Beyond The Network

Policy Measures To Position 5G As A Launchpad For The Digital Economy
5G is the fifth generation of wireless communications technologies. With mobile data speeds up to a breathtaking 100 gigabits per second, 5G is not just a newer version of 4G: It is built on an entirely new proposition – faster response enabling extended reality applications, greater capacity empowering the explosion of digital use cases, and reduced latency allowing for real time interactions delivered seamlessly across terrestrial (fixed, mobile, ad-hoc) and non-terrestrial (HAPS and Satellite) networks.

Those advancements build the foundation of a variety of digital applications, such as connected farms, dynamic fleet management, smart classrooms, remote surgeries, autonomous vehicles, and more. One example is how 5G technology has the potential to transform industrial factories by enabling new levels of automation, connectivity, and efficiency with machine to machine (M2M) communication, predictive maintenance, remote monitoring and control, and collaborative robots. This creates a new paradigm: better productivity and new business models that unlock vast socio-economic benefits and drive new growth engines. Current deployments of 5G are still at a relatively nascent stage, mostly focused on mobile broadband (eMBB) and fixed wireless access (FWA), essentially providing more bandwidth and faster response times.
FIVE WAVES TO 5G USE CASES

5G applications are currently centered around clusters of use cases that will grow and evolve as the network deployment and technology readiness increases in maturity.

The next wave of 5G, however, will bring a host of virtual reality experiences, from multi-duality to true high definition and real time streaming of media services. This wave will monitor and manipulate everything from business processes and hospital systems to factory inventories and autonomous vehicles.

While early indications show promising momentum, additional investments in network capabilities are needed to meet the needs of throughput, ubiquity, reliability, and latency required to unlock the full potential of 5G. As well, the technology business case still faces several constraints regarding funding the 5G roll-out and monetizing the new network and spectrum investments. As the industry continues to look for opportunities to create new value streams and to optimize infrastructure, policy-makers and regulators must also play a critical role in unlocking 5G’s potential.

In this paper, we shed light on select regulatory frameworks and policy measures that would be critical to transition to 5G and position this critical technology as a launchpad for the digital economy.
WE EXPECT TO WITNESS THE PERFECT MARRIAGE OF 5G AND INDUSTRY ACROSS FIVE WAVES:

1. Monitoring And Analysis: This wave is around use cases monitoring and managing agriculture crops, CCTV, hospital or homebound patients, and payments via facial recognition. In agriculture for instance, millions of nodes can be scattered across fields to scrutinize water levels, moisture, heat levels, and to adjust parameters as needed in real time. With 5G, the volumes can increase astronomically, with crop monitoring going beyond looking after a few hundred or a few thousand crops to monitoring hundreds of thousands of crops. The idea of applying 5G in agriculture can also be found in autonomous tractors, spraying drones, robotics, and fully autonomous farms.

2. Optimization: Businesses will turn to 5G to manage their smart inventories and auto fleets, determine optimal truck routes, reorganize distribution, and increase capacity. In logistics, 5G will be instrumental in fleet management. Vehicles can be tracked in real time and controls will be also guided via vehicle-to-vehicle communications. Unresponsive smart cells could also alert fleet managers of vehicle accidents in real time. With the Internet of Things (IoT) forecasted to open up a USD 1.9 trillion opportunity in logistics, 5G is one of the key enablers to facilitate data-driven analytics and decision making with big data and artificial intelligence.

3. Apparatus Control: 5G technologies are virtual super controllers – manipulating factory production lines, unmanned vehicles, drones, and robots shuffling products around in warehouses. They go well beyond the ‘factories of the future’ built on industry 4.0 applications to control all aspects of production in real time. A 5G powered factory is able to switch gears within minutes to respond to customers and unexpected events. Imagine a shipment that arrives, is offloaded, but turns out to be larger than expected. Through 5G, robots are instantaneously rerouted to pick up the shipment and deliver it to an appropriate area. The use of state-of-the-art 5G network technology allows Mercedes-Benz, for example, to optimize existing production processes in its plant with the help of new features. These include data linking or product tracking on the assembly line. With a separate own network, all processes can be optimized and made more robust and, if necessary, adapted at short notice to prevailing market requirements.

KEY DATA POINT

In healthcare, given the huge increase in bandwidth and reduced latency (~1ms), 5G has the potential to enable remote patient monitoring at scale as well as remote surgery through its ability to support a high number of connected devices per square kilometer and its promise of real time communications coupled with greater reliability and security.
There is also the convergence of network and intelligence (5G and AI). In combination, they can support industry and manufacturing; at one level, this convergence will be able to support equipment maintenance by remotely monitoring machinery and anticipating breakage, wear, or other maintenance requirements. Innovative implementation may even allow for the remote operation of machinery.

4. Real Time Remote Control: Remote management of fields, industrial facilities, shipping ports, and operations are all part of 5G. In medicine, 5G allows remote monitoring of patients’ vitals through smart wearables, and for remote doctors to offer potential medical interventions when needed. In transportation, 5G is the brain power behind vehicle-to-vehicle (V2V) communications in which vehicles are connected to each other and make decisions across multiple delivery platforms, deciding, for example, to swerve to avoid that semi-trailer barreling down the highway.

5. Real Time Extended Reality: Digital media is what 5G does best, providing a high-res 3D extended reality (XR) view for remote learning classrooms and mobile maintenance staff. Technical staff can learn to operate certain machines via immersive hologram learning experiences conducted remotely. A mobile maintenance field force is in the middle of a remote oil field to repair a complex widget. Rather than waiting hours for an expert widget-fixer to arrive, the team slips on their goggles to learn how the critical repair needs to be done. XR is expected to improve productivity and convenience for consumers, enterprises, and public institutions in a wide variety of application areas such as entertainment, training, education, remote support, remote control, communications, and virtual meetings. It can be used in virtually all industry segments, including health care, real estate, shopping, transportation, and manufacturing.

The first 5G wave is well underway across industries, with operators loading their networks with the capacity and capabilities to allow them to deliver on the promise of 5G. Yet capacity and network services are only a small portion—potentially around 10% to 15%—of the overall value delivered. The real value is in other relevant deployed applications and services.

In other words, the prize is a fully-connected factory along with all of the associated vertical applications. Capturing this prize requires thinking of 5G beyond the network boundaries, to capture the broader benefits of use cases in the ecosystem.

A good example is provided by Docomo in Japan, which initially launched 5G services in 2020. Their project consisted of four parts: An open lab for indoor testing with four facilities launched in cities as indoor testing environments to provide early access to a ‘real’ 5G environment; a network of outdoor testing sites that allows partners to participate in research and trials; an open cloud for platform training allowing partners to test and demonstrate 5G applications and link 5G verification capabilities to cloud services (including AI suites); and a partner exchange network connecting Docomo partners to facilitate 5G developments, enables meetings, collaborations, and publications. It is important to note that this is not a template, as each country and region has different conditions and participants.

---

1 Source: Small cells, also called nodes, are miniature base stations that bounce signals from one node to the next.
3 Source: DHL.com: 5G AND WHAT IT MEANS FOR LogISTICS
4 Source: The world’s first 5G network for automobile production.
5 Source: AT and 4G use cases - How 5G Lifts Artificial Intelligence
6 Source: AT and 5G: Extended reality at scale with time-critical communication
The challenge of many connected objects with such a large number of Internet of Things (IoT) devices, including those in harsh environments and with limited processing power and battery life requires a new approach to connectivity and security. It is important to prepare for private, autonomous communications with the introduction of private networks for smaller enterprises in a variety of sectors that will require telecommunications providers to serve as ‘security as a service’ partners. A fifth challenge stems from security, as the virtual nature of the 5G network core and the large number of connected devices increases the risk of cyberattacks and data privacy issues. The mobile industry will need to continue to deter these threats, particularly in the era of global cybercrime.

Overall, with 5G networks are becoming more complex as they scale, driving the need for a more sophisticated approach to account for their heterogeneity and the fast pace of change. As well, value pools are shifting from the core network to the broader ecosystem, providing services and applications that are fully embedded in industry verticals and enabling significant potential enhancements and applications.

KEY DATA POINT

By 2024, there will be more than 22 billion connected IoT devices, according to recent research by Ericsson. Out of those devices, 4.1 billion will have cellular connections.

However, when it comes to rollout and adoption at scale for 5G connectivity and associated use cases, there are still many moving parts. It is useful to know some of the challenges that come with such a transformative and far-reaching technology. Here, we outline a handful of them, starting with developing a new network.

As mentioned, 5G is a new breed of networks and requires a new infrastructure to be built in order to fully utilize its capabilities. This includes the addition of small cell technology in densely populated areas and the use of mmWave frequencies, which have a limited range and therefore require a dense network to compensate. Local factors also need to be considered when expanding the 5G network as providers need tens of thousands of small cells and gateways to fixed, mobile, and satellite networks to create each experience. Blanketing a city with thousands of these tiny stations—for example, placed discretely every 200+ meters on lampposts, buildings, or curbs—creates a network ‘relay team’ that hands off signals from one station to the next. While rapid and robust, such networks are costly to build and maintain, with the cost of setting up a single microcell estimated at around $200,000 and small cells costing around $10,000 each⁹. There are also costs associated with acquiring spectrum licenses, configuring and testing networks, and maintaining and updating them¹⁰. By 2024, there will be more than 22 billion connected IoT devices, according to recent Ericsson research. Out of those devices, 4.1 billion will have cellular connections. As a result, enterprises that deliver hardware-based solutions are working to develop strategies to stay competitive.
REGULATORY POLICY MEASURES: BALANCING THE PUSH AND THE PULL

Regarding the government response to enable the digital economy agenda via accelerated 5G ecosystems, policy-makers and regulators have a handful of tools to deploy, where they need to balance carefully between the ‘push’ and the ‘pull’ levers to ensure sufficient support while maintaining market attractiveness.

When it comes to the ‘push’ aspect, three components come to mind:
1. Push more (timely) spectrum into the market,
2. Establish flexible experimentation spaces for innovation, and
3. Facilitate infrastructure access and deployment

1. Releasing Timely Spectrum Into The Market: Working to capture the benefits that 5G offers requires proactively anticipating industry needs and making spectrum available for research, development, and experimentation prior to commercial launch. This timely release of spectrum at a reasonable price should not focus on maximizing government revenue but on ensuring that the ecosystem develops without incurring prohibitive cost burdens. Spectrum should be made available for all business models with a technology-neutral approach to promote competition and innovation that could transform the marketplace—for example, enabling high-speed Internet access via a mix of terrestrial networks and low-earth orbit satellites. After accounting for differences in income across countries, a GSMA study found that final spectrum pricing in developing markets were more than 3 times those of developed countries, and that reserve prices in developing countries were more than 5 times those of developed countries.13

Also important within this theme is for policy-makers to experiment with and explore more inventive options, such as private/local deployments or tailored spectrum licenses to allow tests, trials, and innovations more broadly. This allows rising and established companies alike to take a small amount of the spectrum to experiment with—perhaps to build a proof-of-concept—before making the 15+ year investments required for spectrum licenses.

A careful trade-off between spectrum availability and deployment cost needs to be considered for 5G affordability. Policies targeting harmonization of bands, optimization of channel sizes, and release of additional diverse bandwidth (low, medium, high bands) has been found to be a key driver in making or breaking the business case as it has a profound impact on network deployment.

2. Establish A Flexible Market-Oriented Regulatory Framework: The second point is to modernize outdated regulations. There are numerous regulations in place to ensure fair competition and consumer pricing (such as minimum coverage requirements in exchange for spectrum licenses and maintaining a specific price per voice/data unit in local markets). However, such regulations are not necessarily the best way to encourage businesses to be more innovative or to invest in new technologies. Business success will hinge on modernizing outdated regulations in order to facilitate partnering, encourage competition, and promote investment.
Examples of modernization include adjusting and adopting spectrum and license pricing mechanisms and formulas to account for new realities (e.g., mmWave spectrum, satellite coverage, etc) and ensuring that there is no artificial, prohibitive costs or barriers in local markets.

A flexible regulatory framework is one that rethinks coverage—essentially moving from several ad-hoc network blocks to a coherent network-of-networks approach. Here, an all-inclusive approach to policies is ideal when considering satellite, terrestrial, local area unlicensed, and all other new network arrangements and technologies. Flexibility pertains to other areas as well, from spectrum licenses for non-terrestrial networks (HAPS, satellites, etc) and support for targeted investments in network deployments, to exploring unique options such as private and/or local deployments.

3. Infrastructure Sharing And Access To Site Locations:
Several operators around the world are moving now towards lighter regulation of infrastructure sharing and facilitating access to site locations to enable more reasonable and feasible options for deploying network nodes, especially as the number of access points needed for the next generation of dense networks gets higher.13

Naturally, regulators have to be aboard with an infrastructure deployment plan in place, ideally one that ensures broad coverage and aligns with plans to bridge the digital divide. With this in mind, regulators like the FCC have taken steps to remove regulatory barriers to wireless infrastructure at the state and local levels and are limiting state and local government category of fees14. A next step might be to push for more network sharing, especially regarding small cells.

Yet deploying thousands of these small cells will require jumping through a lot of regulatory hoops. The good news is that countries can realize and remove these regulatory barriers at the federal, state, and local levels relatively easil.

For example, it is important to streamline installation of wireless infrastructure (e.g., small cells as mentioned earlier) and establish reasonable deadlines for cities and municipalities to act on siting applications and reasonable limits on sitting fees.

When it comes to the ‘pull’ approach, three key levers prevail: Introducing incentives to accelerate adoption, facilitating partnering and creating attractive investment conditions, and providing a transparent, predictable, and stable regulatory environment.

1. Introducing Incentives To Accelerate Adoption: These may include financial incentives such as grants or tax breaks, infrastructure support, educational programs, and regulatory reform. Financial incentives can help offset the costs associated with adopting 5G technology, while educational programs and adoption blueprints can help less tech-savvy businesses understand the benefits of 5G technology and how to use it effectively, while regulatory reform can remove barriers to the adoption of 5G technology.
2. Facilitating Partnering And Creating Attractive Investment Conditions For 5G Innovations: Partnership models are powerful ways to build strong relationships, expand an operator’s own 5G enterprise capabilities through experimentation, and fill capability gaps in areas outside of the telecommunication provider’s core competencies. For example, creating a tighter link between the network and cloud/edge providers might be needed for certain mobile cloud gaming or real time remote apparatus control applications. As such, creating the right incentives and mechanisms, such as innovation sandboxes or test-and-trial licenses, can open up new opportunities that might have been more costly or prohibitive under the normal regime.

Many entities around the world have conducted test-and-trial licenses for 5G technology. For example, the United States (FCC), UK (ofcom) and Australia (ACMA) are experimenting with test-and-trial licenses for 5G technology to a variety of entities, including telecommunication companies, research institutions, and other organizations. In the US, the FCC opened up its experimental licensing system, which is expected to benefit entities looking to further 5G technology research. These licenses allow the holders to conduct testing and experimentation with 5G technology in specific geographic areas and for specific periods of time, and are typically issued to support the development and deployment of 5G networks and to help ensure that the technology is safe and reliable before it is widely while allowing for experimentation and testing/development in contained environments before dedicating the substantial financial, technical, and personnel resources necessary for scaling up and complying with broader regulatory requirements.

Docomo 5G Open Lab™ Guam, a recently launched corporate venture, provides a good example of a 5G open partner program, a 5G open partner program to promote collaboration in creating innovative 5G services. Around 100 overseas companies and organizations are participating in the program, testing various solutions that incorporate 5G’s extra-high-speed, large-capacity, and low-latency technologies. The potential solutions include a remote training system using high-definition virtual reality and a monitoring system using AI surveillance cameras.

3. Providing A Transparent, Predictable, And Stable Regulatory Environment For Future Investment: The big question for many industry operators is how to share a longer-term view and roadmap when both the future regulatory environment and the next technology wave are both unknown. Operators are understandably skeptical about releasing spectrum when they don’t know what form the next big wave will take. While one-year market forecasts are possible, five-year forecasts are not.

An example of a functional model is to develop a market-oriented roadmap in which policy makers, regulators, and operators (including terrestrial and non-terrestrial) engage in periodic and meaningful discussions to better understand their needs and future plans. Sharing spectrum policies, infrastructure policies, or regulatory policies offers more certainty for all involved and certainty enables investment. People are willing to invest more when they worry less about what the future looks like.
Looking Ahead: A New 5G Approach

5G will be critical to deliver on national socio-economic ambitions for growing the economy, bridging the digital divide at the connectivity and application level, and improving overall national competitiveness across industry verticals. Some nations are realizing the opportunity—and acting on it. While early action will surely be favorable, it is important to recognize that it is not an advantage to be only the first and the fastest—it is more important to move with flexibility and adaptability in policy and regulatory frameworks.

With its cloud-first architecture, high bandwidth, and low latency, 5G is emerging as a platform that will drive innovation in various sectors like healthcare, automobiles, logistics, massive IoT, and more. Industrial IoT and mission-critical use cases will benefit from the always-on and real-time connectivity of this next generation network. This requires a new way of thinking: A change from a linear, top-down approach to a collaborative dynamic approach embracing a market-oriented policy and regulatory framework. That kind of public sector leadership can expand the 5G mandate beyond network deployment and expansion to creating an ecosystem that enables the development of applications and use cases which in turn drive the business and investment opportunities that allow nations and economies to thrive.

ABOUT WGS

The World Government Summit Organization is a global, neutral, non-profit organization dedicated to shaping the future of governments. The Summit, in its various activities, explores the agenda of the next generation of governments, focusing on harnessing innovation and technology to solve universal challenges facing humanity.

The World Government Summit Organization operates at the intersection of government and innovation. It functions as a knowledge exchange platform that convenes leaders in the public and private sectors to collaborate with world-renowned experts in creating positive impact for citizens around the world.

Including initiatives and events held throughout the year, the World Government Summit holds a flagship annual gathering in Dubai.

Visit www.worldgovernmentsummit.org

ABOUT BOSTON CONSULTING GROUP (BCG)

Boston Consulting Group partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities. BCG was the pioneer in business strategy when it was founded in 1963. Today, we work closely with clients to embrace a transformational approach aimed at benefiting all stakeholders—empowering organizations to grow, build sustainable competitive advantage, and drive positive societal impact.

Our diverse, global teams bring deep industry and functional expertise and a range of perspectives that question the status quo and spark change. BCG delivers solutions through leading-edge management consulting, technology and design, and corporate and digital ventures. We work in a uniquely collaborative model across the firm and throughout all levels of the client organization, fueled by the goal of helping our clients thrive and enabling them to make the world a better place.

Visit www.bcg.com

---

Source: GSMA study of more than 1000 awards of spectrum bands across 102 countries from 2010-2017
Source: Infrastructure Sharing: An Overview (GSMA)
Source: FCC. 2018. Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment
Source: 5G technology research set to benefit from FCC experimental licensing system
Source: DOCOMO to Further Expand 5G Trials with Overseas Partners