitment that goes beyond open innovation. We are investing and building out interoperability so companies can bring their own components, and we can do the integration."

9 Ericsson, "Edge computing is key". Available at: https://tinyurl.com/uqhwz4v

10 https://www.ge.com/digital/blog/what-edge-computing

11 O-Ran Alliance, "Leading the industry towards open, interoperable interfaces and RAN virtualization". Available at: https://www.o-ran.org/.

AGILITY: Actionable strategies:

» **Leverage edge computing to cut costs and enhance operational efficiencies.** Help customers invest in revenue-generating business and position telecom companies as a support system to help them grow their business.

» **Share learnings and collaborate.** Open interfaces will enable multi-vendor deployments, ushering in a more competitive and vibrant supplier ecosystem that lets participants introduce their own services or customise the network to suit their unique needs.

Chapter 4

Security in the era of 5G complexity

When connecting millions of people, objects and systems while data capacity is increasing thousand-fold, it is no wonder that 5G and the IoT unleash countless access points for cyber-criminals to infiltrate.[12] Risk catalysts can be everything from a more distributed architecture to smart computing at the edge, the need for more antennae and increased dependency on software. Governments have expressed concern about inadequate security practices among network operators and the potential risks of a high dependency on just a small number of 5G vendors. Therefore, cybersecurity is a business imperative for 5G vendors.

That being said, 5G security is a matter for the regulators responsible for enforcing legislation that mandates industry requirements. The role of telecom companies is to collaborate with national cyber security agencies and respective regulators, increase hiring of internal cyber security experts and to conduct deeper due diligence when developing partnerships and collaborations to ensure all partners meet legislative standards.

Governments can also help by advocating for harmonisation. Europe, for instance, remains a fragmented market with different national standards and procedures,[13] although a recently-adopted toolbox is attempting to strengthen security practices in areas like supplier risk assessment, supplier involvement with critical assets and supplier diversification.[14] Telecom companies are also working with global tech giants to make this possible.

SECURITY: Actionable strategies:

- **Increase hiring and upskilling in cyber security.** Telecom companies need to keep abreast of new hacking practices and trends, especially from rogue and nation states that are more likely to target telecom infrastructure. Hiring more cyber security professionals and collaborating closely with national cyber agencies can help future-proof telecoms against cyber threats.
- **Virtualise network functions.** Operate these functions as software workloads and enable the application of tight security policies.
- **Carefully review the supplier landscape to ensure alignment with security standards and regulations.** Telecom supply chains have become extended and more complex, covering hardware, software and middleware, often from multiple locations. Joined-up oversight will be critical to minimise risk.
- **Consider creating internal "red teams" who can test for cyber weaknesses within 5G systems.** As software plays an instrumental role in 5G systems, telecom companies may wish to adopt practices from the software sector, including its use of internal "hack" teams who proactively stress test vulnerabilities.

12 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/819469/CCS001_CCS0719559014-001_Telecoms_Security_and_Resilience_Accessible.pdf

13 https://www.ft.com/content/9d95f576-20bd-11ea-92da-f0c92e957a96

14 https://ec.europa.eu/commission/presscorner/detail/en/ip_20_123

Chapter 5

5G and government: A regulatory roadmap

While the necessary action points may seem overwhelming, telecom companies are not in this alone. Most obviously, governments can help through the efficient and swift auction of relevant spectrum. Notable recent developments include the US Federal Communications Commission's efforts to free up 280 megahertz of mid-band spectrum for 5G services.[15] Auctions processes can also be made more innovative and agile. "Could we put in regulatory best practices allowing us to auction public street furniture like we auction spectrum, rather than an operator going rooftop by rooftop, lamp post by lamp post?" asks Mr Dohler.

Other opportunities include fiscal incentives. Around £1bn of public funds has been earmarked in the UK for fixed fibre and 5G digital infrastructure.[16] South Korea reduced its tax framework and created public innovation funds, and Germany issued a 5G plan laying out coverage targets along all major roads by 2025.[17] Updated security guidelines can also help ensure co-ordination and safe market development.

"To achieve the full potential of 5G, we need active participation from governments and regulators in areas like spectrum auctions, planning and public infrastructure, network rollout conditions and market-driven pricing," says Ms Akkaraju.

15 US Federal Communications Commission, "FCC Acts to Free up C-Band Spectrum for 5G Services", February 2020. Available at: https://docs.fcc.gov/public/attachments/DOC-362743A1.pdf

16 UK Department for Culture, Media & Sport, "Next Generation Mobile Technologies: A 5G Strategy for the UK", March 2017. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/597421/07.03.17_5G_strategy_-_for_publication.pdf

17 GSMA and GTI, "Supportive policies for a sustainable mobile industry in the 5G era", March 2020. Available at: https://www.gsma.com/greater-china/wp-content/uploads/2020/03/SupportivePoliciesforaSustainableMobileIndustryinthe5GEra.pdf

Conclusion

Telecom operators have spent an increasing amount of time and effort developing their 5G technical capabilities, but the focus is now shifting towards identifying viable revenue models. This requires the C-suite to adopt a range of new approaches, tactics and attitudes that are remarkably different from previous generations of connectivity.

New revenue models will be essential to propel 5G as a business-booster for telecom companies. A greater focus on the enterprise and business-to-business sector, along with governments and municipal authorities, is now warranted given the significant uplift 5G can provide these domains.

Next-generation connectivity could also lead to the formation of new types of marketplaces just as 4G did with the "app economy" and the emergence of platform-based business models. As a result, telecom companies must educate their customers about the specific advantages that 5G could herald when it comes to producing new revenue possibilities and helping them build those engines of growth. Furthermore, they must reorganise their sales structures to enable revenue-building in specific verticals rather than perceiving themselves as mere infrastructure providers.

Ensuring the success of 5G business strategies will not just hinge on technology and use cases, but also a shift in company culture. Telecom companies are often large, slow-moving and hierarchical businesses, but 5G innovation will instead be driven by a diverse mix of cultures and practices from the technology and start-up world including experimentation, speed, co-creation and agile development. Therefore, telecom companies should adopt a more entrepreneurial outlook by forming spin-out units, acquiring or collaborating with start-ups, creating test labs and opening up access to their procurement and tendering protocols. They will also need to be much more open to collaboration with partners in order to develop use cases and pursue structural innovations like the creation of open standards.

Over the past two decades, the telecoms industry was often left behind as start-ups and other technology companies developed the infrastructure on which the modern economy now depends. Today, 5G presents telecom companies with their own opportunity to be the envelope-pushing pioneers at the forefront of this new chapter.

Today, 5G presents telecom companies with their own opportunity to be the envelope-pushing pioneers at the forefront of this new chapter.

VMware, Inc. 3401 Hillview Avenue Palo Alto CA 94304 USA Tel 877-486-9273 Fax 650-427-5001 vmware.com Item No: EIU126 - VMWare - Report DV4 8/19