AN INFORMATIONAL HEARING OF THE ASSEMBLY SELECT COMMITTEE ON EMERGING TECHNOLOGIES & INNOVATION

NEXT-GENERATION 5G TECHNOLOGY IN CALIFORNIA: IDENTIFYING ITS OPPORTUNITIES AND CHALLENGES

August 25, 2021
10:00 a.m.
State Capitol, Room 437

BACKGROUND PAPER

Introduction

As of this moment, most American consumers have become familiar with the phrase "5G," an acronym for "fifth generation mobile network."[1] Almost every internet service and wireless provider has inundated television channels with advertisements on products that connect to 5G networks. The claims are grand: better streaming capabilities, faster download speeds than ever, unfathomable data-sharing capabilities, among others. One may not necessarily understand what 5G is after watching these commercials, but the general message is clear: if you are interested in the fastest possible internet service, then purchase a smartphone or other device that connects to a "nationwide 5G network."

However, the current state of 5G technology is more complicated. While 5G products and technologies are currently being heavily advertised, the reality is that the United States is several years from having access to fully deployed 5G networks:

> If you've seen any wireless commercials lately, or even just watched the recent Super Bowl, you know the hottest mobile communication technology is "5G," the next-generation network that will eventually power our smartphones and other connected devices. ...
>
> TV commercials for 5G leave out some important caveats. The rollout of high-speed 5G hinges on a mix of domestic and global telecommunications policies, many of which still need to be resolved. U.S. carriers need larger swaths of airwaves to transmit all that data, and new technology to make the most of their existing bandwidth. The highest 5G speeds will also require far more transmitters—think small antennas on every city block, not occasional towers. And on the global stage, 5G standards are still being hashed out by the world's economic powers.[2]

To illustrate where we currently are from fully-implemented 5G, the United States may need about 800,000 individual transmitters installed throughout the country for customers to enjoy nationwide 5G; as of 2019, only about 200,000 have been installed.[3] Thus, the 5G devices for

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[1] Qualcomm, *Everything you need to know about 5G*, https://www.qualcomm.com/5g/what-is-5g#:~:text=A%3A%205G%20is%20the%205th,machines%2C%20objects%2C%20and%20devices.

[2] Steven Overly, *So You Wanna Get 5G?*, POLITICO (February 25, 2020), https://www.politico.com/news/agenda/2020/02/25/so-you-wanna-get-5g-106341.

[3] William M. Lawrence & Matthew W. Barnes, *5G Mobile Broadband Technology - America's Legal Strategy to Facilitate its Continuing Global Superiority of Wireless Technology*, 31 NO. 5 INTELL. PROP. & TECH. L.J. 3, 5 (May 2019).

most consumers are not connecting to 5G networks; rather, their phones are mostly connecting to 4G infrastructure.[4] Granted, there are select locations across the country where one can experience 5G to its fullest,[5] but, for the most part, 5G is several years away from becoming a wide-ranging fixture of our lives.

Yet, once carriers have fully deployed their 5G networks, society will be poised for drastic transformation. Economists estimate that the rise of 5G will spur trillions of dollars in global economic growth and output, and create millions of jobs along the way.[6] Such economic growth will be driven by the rise of new technologies that could not exist otherwise, e.g., self-driving cars, advanced augmented reality experiences, "smart city" systems, and so much more.[7]

Due to massive changes that 5G will bring to the global economy, it is only sensible that California legislators – representing the fifth-largest economic power in the world – should have an understanding of what exactly is 5G, as well as its several applications, its infrastructure, and the opportunities and challenges involving its implementation. The objective of this hearing is to discuss exactly these topics.

Features of 5G and its Impact on the Economy and Data

What exactly do we mean when we discuss the fifth generation mobile network? Perhaps the best way to explain 5G is to detail the differences in each generation of mobile networks.

In the early 1980s, the first generation of mobile networks – 1G – was created, which was strictly limited to analog voice calls. Then, the early 1990s brought the creation of 2G, which built upon 1G to enable text messages and picture-sharing. In the early 2000s, 3G brought the rise of the first smartphones, which empowered mobile devices to access the internet, and support applications and GPS. 2010 was the year 4G was attained, which gave smartphones the capacity to support applications that have given rise to the modern "gig" economy. 5G was realized in 2018. Below is a timeline of this evolution, alongside models that illustrate the download speeds for each generation.[8]

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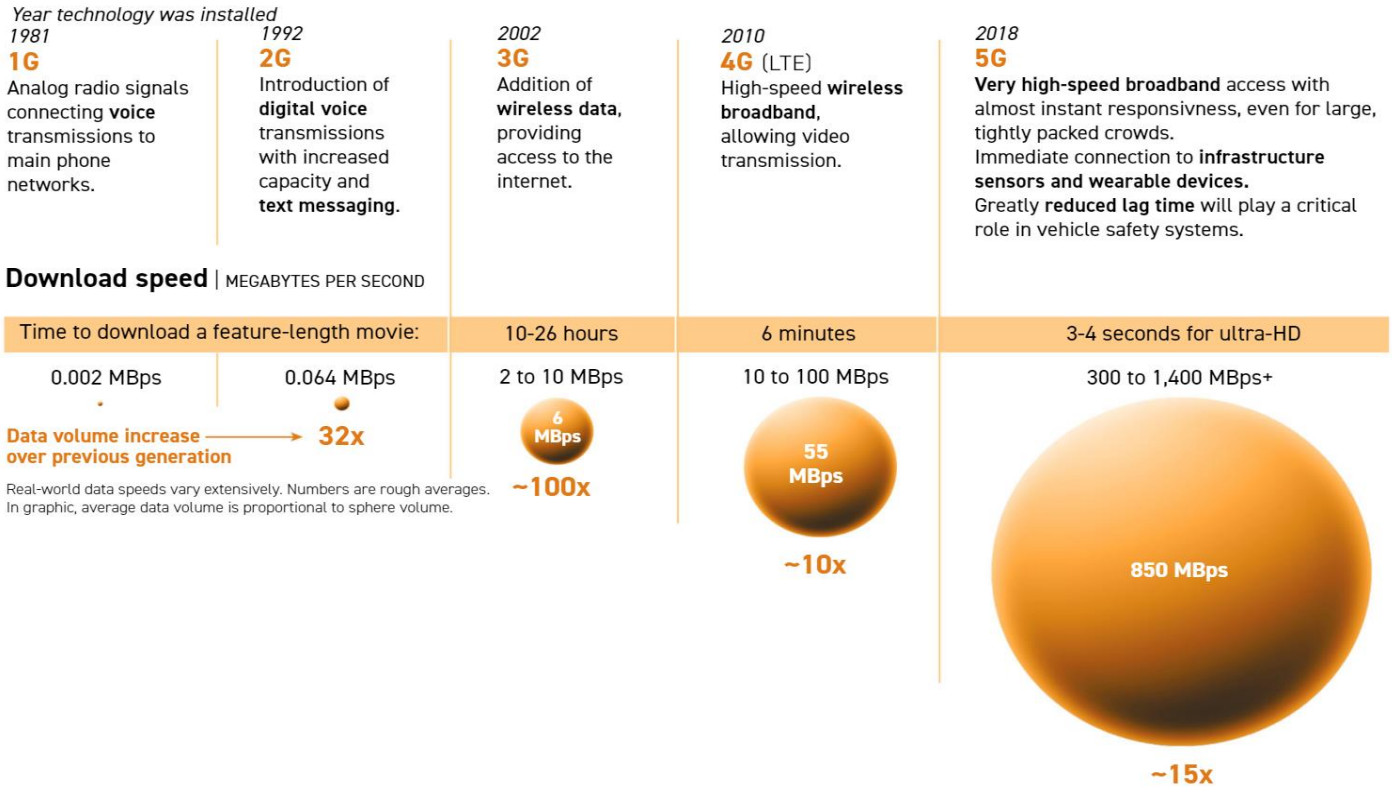
[4] Harald Remmert, *What is 5G Network Architecture?*, Digi International (March 19, 2021), https://www.digi.com/blog/post/5g-network-architecture.

[5] For example, a reporter notes his experience in Union Station in Washington, D.C., *see*, Overly, *supra*, note 2.

[6] IHS Markit, *The 5G Economy in Post-COVID-19 Era: The role of 5G in a post-pandemic world economy*, 3-4 (November 2020), https://www.qualcomm.com/media/documents/files/the-5g-economy-in-a-post-covid-19-era-report.pdf.

[7] Marguerite Reardon, *5G will change the world. China wants to lead the way*, CNET (July 10, 2020), https://www.cnet.com/tech/mobile/5g-will-change-the-world-and-china-wants-to-lead-the-way/.

[8] Patterson Clark, *The What, When and How of 5G*, Politico (Feb. 25, 2020), https://www.politico.com/news/agenda/2020/02/25/the-what-when-and-how-of-5g-114485.



Every mobile network advertisement involving 5G networks will tout their speed on mobile phones, but the reality is that 5G networks bring a more comprehensive set of changes to all of our internet devices. Specifically, there are three primary aspects in how 5G will "revolutionize and fundamentally transform the internet and, consequently, our lives":

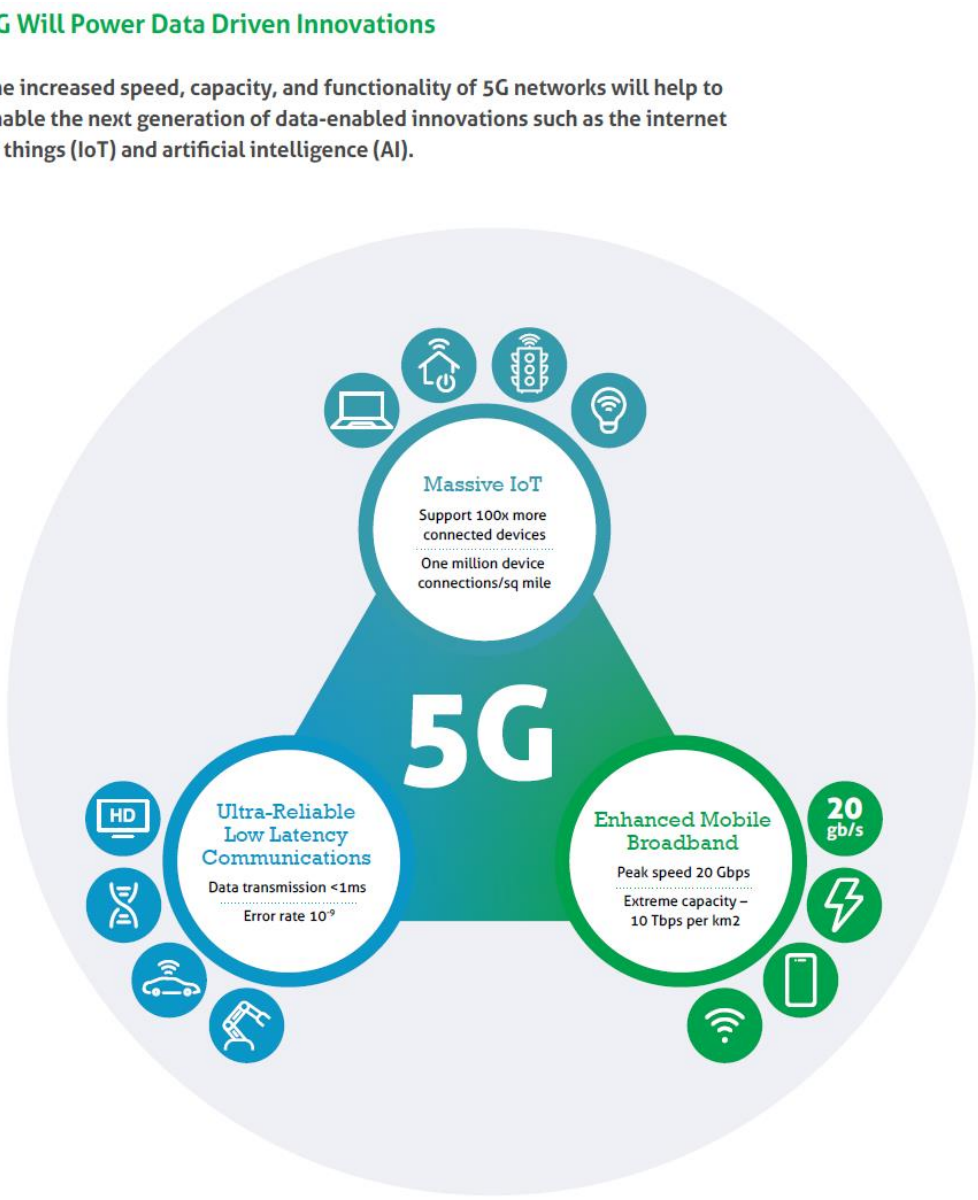
1. "Exponentially more rapid data transfer speeds, resulting in markedly faster content transmission and download times";
2. "Dramatically reduced lag times, resulting in no-delay and glitch-free content streaming"; and
3. "Substantially increased connectivity and capacity abilities, resulting in more users and devices communicating simultaneously."[9]

Moreover, compared to 4G LTE, 5G delivers the following technological benefits: "1,000 times the system capacity; 10 times the spectral efficiency and energy efficiency; 25 times the average cell throughput; 10 times longer battery life; 5 times reduced latency; and ubiquitous (M2M), human-to-machine, and human-to-human communications."[10]

[9] Lawrence, *supra*, note 3 at 3.

[10] Britney Wightman, *The Global Shift to 5G: How to Leverage Bilateral Access Reciprocity Agreements to Protect Telecommunications Infrastructure and Achieve Growth*, 44 HASTINGS INT'L & COMP. L. REV. 63, 75 (Winter, 2021)

Below is an illustration of these transformations brought by 5G.[11]



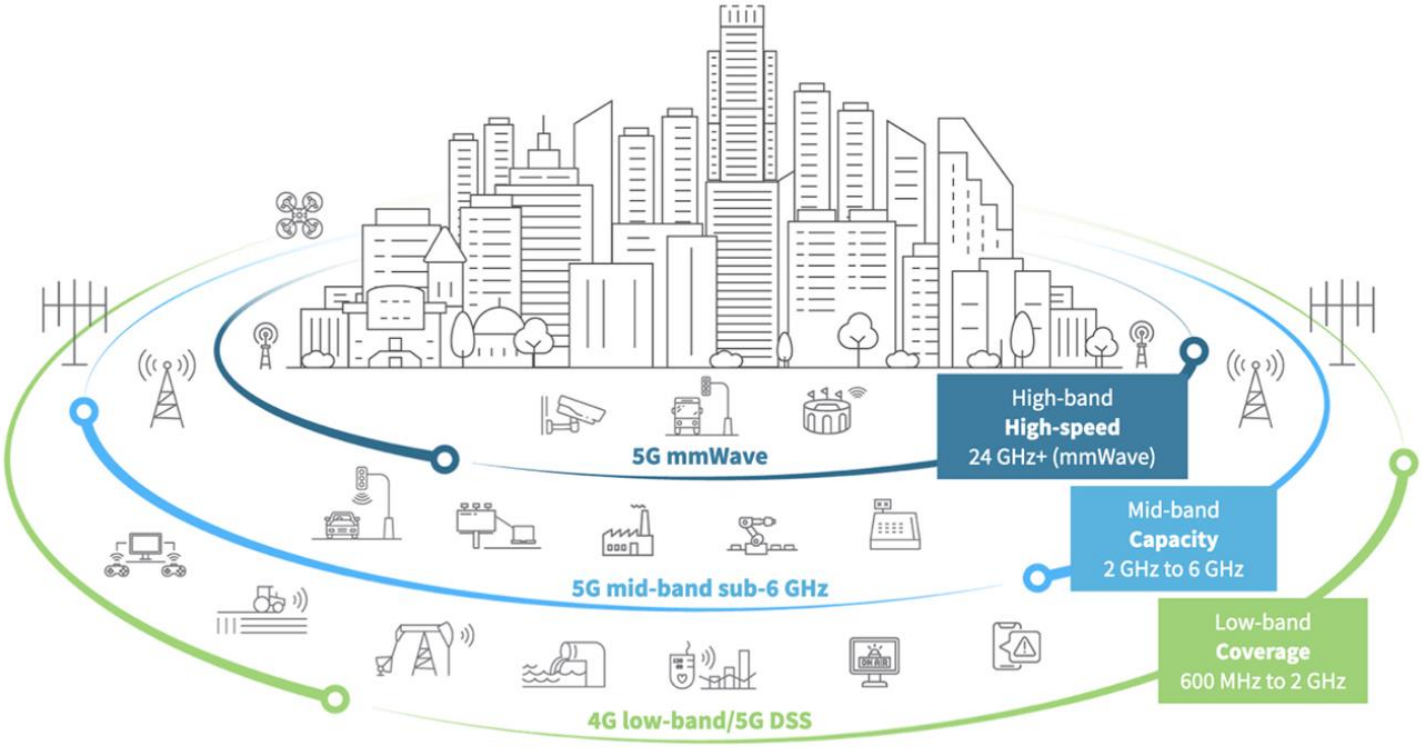
However, not all applications of 5G networks are created equal. As explained below, three different levels, or "tiers," of 5G exist:

> Imagine 5G is a three-tiered cake. . . The lowest tier is the widest and can serve the most people, but it's not as fast or low on lag. Its crucial advantage, however, is its ability to transmit data over long distances. This low-band 5G is the nationwide service that AT&T and T-Mobile have unfurled already to have a claim on the territory.

[11] Information Technology Industry Council, *ITI's 5G Policy Principles and 5G Essentials for Global Policymakers* (June 2020), https://www.itic.org/policy/ITI_5G_Full_Report.pdf.

> As you move up the cake, each tier serves fewer people, but it's faster, with fewer delays. The middle tier, which consists of 5G running on something called mid-band spectrum, is faster and can still cover a reasonable distance. ...
> The highest tier, known in the industry as millimeter wave, is the most potent but travels very short distances and therefore serves the fewest people.[12]

To illustrate this "three-tiered cake," below is a visual representing the tiers in 5G networks, most notably conveying that the most powerful 5G networks will cover shorter distances than the others.[13]



As a result, the most potent 5G networks will arrive first in densely populated areas with high levels of social and economic activity, e.g., "major shopping centers, sports stadiums, university campuses and airports."[14] When 5G networks reach suburban and rural areas, they can expect in most cases to receive middle-tier 5G.[15]

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[12] Overly, *supra*, note 2.
[13] Remmert, *supra*, note 4.
[14] *Id.*
[15] "For more suburban and rural areas, eMBB would seek to replace 4G's current LTE system, with a new network of lower-power omnidirectional antennas providing 50 Mbps downlink service." Scott Fulton III, *What is 5G? Your guide to the current generation of wireless communications*, ZDNET (April 27, 2021), https://www.zdnet.com/article/what-is-5g-the-business-guide-to-next-generation-wireless-technology/.

As highlighted in the introduction, the rise of 5G will provide a substantial boost to the global economy. The same can be said specifically for the United States. The implementation of 5G has the potential to increase U.S. gross output (i.e., sales) by $2.7 trillion between this year and 2025.[16] Within the same period, 5G will contribute an additional $1.5 trillion to national GDP, "create or transform" about 16 million jobs, and enhance the growth potential of every sector within the economy.[17] Further, every state has much to gain from 5G with projected economic activity estimated in the billions of dollars for each state.[18]

Specifically, California "can expect to create or transform up to 2.4 million jobs and $253 billion of GDP increase."[19] These benefits stem from the 5G's empowerment of industry in the following ways: unlocking the potential for new products, services and business models; simultaneously increase productivity and output; and improve customers' experiences.[20] Specifically, the following estimates demonstrate the additional economic activity and jobs 5G technologies will add to numerous California regions over the next ten years:

- $9.5 billion in gross domestic product (GDP) growth and 30.1k new jobs within Sacramento-Roseville-Folsom;
- $79.7 billion in GDP growth and 132.9k new jobs within San Jose-Sunnyvale-Santa Clara;
- $2.3 billion in GDP growth and 8.3k new jobs within Fresno;
- $2.5 billion in GDP growth and 8.6k in new jobs within Bakersfield;
- $4.3 billion in GDP growth and 12.4k new jobs within Thousand Oaks-Ventura;
- $98.4 billion in GDP growth and 228.3k new jobs within Los Angeles-Long Beach-Anaheim; and
- $14 billion in GDP growth and 45.3k new jobs within Riverside-San Bernardino-Ontario.[21]

Thus, the deployment of 5G is poised to create incredibly meaningful economic gains throughout California and the United States.

Emerging Trends in 5G and Specific Use Cases

5G networks will drive innovation throughout the entire economy.[22] Undoubtedly, this innovation will be spearheaded by the information and communications technology industry, which will develop the technologies that will power the transformations within every other industry. For example, "[a]s automotive manufacturers ramp up connected vehicles and telematics applications . . . communications service providers (CSPs) will be providing the

[16] Jefferson Wang et al., *The Impact of 5G on the United States Economy*, ACCENTURE STRATEGY 3 (February 2021), https://www.accenture.com/_acnmedia/PDF-146/Accenture-5G-WP-US.pdf#zoom=50.
[17] *Id.* at 3.
[18] Communications Technology Industry Association, *The 5G Economy*, https://www.ctia.org/the-wireless-industry/the-5g-economy. The data is also organized into current districts for the United States House of Representatives.
[19] Wang, *supra*, note 16 at 3.
[20] *Id.* at 5.
[21] Communications Technology Industry Association, *The 5G Economy*, https://www.ctia.org/the-wireless-industry/the-5g-economy/map/states/California/metro_areas/.
[22] Wang, *supra*, note 16 at 28.

network, devices and services that unlock their potential."[23] Below is a sample of emerging trends that are fueled by the implementation of 5G networks and CSPs.

Smart Cities and Public Safety

The implementation of 5G networks will bring the rise of "smart cities," or "cities that use information and communication technologies to drive economic growth, increase operational efficiencies, share information publicly, improve government services, and enhance public welfare."[24] Among the technologies that smart cities will deploy include automated traffic management systems of city roadways, digital utility monitoring of service issues for consumers and neighborhoods, and crowdsourcing data collections of socioeconomic patterns.[25] 5G-powered applications could even enable drivers to locate available parking spots within crowded areas in real-time, and increase cities' parking fee revenues as well.[26]

One of the ways the emergence of smart cities will affect the lives of all their residents will be regarding public safety. With 5G networks, cities can implement reporting applications that "allow citizens to report issues like traffic accidents and vandalism directly and instantaneously to applicable city departments."[27] Further, smart city technology enables law enforcement to learn in real-time about emergency situations. For example, systems can be harmonized to triangulate the location of a gun shooting and sometimes even identify the type of gun used. San Francisco has already adopted a form of this technology.[28]

Healthcare

5G networks bring several possibilities to the improvement of quality and effective healthcare treatment and services. Its ability to expand "remote patient monitoring can improve health care delivery and enhance preventative care,"[29] especially for patients with sensitive or critical conditions.[30] Further, 5G-powered applications can provide healthcare providers the ability to rapidly transmit and process medical data.[31] Telehealth appointments are enhanced with new types of data-sharing software, which opens up the opportunity for healthcare providers like dermatologists to make telehealth appointments.[32] Additionally, a 5G-connected hospital improves the physical safety of staff and patients and expands the versatility of facilities by eliminating the need for wires.[33] These types of innovations have proven to be invaluable cost-

[23] Wang, *supra*, note 16 at 23-24.
[24] Lawrence, *supra*, note 3 at 4.
[25] *Id.*
[26] Majed Al Amine, Kenneth Mathias, and Thomas Dyer, *Smart Cities: How 5G Can Help Municipalities Become Vibrant Smart Cities*, ACCENTURE STRATEGY at 9, https://www.accenture.com/t20170222T202102__w__/us-en/_acnmedia/PDF-43/Accenture-5G-Municipalities-Become-Smart-Cities.pdf.
[27] Lawrence, *supra*, note 3 at 4.
[28] Al Amine, *supra*, note 26 at 9.
[29] Information Technology Industry Council, *supra*, note 11.
[30] Wang, *supra*, note 16 at 43.
[31] *Id.* at 42; see also Corinne Reichert, *5G couldn't have come to health care at a better time*, CNET (July 16, 2020), https://www.cnet.com/tech/mobile/5g-couldnt-have-come-to-health-care-at-a-better-time/.
[32] *Id.* at 45.
[33] *Id.* at 46.

savers and promoters of efficiency at Chicago's Rush Hospital, the country's first 5G health care facility.[34]

Education

The COVID-19 pandemic forced schools to reimagine how to facilitate quality education with virtual education and distance learning. While in-person learning is probably ideal for most instruction, there are still several valuable lessons from pandemic-era learning that schools may permanently apply.[35] With 5G technology, schools will be able to build upon these lessons with the following implementations: cloud-based storage of information; "smart" classrooms; low-latency and accessible video-based learning; and flexible and personalized learning for students with unique needs.[36]

Agriculture

5G brings new opportunities in efficiency and production capabilities for agriculture. For example, 5G-powered technology includes sensors to "communicate soil nutrition levels" [37] and detect pests.[38] Other examples of the boon that agriculture would receive from 5G include: reporting on weather patterns; livestock analysis; autonomous directing of harvesting vehicles; and consulting with in-field experts online.[39] Further, 5G has the potential to improve the transportation of agricultural products – as well as other products – with applications that reduce wasted cargo space of vehicle fleets.[40]

Manufacturing

From the production of vehicles to construction tools to containers and everything in between, manufacturing has as much to gain from 5G deployment as any other industry. Every aspect of moving, controlling, and assembling products will be handled with unprecedented levels of precision, productivity, and efficiency. For example, 5G technology will enhance the production of products with factory floor automation and robotic process control.[41] Defective products and worn-down machinery can be identified at higher rates.[42] Workers will be able to accomplish tasks along with others using collaborative applications.[43] Additionally, there are "capabilities for real-time asset-health monitoring and predictive and prescriptive maintenance to reduce unplanned downtime, extend the useful life of assets and improve key metrics, such as mean time between failures."[44] The possibilities may be endless.

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[34] Wang, *supra*, note 16 at 46.
[35] *E.g.*, Sydney Johnson, *Distance learning changed California education. What's here to stay?*, EDSOURCE (March 15, 2021), https://edsource.org/2021/distance-learning-changed-california-education-whats-here-to-stay/651179.
[36] IHS Markit, *supra*, note 6 at 15.
[37] Information Technology Industry Council, *supra*, note 11.
[38] Qualcomm, *5G: The Fabric for Society* (June 2018), https://www.qualcomm.com/media/documents/files/5g-vision-use-cases.pdf.
[39] Information Technology Industry Council, *supra*, note 11.
[40] Wang, *supra*, note 16 at 52.
[41] *Id.* at 30.
[42] *Id.* at 31, 32.
[43] *Id.* at 31-32.
[44] *Id.* at 31.

Building and Implementing 5G Networks

As explained earlier, 5G networks are part of an evolution of four previous technological generations. Yet, this does not mean 5G networks are wholly separate from previous generations; rather, the building of 5G networks complements and improves existing mobile network infrastructure.[45]

The technology that makes 5G networks is guided by industry-wide standards created by the 3rd Generation Partnership Project (3GPP). 3GPP is "the focal point of development for 5G specifications and standards . . . a consortium made up of seven of the regional telecommunications standards development bodies."[46] 3GPP periodically releases comprehensive industry standards for 5G technology, with the latest standards released in July 2020. Guided by these standards, technology firms are able to produce the infrastructure that will power 5G networks throughout the world.

The most potent type of 5G network is the high-band 5G, and it is made possible with the installation of several "small cells" on elevated structures that transmit "millimeter waves":

> 5G technology is made possible using millimeter waves. Millimeter waves on the spectrum provide greater bandwidth and speed. However, the millimeter waves cannot travel long distances or penetrate obstacles, so small cell sites are placed closer together to relay signals around the obstacles. Small cells are "low-powered, short-range, low-cost, self-contained cell site nodes ..." They can be installed on poles, billboards, sides of buildings.[47]

As a result of its short-distance limitations, high-band 5G cannot be applied to wide-ranging areas – at least in the immediate future. Thus, for communities, mid-band and low-band 5G will be deployed first. Unlike high-band 5G, mid- and low-band 5G does not employ millimeter waves; instead, these networks will operate on spectrum technology powered by enhanced mobile broadband (eMBB), which constitutes "a 'bigger pipe' that provides high data/bandwidth throughput" and "supports services like high-definition videos, virtual reality, and augmented reality."[48]

The full deployment of nationwide 5G infrastructure happens in three phases, with the United States currently at the second phase:

1. *Foundation* – "In this first phase, operators will deploy a baseline broadband network (low- to midband) for better connectivity to deliver extreme mobile [eMBB] and fixed and mobile wireless access services, as well as initial [millimeter wave] deployments in population-dense city areas."

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[45] Remmert, *supra*, note 4.

[46] Information Technology Industry Council, *supra*, note 11.

[47] Lowell, *supra*, note 45 at 81. *See also* Peter Brown, *Micro 5G base stations on street lamps key to proliferating mmWave technology*, ELECTRONICS360 (Sept. 25, 2019), https://electronics360.globalspec.com/article/14127/micro-5g-base-stations-on-street-lamps-key-to-proliferating-mmwave-technology.

[48] Wightman, *The Global Shift to 5G*, 44 Hastings Int'l & Comp. L. Rev. at 75. For a detailed explanation on what makes a 5G network, *see* Dario Sabella et al., *Designing the 5G network infrastructure: a flexible and reconfigurable architecture based on context and content information*, EURASIP JOURNAL ON WIRELESS COMMUNICATIONS AND NETWORKING (August 2018), https://jwcn-eurasipjournals.springeropen.com/articles/10.1186/s13638-018-1215-1.

2. *Expansion* – Here, "operators will expand 5G networks across the US. 5G coverage is becoming more available along major transit routes using low-band and midband spectrum and in areas with lower population densities, and [millimeter wave] densification in urban cores and hot spots such as venues and shopping centers is continuing."
3. *Augmentation* – "In this third phase, operators will expand mid band and [millimeter wave] densification across cities, businesses, and major and secondary transit routes."[49]

While the emergence of 5G networks is a modern development, the legal framework that governs its deployment stem from decades-old laws. First, the federal Telecommunications Act of 1996 (Telecom Act) establishes several requirements to remove barriers to competitive telecommunications markets, which includes barriers to the installment of small cells. The Telecom Act provides that "[n]o state or local statute or regulation . . . may prohibit or have the effect of prohibiting . . . telecommunications service."[50] Yet, it also authorizes state and local governments to regulate service providers, albeit in a limited capacity.[51] Further, state and local governments "shall not unreasonably discriminate among providers of functionally equivalent services," [52] and are required to act on the request of a service provider for placing up personal wireless service facilities "within a reasonable period of time."[53] The Telecoms Act also creates restrictions on publicly- and privately-owned utility companies, i.e., utility companies must allow service providers "nondiscriminatory access" to its poles[54] and that the rates for such access be "just and reasonable."[55]

Second, the federal Spectrum Act of 2012 provides that a local government "may not deny, and shall approve, any eligible facilities request for a modification of an existing wireless tower or base station that does not substantially change the physical dimensions of such tower or base station."[56] As a result, the Spectrum Act ensures the speedy deployment and modification of wireless facilities. Additionally, regarding publicly owned electric utilities specifically, state law requires them to make available appropriate space and capacity on and in their poles and support structures for use by service providers.[57]

The Federal Communications Commission has supported the expansion of 5G networks, predicting that it "can unleash a new wave of entrepreneurship, innovation, and economic opportunity for communities across the country."[58] In response, the FCC has taken several major actions towards promoting 5G across the United States. In March 2018, the FCC exempted small cells deployments from historic preservation and environmental reviews under certain circumstances based on the reasoning that any environmental benefits would be far exceeded by

[49] Enrique Duarte Melo et al., *5G Promises Massive Job and GDP Growth in the US*, BOSTON CONSULTING GROUP (February 2021).
[50] 47 U.S.C. § 253(a).
[51] 47 U.S.C. § 332(c)(7).
[52] *Id.* § 332(c)(7)(B)(i)(I).
[53] *Id.* § 332(c)(7)(B)(ii).
[54] 47 U.S.C. § 224(f)(1).
[55] *Id.* § 224(b)(1).
[56] 47 U.S.C. § 1455(a)(1).
[57] AB 1027 (Buchanan), Chapter 580, Statutes of 2011.
[58] FCC's Declaratory Ruling and Third Report and Order (WT Docket No. 17-79 and WC Docket No. 17-84) adopted September 26, 2018, Section I.1.

costs and delays.[59] Additionally, in September 2018, the FCC adopted its Plan to Facilitate America's Superiority in 5G Technology (FAST Plan), which includes making more spectrum available to the commercial marketplace, promoting and reforming rules that ultimately create thousands of small cell sites and other necessary infrastructure for 5G, and modernize regulations to meet 5G infrastructure requirements and promote 5G backhaul and digital opportunities.[60]

Yet most significantly, the FCC has also taken an aggressive rulemaking approach toward limiting the abilities of local governments to review the health and safety of small cell installations. Between August and September 2018, the FCC promulgated three distinct orders with the clear objective of limiting local government control against 5G deployment within their communities:

1. *The Small Cell Order* – This order expressly limits state and local fees for the deployment of small cells to a "reasonable approximation," and provides safe-harbor maximum amounts for what constitutes as reasonable fees. If a local zoning authority fails to properly respond to a permitting request for a small cell deployment within specified time periods, the delay is deemed unreasonable, and the requester can seek an injunction to enforce their request. Further, aesthetic restrictions against small cells are preempted unless they were reasonable, nondiscriminatory, and objective and published in advance.[61]
2. *Moratoria Order* – This order targets actions by local governments that halt 5G deployment, i.e., "moratoria." However, it addresses moratoria by distinguishing between two general categories. "Express" moratoria – "statutes, regulations, or other written legal requirements" that halt 5G deployment – are prohibited, even if they last for a limited duration. "De facto" moratoria – "state or local actions that are not express moratoria, but that effectively" halt 5G deployment in a manner "akin to an express moratorium" – are also prohibited, but only when they unreasonably or indefinitely delay deployment. However, this order allows for "emergency" bans against 5G facility construction, but only in limited circumstances.[62]
3. *One-Touch Make-Ready Order* – With this order, broadband providers are empowered to make attachments to existing utility poles. It allows the providers to do all the preparations for installing attachments to poles themselves, rather than wait for the pole owners – i.e., a local government or utility company – to perform the preparatory work.[63]

These three orders have been subjected to a legal fight that concluded merely a few months before this hearing. In 2019, a massive panel of municipalities-plaintiffs led by the City of Portland, Oregon challenged the legality of these orders on administrative and constitutional grounds. In August 2020, the U.S. Court of Appeals for the Ninth Circuit upheld the legality of

[59] FCC-CIRC1803-01--In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment--WT Docket No. 17-79.

[60] Lawrence, *supra*, note 3 at 9-10.

[61] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Inv.*, 33 FCC Rcd. 9088 (2018). The presumptively reasonable level of fees are applications fees less than $500 and recurring fees less than $270 per year, but localities may charge fees above these limits to cover their actual costs.

[62] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Inv.*, 33 FCC Rcd. 7705, 7775-91 (2018).

[63] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Inv.*, 33 FCC Rcd. 7705, 7705-91 (2018).

the three orders, with the exception for the regulations against aesthetics restrictions.[64] In June of this year, the United States Supreme Court denied the petitioners' petition for writ of certiorari, which effectively affirms and solidifies the FCC orders' legality.

While the legal battle over the FCC's promulgations has been ongoing, 5G implementation has faced resistance from several Californian communities. For example, Santa Barbara's city council recently voted against approving a contract with Verizon to install small cell facilities on city streetlights; an action supported by several community members opposed to 5G expansion.[65] Similar opposition has been reported in several other cities, as well.[66]

Opposition to 5G often relates to health concerns that 5G network radio waves may cause illnesses or adverse health outcomes.[67] Communities may also be opposed to small cells for aesthetic purposes, and raise concerns to declines in property values.[68]

Moreover, there are significant concerns that the push for 5G by the FCC has gone too far in undermining local governments' abilities to protect its residents from potential health and safety hazards. As covered above, the Small Cell Order significantly limits local governments to the extent to which they may charge carriers for reviewing their plans for 5G deployment and have a very limited period of time before applications become presumptively granted. This order, alongside the moratoria restrictions and authorization for broadband providers to prepare installations, arguably leave localities without substantive legal recourse to address legitimate health and safety issues that come with the expansion of 5G.

Notably, the FCC orders do not necessarily shut down the prospects of deployment agreements between localities and carriers. Nevertheless, these orders give carriers significantly "more leverage when negotiating with local governments."[69] As a result, the current legal environment, coupled with the heavy investment in 5G deployment, raise the prospects of many communities receiving 5G infrastructure with little consideration as to what works best for them.

It is incumbent to weight these concerns with the potential of 5G. As was alluded to earlier, the rise of 5G brings with it substantial economic growth for almost every industry. For example,

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[64] *City of Portland v. United States*, 969 F.3d 1020 (9th Cir. 2020). Regarding the aesthetic restrictions, the court reasoned that they were inconsistent "with the more lenient statutory standard [of 47 U.S.C. § 332(c)] that regulations not 'unreasonably discriminate.'" Further, the court deemed that objectivity element of the restrictions was arbitrary and capricious.

[65] Joshua Molina, *Santa Barbara City Council Rejects 5G Technology for Now*, NOOZHAWK (March 4, 2020), https://www.noozhawk.com/article/santa_barbara_city_council_rejects_5g_for_now#:~:text=%7C%208%3A29%20p.m.&text=The%20Santa%20Barbara%20City%20Council,health%20impacts%20of%20the%20technology.

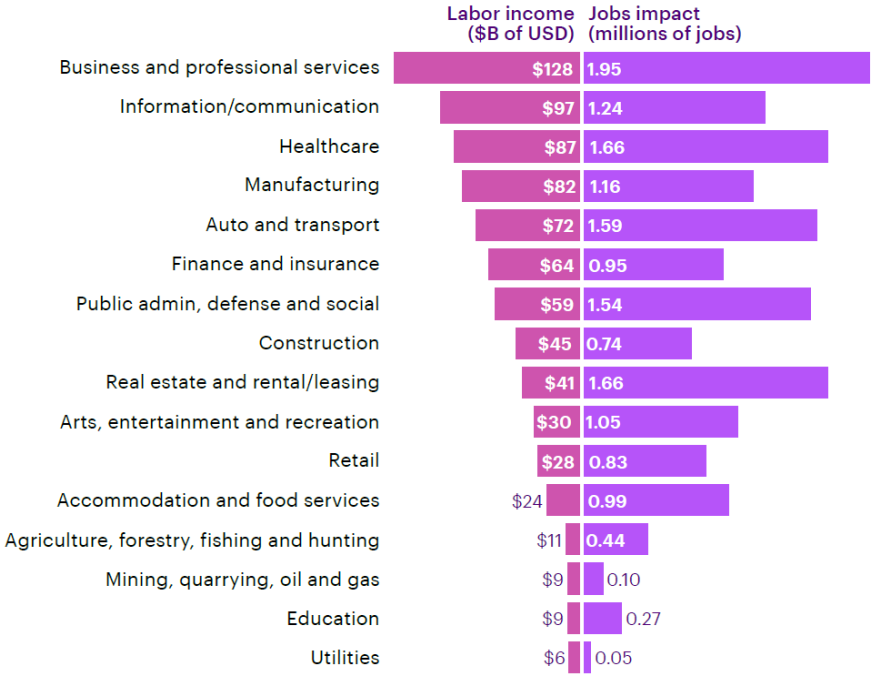
[66] *E.g.*, Christopher Mims, *Cities Are Saying No to 5G, Citing Health, Aesthetics – and FCC Bullying*, WALL STREET JOURNAL (August 24, 2019), https://www.wsj.com/articles/cities-are-saying-no-to-5g-citing-health-aestheticsand-fcc-bullying-11566619391; Danny Crichton, *Bay Area city blocks 5G deployments over cancer concerns*, TECH CRUNCH (Sept. 10, 2018), https://techcrunch.com/2018/09/10/bay-area-city-blocks-5g-deployments-over-cancer-concerns/.

[67] *E.g.*, Mims, *supra*, note 66.

[68] *See* Robert McCartney, *The ugly side of 5G: New cell towers spoil the scenery and crowd people's homes*, WASHINGTON POST (July 12, 2021), https://www.washingtonpost.com/local/5g-towers-dewey-beach/2021/07/11/455e3866-e0f4-11eb-9f54-7eee10b5fcd2_story.html.

[69] Arthur Scott and Zach George, *Next Generation Local Zoning Authority: 5G Wireless Broadband 101*, NATIONAL ASSOCIATION OF COUNTIES (Aug. 1, 2019), https://www.naco.org/resources/featured/next-generation-local-zoning-authority-5g-wireless-broadband-101.

below is a chart that details estimated growth in labor income and jobs impact by 5G implementation over the next 4 years:[70]



Further, if it is determined that the deployment of 5G networks are a worthy cause, then there are several opportunities to direct 5G expansion toward other objectives, such as:

- *Workforce shortages and Education* – California's workforce and general population is rapidly aging,[71] and workforces in specific industries, e.g., manufacturing and utilities, are aging at a faster rate than others.[72] With 5G technology, these industries may be able to increase efficiencies to accommodate for rising retirements, but workforce gaps can still be expected to persist. To address workforce issues, it may be possible to couple incentives to 5G deployment alongside job training programs to create a modern workforce ready to meet the needs of a 5G economy. However, such programs would ideally also incentivize cooperation with local governments and utility companies in a manner consistent with FCC regulations.
- *Healthcare costs* – As detailed earlier, 5G-powered technologies have great potential for the healthcare industry. 5G applications and devices give healthcare providers the opportunities to reduce costs, increase efficiencies, enhance quality of care, and even improve workplace safety. However, such technologies will require lengthy FDA approvals and must be carefully tailored to comply with HIPAA. There may be an opportunity to incentivize speeding up the development and authorization of such

[70] Wang, *supra*, note 16 at 24.

[71] "Over the next two decades, California's over-65 population will nearly double, clearly indicating an increased demand for health and support services." Laural Beck and Hans Johnson, *Planning for California's Growing Senior Population*, PUBLIC POLICY INSTITUTE OF CALIFORNIA (August 2015), https://www.ppic.org/publication/planning-for-californias-growing-senior-population/.

[72] Wang, *supra*, note 16 at 29, 57.

technologies by studying and possibly adjusting reimbursement rates to fairly compensate services through these new innovations.[73]

- *Environmentalism and Fire Prevention* – 5G has the ability to empower California to more effectively tackle pressing environmental issues, such as improving our recycling systems.[74] Further, utilities have much to gain from 5G, such as being able to more effectively identify faulty equipment before it starts fires and distribute power more efficiently to avoid blackouts.[75] There may be an interest to incentivize the implementation of this technology for these fields.

The time has come to understand the intersection between 5G deployment and other issues we face as a state. After all, even modest delays in creating a 5G economy carries significant opportunity costs.[76] Hopefully, this hearing is the beginning of a comprehensive understanding regarding the opportunities and challenges that come with 5G deployment.

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[73] Wang, *supra*, note 16 at 47.

[74] At the same time, it is worth noting that the adoption of 5G will also lead to challenges in the electronic waste management. 5G deployment will render obsolete older mobile devices and other gadgets, and as a result, the world faces the threat of a massive rise in e-waste. *See* Alana Semuels, *The World Has an E-Waste Problem*, TIME (May 23, 2019), https://time.com/5594380/world-electronic-waste-problem/.

[75] Wang, *supra*, note 16 at 58-60.

[76] Melo, *supra*, note 54.