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# **The Politics of 5G: The Battle Over the Control of the Next Super Leverage**

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## **Abstract**

The world is at a crossroads. The world's hegemony is on the verge of a turnaround. Changes are coming in our life from every perspective. 5G, at this crossroads, comes as the medium of change. The move to 5G from the existing generation of technology comes with boundless opportunity. However, this technological miracle poses some serious threats too. The leader in the 5G transformation will have the growth and the power to rule the world by setting technological standards. The 5G leader in the technological world can be assumed to hold the same power as the dollar holder has in the financial world. That is why all the powerful countries are chasing control over it. If they cannot have power, they are preventing some other country with different ideals from getting it. In the midst of this clash, the countries that do not have any equivalent power are facing a dilemma. In this paper, I have tried to analyze the politics of 5G and come up with some strategies for those countries. Basically, I suggested three strategies such as building your own technical capabilities to investigate the 5G technologies of a foreign country or following your trusted partner, forming multilateral organizations, and following your own interest. The point I want to focus on is that building consensus among ourselves is a must to protect our national sovereignty, embrace this new technology and reap the benefits that 5G promises.

The views and findings expressed here are those of the authors and do not necessarily reflect those of the Middlebury Institute of International Studies or any officials of the Institute.

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# 1 INTRODUCTION

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When in 2009, Stuxnet, a computer worm which was reportedly developed by the U.S. National Security Agency and the Israeli army's Unit 8200<sup>1</sup>, hit the Iranian uranium enrichment plant in Natanz, Iran and knocked out hundreds of centrifuges, a new era of warfare was marked. Characterized by cyber capabilities, this new era has created a new type of weapon of mass destruction which is, as Ralph Langner called out in his 2011 TED talk, Cyber Weapon of Mass Destruction. The threat of such weapon is not limited by the military or financial power of a country because everything in the cyber world is connected and one can access, given appropriate resources are provided. This enables a hacker from Ukraine with a computer in Alicante, Spain, can make ATMs in Taiwan to dispense cash automatically to his money mules<sup>2</sup>, or hackers from North Korea can instruct New York Fed to send money from the deposits of the central bank of Bangladesh to fake organizations in Philippines and Sri Lanka<sup>3</sup>. This unprecedented level of connectivity also comes with the new era of innovations. We can stream high-definition videos which has created billion-dollar companies like Netflix. We can have real time games where players of different continents can play simultaneously. It seems growth of our world is now centered around each generation of connectivity. As in figure 1, with each generation, we had a new stream of innovations. We see the world has never stopped growing, yet the growth is largely driven by the speed of mobile connectivity. The progress of connectivity driven technology and its growing share in the world productivity are changing the focus of governments and increasingly it is getting into the primary target of world superpower. While USA is the front runner in the information technology form the beginning - more or less organically from Silicon Valley - China became determined to be the frontrunner in this race since the beginning of second decade of twenty first century and by 2020 it has created companies like Huawei, having the most contribution in the 4G implementation. Until now, the USA, willingly or unwillingly, kept itself focused on the products of information technology like Google and Apple, paving the way for non-US companies like Huawei, Nokia, Samsung, Ericsson etc. to lead the connectivity infrastructure.

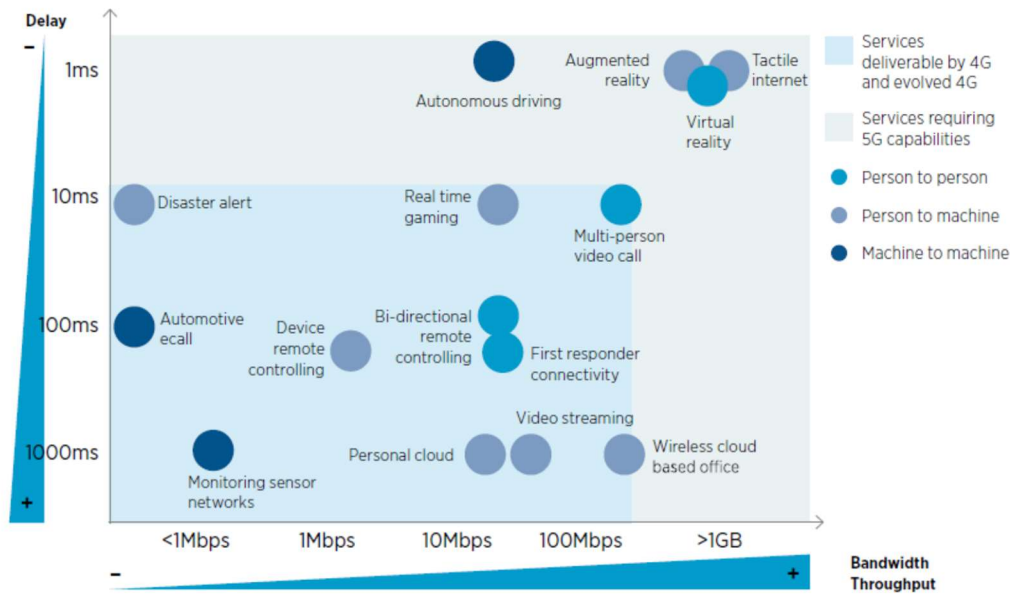
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<sup>1</sup> <https://www.haaretz.com/us-news/.premium-what-a-future-cyberwar-will-look-like-1.7441901>

<sup>2</sup> [https://www.kaspersky.com/about/press-releases/2015\\_the-great-bank-robbery-carbanak-cybergang-steals-1bn-from-100-financial-institutions-worldwide](https://www.kaspersky.com/about/press-releases/2015_the-great-bank-robbery-carbanak-cybergang-steals-1bn-from-100-financial-institutions-worldwide)

<sup>3</sup> <https://www.wired.com/2016/05/insane-81m-bangladesh-bank-heist-heres-know/>

Figure 1: Innovations related to speed of connectivity.



Source: The 5G guide by GSMA 5G taskforce, page 31.

Now, the world is in a point of time from where we can easily forecast a connectivity driven future and already controlling the connectivity infrastructure means controlling the dollar in the financial world. To make things more serious, the 5G technology is here. As the experts are saying, this technology will enable us to do things we could only think of, like holographic phone call, autonomous driving and so on. It will create a havoc on our existing technologies. However, it is already having havoc in international geopolitics among the world superpowers. The timing of 5G is impeccable. For the USA, the current ruling power of the world, already facing threats in other fronts like negative trade balances, insurmountable national debt, Covid, Trump etc. if concedes the 5G infrastructure to the rising power, China, this would be the last nail in the coffin in its diminishing world leadership and influence. On the other hand, if China, which is already giving signals to world of its imminent supremacy, can get the control of the 5G technology, it will seal the deal for it. 5G technology, for the first in history, can shift the control of the world from one civilization to other which is completely different in terms of culture and values. Even the government system is also very different. In this report, I will endeavor to shed light on all political aspects of this 5G technology and try to find out how and why a generation of mobile connectivity unlike its four predecessors become the center of the international geopolitical interests.

## 2 WHAT IS 5G: A SIMPLE VERSION

In simple words, 5G is the next generation of mobile connectivity which is really fast. To understand the basic features of 5G, I will give a description of the 5G KPIs (Key Performance Indicators) in our daily used terms, instead of going into the technical specifications. KPIs are the indicators that differentiate one generations of mobile connectivity from another. Generations of mobile connectivity like 2G, 3G, 4G, 4G-LTE are coexistent. The last best is the 4G-LTE which is a version of 4G. 4G is currently available in 53% of the world (GSMA Intelligence, 2019). Since we somewhat know what 4G-LTE is, I will compare its characteristics with the characteristics of 5G to grasp what will it mean to have 5G. Table 1 gives a KPI wise explanation of 5G.

Table 1: KPIs of 5G technology in daily used terms

KPI	KPI Description	5G	4G-LTE	Usage in our daily life
<b>1. Speed- In what speed we will download or stream</b>				
<b>MBPS</b> or <b>GBPS</b>	Megabyte per second <sup>4</sup>	50 Mbps and up	15 Mbps-50 Mbps	If we look at Netflix recommendations for streaming speeds, it recommends 25Mbps for Ultra HD quality. You only need 5Mbps for HD. The aim with 5G is to hit 50Mbps as an average minimum. It is always nice to have faster speeds, but that is not really the big attraction with 5G because 4G speeds are already pretty good <sup>5</sup> .
<b>2. Latency- the time it takes for data from your device to be uploaded and reach its target</b>				
<b>Ms/bit</b>	Milliseconds per bit transfer	1-10 ms	50 ms	To understand milliseconds, it takes at least 10ms for an image seen by the human eye to be processed by the brain. If something moves at a faster speed than that, our brain will not realize something is moving. This

<sup>4</sup> Though MBPS means megabit per second, we confuse that with megabyte per second. Since people understand megabyte better than the megabit, I will use megabyte in my description.

<sup>5</sup> <https://www.digitaltrends.com/mobile/5g-vs-4g/>

				feature is the key feature of 5G that will distinguish it from its predecessors.
<b>3. Connectivity- how many devices can be connected to the network in a square mile</b>				
<b>Device s/Sq. Mi.</b>	Devices supported per square mile	1 million	10 k – 100k	5G could support up to 100 times more devices than 4G – leading to a world more connected than ever. This shift is critical as billions of IoT devices come online and strain existing 4G networks. Think of 5G making possible future cities with smart transportation, efficient energy grids, and remote security <sup>6</sup> .
<b>4. Energy Efficiency</b>				
<b>Energy used/bit</b>	How much energy is used per bit transfer	5G will use 10% of current energy consumption <sup>7</sup>		Energy consumption has a big impact on battery life for mobile devices. It has been a thorn in the side for people using smartphones, smartwatches, and tablets. By using fast, low latency 5G networks, more data could be processed in the network instead of on a device. That could mean less energy used and longer battery lives.
<b>5. Mobile Data Volume</b>				
<b>Terabytes/Sq. km.</b>	How much data can be carried in a km simultaneously	10 TB/s/S q. km.	1/100 TB/s/S q. km.	Imagine high-density areas where thousands of devices communicate across the same network, such as airports or sports arenas. Communication comes to a crawl and data transfer speeds slow down dramatically. With faster speeds and lower latency, 5G could handle 1,000 times the volume of mobile data compared to 4G.

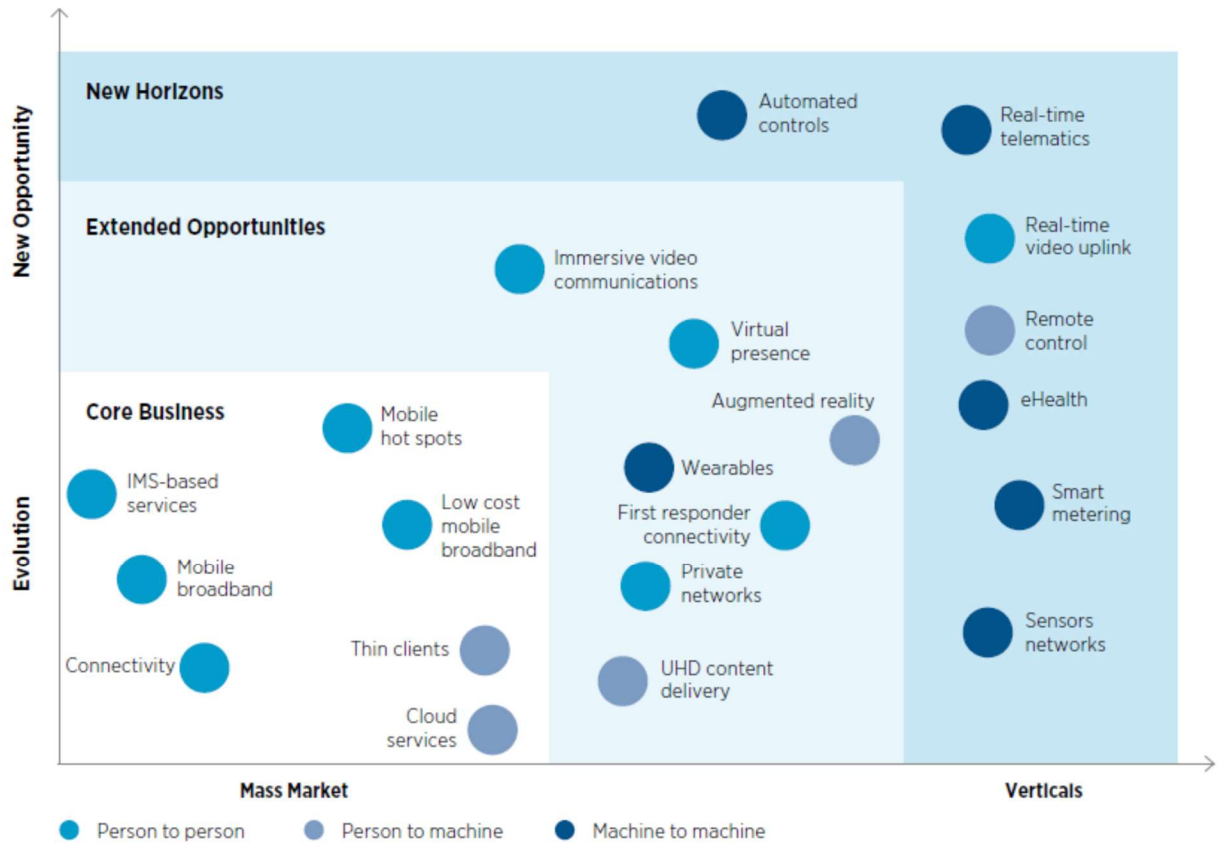
<sup>6</sup> <https://datamakespossible.westerndigital.com/5g-vs-4g-side-by-side-comparison/>

<sup>7</sup> <https://www.verizon.com/business/resources/5g/8-currencies-5g-network-performance/>



Although there are some other technical KPIs, the above table should give us a basic idea what 5G means. Some of its characteristics are critically important for the next level of innovations like automatic cars, IoT, and universal mobile connectivity. Figure-2 gives an account of the possible upcoming innovations dependent on the 5G technology.

Figure 2: Possible opportunities via 5G technology



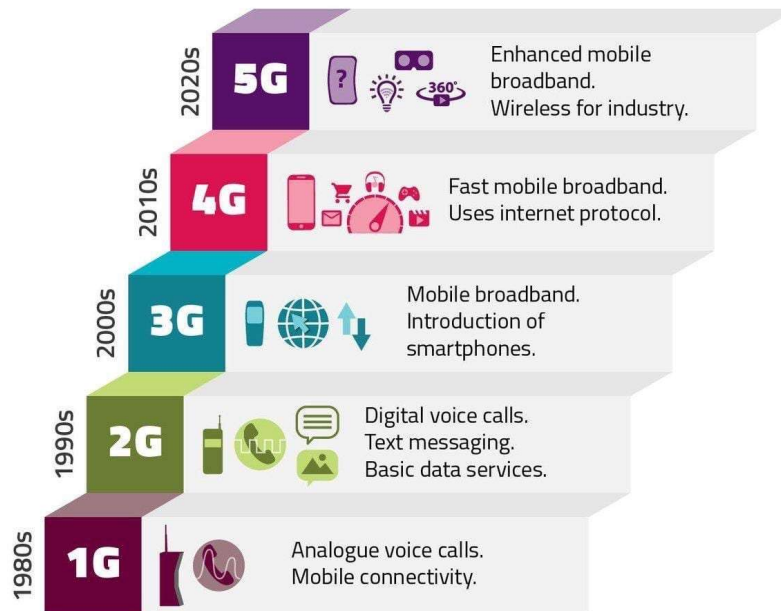
Source: The 5G guide by GSMA 5G taskforce, page 34.

The light blue portion of the above graph is already in action in many developed places of the world. These facilities will get much smoother with the 5G evolution and that will lead to the innovations mentioned in the blue portion of the graph. These facilities almost completely hinge on the facilities promised by 5G.

### 3 A BRIEF HISTORY: HOW DID WE GET HERE

The following graph gives a summary of each generation of mobile connectivity. We will get into a little bit of details as this will give us an idea of what happened when a new generation of mobile connectivity came and the first mover advantage.

Figure 3: The evolution of 5G



Source: <https://prc.chapters.comsoc.org/2019/04/01/5g-evolution-wireless-communications/>

Mobile wireless technology has been in development for decades, with the first generation (1G) introduced in the late 1970s and fielded in the early 1980s. Since then, new generations of technology and wireless standards have been introduced every decade or so, culminating in our present state of transition between 4G and 5G capabilities. The value of each generation has increased exponentially, as each has enabled a host of other technology advancements across the commercial sector and military.

#### 3.1 1G (VOICE CALLS)

1G mobile networks were fielded in the early 1980s with voice communications and limited emphasis on data transfer capability (early capability ~2.4 Kbps). 1G networks utilized analog

signals to “hand off” cell users between a network of distributed base stations (hosted on cell towers) using standards like AMPS and TACS.

### **3.2 2G (MESSAGING)**

In the 1990s, 2G mobile networks spawned the first digitally encrypted telecommunications that improved voice quality, data security, and data capacity, while hosting limited data capability by way of circuit-switching using the GSM standard. In the late 1990s, 2.5G and 2.75G technology brought about improved data rates (upwards of 200 Kbps) using GPRS and EDGE standards, respectively. These later 2G iterations introduced data transmission via packet-switching, which served as a stepping-stone to 3G technology.

### **3.3 3G (LIMITED DATA: MULTIMEDIA, TEXT, INTERNET)**

The late 1990s and early 2000s introduced 3G networks with faster data transfer speeds by fully transitioning to data packet-switching, with some voice circuit-switching that had been standard for 2G. This enabled data streaming, and in 2003 the first commercial 3G service was launched with mobile internet access, fixed wireless access, and video calls. 3G networks have now increased data speeds to 1Gbps when stationary and upwards of 350Kbps when mobile, using standards such as UMTS and WCDMA.

### **3.4 4G AND LTE (TRUE DATA: DYNAMIC INFORMATION ACCESS, VARIABLE DEVICES)**

4G network services were introduced in 2008 and featured data transfer at 10 times the speed of 3G by leveraging all-IP networks and relying entirely on packet-switching. 4G networks enhanced the quality of video data due to larger bandwidths allowing for increased network speed. The introduction of the LTE network has since set the standard for high-speed wireless communications on mobile devices and data terminals. LTE is in constant evolution and is currently on release number 12. “LTE advanced” can support ~300 Mbps (Medin & Louie, 2019). While 4G is the current standard around the globe, some regions are plagued by network patchiness and have low 4G LTE penetration. According to Ogury, a mobile data platform, UK residents can only access 4G networks 53 percent of the time, for example (Brainbridge, 2020).

### 3.5 5G: THE INTERNET OF THINGS (IOT)

With 4G coverage so low in some areas, why has the focus shifted to 5G already? 5G has actually been years in the making.

During an interview with Tech Republic, Kevin Ashton described how he coined the term "the Internet of Things" – or IoT for short – during a PowerPoint presentation he gave in the 1990s to convince Procter & Gamble to start using RFID tag technology<sup>8</sup>.

The phrase caught on and IoT was soon touted as the next big digital revolution that would see billions of connected devices seamlessly share data across the globe. According to Ashton, a mobile phone is not a phone, it is the IoT in your pocket; a number of network-connected sensors that help you accomplish everything from navigation to photography to communication and more. The IoT will see data move out of server centers and into what are known as 'edge devices' such as Wi-Fi-enabled appliances like fridges, washing machines, and cars<sup>9</sup>.

By the early 2000s, developers knew that 3G and even 4G networks would not be able to support such a network. As 4G's latency of between 40ms and 60ms is too slow for real-time responses, a number of researchers started developing the next generation of mobile networks.

In 2008, NASA helped launch the Machine-to-Machine Intelligence (M2Mi) Corp to develop IoT and M2M technology, as well as the 5G technology needed to support it<sup>10</sup>. In the same year, South Korea developed a 5G R&D program<sup>11</sup>, while New York University founded the 5G-focused NYU WIRELESS in 2012<sup>12</sup>.

The superior connectivity offered by 5G promised to transform everything from banking to healthcare. 5G offers the possibility of innovations such as remote surgeries, telemedicine and even remote vital sign monitoring that could save lives.

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<sup>8</sup> <https://www.techrepublic.com/article/how-the-term-internet-of-things-was-invented/>

<sup>9</sup> <https://www.brainbridge.be/news/from-1g-to-5g-a-brief-history-of-the-evolution-of-mobile-standards>

<sup>10</sup> <https://phys.org/news/2008-04-nasa-m2mi-satellite.html>

<sup>11</sup> <https://www.rcrwireless.com/20190912/5g/how-south-korea-built-5g-and-what-its-learning>

<sup>12</sup> <https://www.nyu.edu/about/news-publications/news/2015/january/the-race-for-5g-.html>

Three South Korean carriers – KT, LG Uplus and SK Telecom – rolled out live commercial 5G services last December and promise a simultaneous March 2019 launch of 5G across the country<sup>13</sup>.

## 4 LEARNING FROM THE HISTORY

The main learning from the history is that the country which led the implementation of any mobile generation has reaped the most benefit out of that generation. For this part of this report, I adopted the chapter “History’s Lessons: First-Mover Advantage in Generation Transitions” by Medin & Louie (2019).

Figure 4: Learning from history

1 <sup>st</sup> to 2 <sup>nd</sup> Generation	2 <sup>nd</sup> to 3 <sup>rd</sup> Generation	3 <sup>rd</sup> to 4 <sup>th</sup> Generation	4 <sup>th</sup> to 5 <sup>th</sup> Generation
<b>Lead Country</b>	<b>Lead Country</b>	<b>Lead Country</b>	<b>Lead Country</b>
Germany with EU	Japan, then USA	USA	China
<b>Lead Companies</b>	<b>Lead Companies</b>	<b>Lead Companies</b>	<b>Lead Companies</b>
Nokia and Ericsson	DoCoMo Verizon and AT&T	Verizon and AT&T Beneficiary: Apple, Google, Facebook, Amazon, Netflix	Huawei, ZTE (China) Samsung, LG (KR) Nokia, Ericsson (EU)
<b>Advantages</b>	<b>Advantages</b>	<b>Advantages</b>	<b>Advantages</b>
European technology boomed	Japan reaped the benefits at US costs	The control of designing the 4G ecosystem. USA Products and OS are rampant	China's company designing 5G infrastructure, probable super control

Source: Author’s compilation

<sup>13</sup> <https://www.voanews.com/silicon-valley-technology/south-korea-launch-worlds-first-national-5g-networks>

## 5 MAJOR COMPANIES IN THE 5G RACE

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In this segment, I am going to look into major 5G companies from two perspective. One, how they are doing in the 5G patent race and the other is how they are doing in the 5G initiatives in real terms.

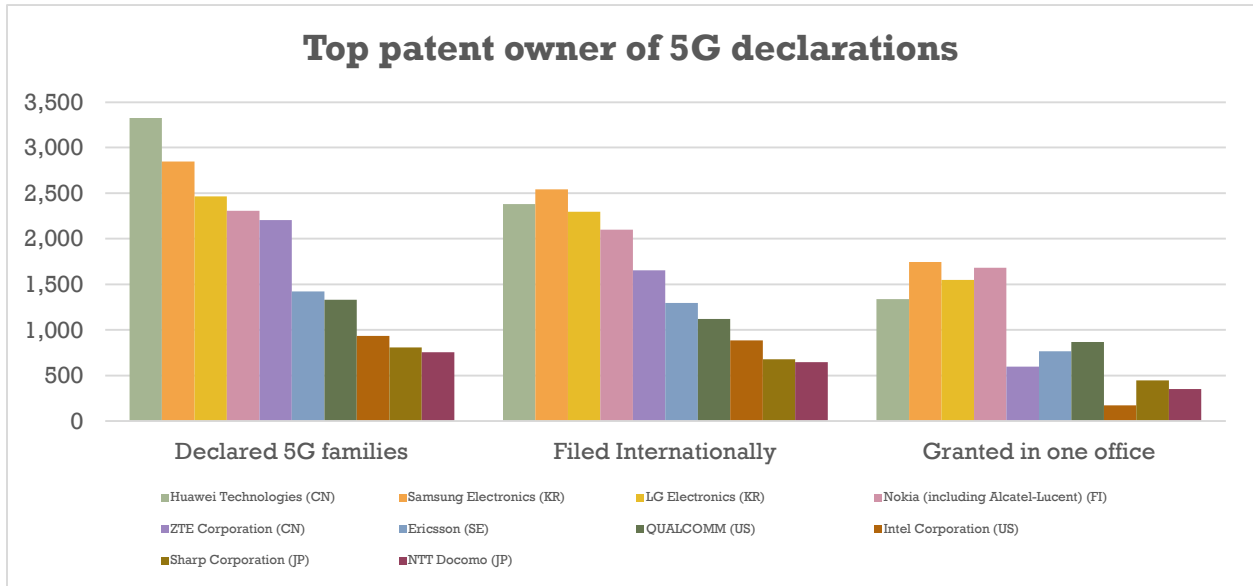
### 5.1 5G COMPANIES IN 5G PATENT RACE

Companies' development in the 5G race is usually measured in their patent ownership. The higher the number of patents a company holds, the more advanced that company is in the 5G race. Pohlmann (2019) made an analysis on the latest 5G patent race of all the company. As of November 2019 75,654 5G patent declarations were identified, which resulted in 20,194 5G patent families, of which:

- 98% are active and at least one family member has an active status (it has not lapsed, been revoked or expired);
- 78% have been filed in at least one of the following offices: the USPTO, EPO or through the Patent Cooperation Treaty (PCT) route;
- 44% include at least one granted patent;
- 24% have already been declared to preceding technology generations such as 2G, 3G or 4G; and
- 98% relate to technical specification that are classified as district 5G specification (in comparison to the 2% that relate to technical specification relating to a combination of, for example, 5G/4G or 5G/3G).

I am going to focus on the top 10 companies in this race and try to assess which company is leading the race.

Figure 5: Top patent owner of 5G declarations.

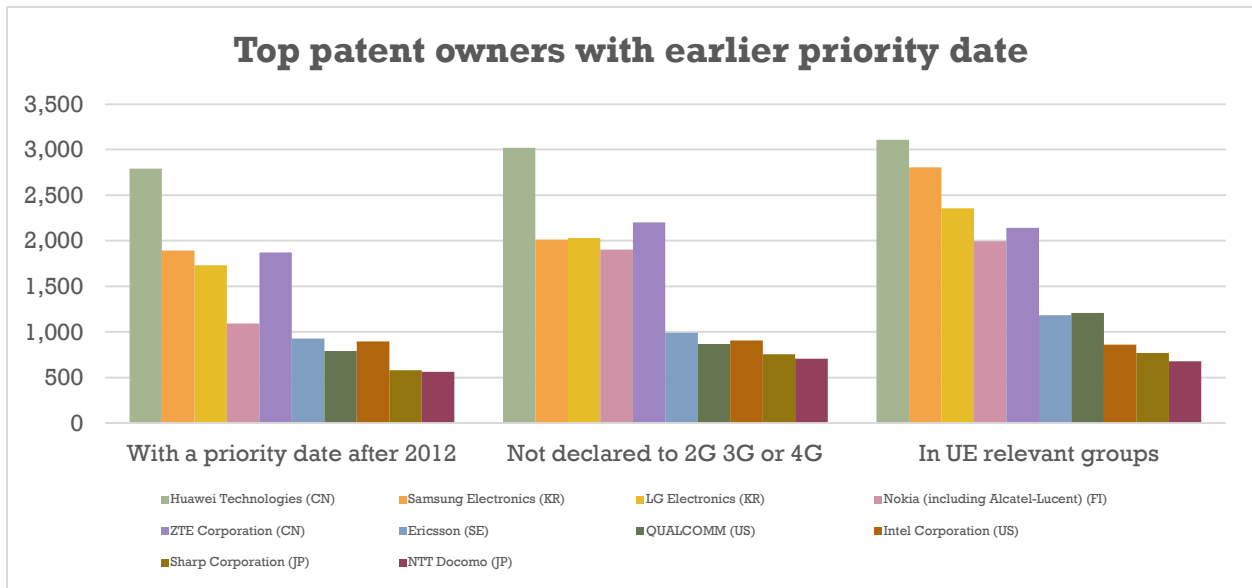


First cluster of figure 5 illustrates the top patent owners of declared 5G patent families. The Chinese company Huawei has the largest declared 5G portfolio, followed by the South Korean companies Samsung and LG and the Finnish company Nokia. Qualcomm and Intel are the largest US companies holding declared 5G patents; Sharp and NTT DOCOMO are the largest Japanese ones.

The second cluster shows the number of 5G families that have been filed internationally (USPTO (United States Patent and Trademark Office), EPO (European Patent Office) or PCT (Patent Cooperation Treaty)). Here, Samsung has the largest international 5G portfolio followed by Huawei, LG, Nokia, and Ericsson.

When counting granted 5G patent families only (third cluster), again Samsung owns the largest 5G portfolio, followed by LG, Nokia, and Huawei.

Figure 6: Top patent owners of 5G declarations as to the number of patent families as to the earliest priority date



The first cluster of figure 6 counts 5G declared patent families with the earliest priority date after 2012. It is assumed that the main inventions for 5G technologies came up in the years following 2012. The counts of 5G declarations with a priority date after 2012 show a leading position for Huawei, followed by Samsung, LG and ZTE. Only 44% of all declared 5G patent families from Nokia have a priority date after 2012. Also, the 5G portfolios of Qualcomm (62%) and Ericsson (68%) show lower counts for 5G patent families with a priority date after 2012. In comparison, ZTE or CATT and Intel have declared 5G patents that have been mostly invented after 2012 (i.e., within the time period that is considered the most likely to include new 5G inventions). This picture is consistent with earlier history section of report in which it is proved that China has refocused its technology agenda and is well ahead in the 5G race.<sup>14</sup>

In addition, IPlytics identified declared 5G patent families where at least one patent has been already declared to previous standards generations such as 2G, 3G or 4G (cluster 2 of figure 6). 90% of Huawei, 99% of ZTE, 95% of Intel and 92% of Sharp's 5G patent families have been solely declared to 5G. In comparison, Ericsson with a rate of 68%, Qualcomm's 69% and Nokia's 78% have declared many patents that were already declared to 3G or 4G years before 5G was developed.

<sup>14</sup> Huawei's official grants, disclosed in annual reports, total \$1.6 billion since 2008. In the five years to 2018, they were 17 times as large as similar subsidies reported by Nokia Corp. of Finland, the world's second-largest telecom equipment maker. Sweden's Ericsson AB, the third largest, posted none in the period.: <https://www.wsj.com/articles/state-support-helped-fuel-huaweis-global-rise-11577280736>



Finally, IPlytics counted 5G patent families declared to standards specification originating from groups RAN1, RAN2, RAN4, SA2, SA3, SA4 and CT1 that work on user equipment (UE), in comparison with groups that work on infrastructure technologies (e.g., RAN3). Again, Huawei declared the largest UE relevant 5G portfolio and the order of rank looks very similar to the overall declared number of 5G patent families (third cluster of figure 6).

Beyond the patent declaration data analysis, it is also worth examining the companies that are actively involved in the 5G standards development. The 5G standard is specified in international meetings in which companies present and submit technical contributions. Table 2 shows the top 10 companies that submitted technical contributions to 5G. Again, Huawei is responsible for most 5G contributions, followed by Ericsson, Nokia, Qualcomm and ZTE.

*Table 2: Top companies in 5G standards development.*

<b>No.</b>	<b>Contributing company</b>	<b>5G contributions</b>	<b>First contributor</b>	<b>Weighted</b>	<b>In UE relevant groups</b>	<b>Approved</b>
<b>1</b>	Huawei Technologies (CN)	19,473	17,466	11,992	11,662	5,855
<b>2</b>	Ericsson (SE)	15,072	13,195	12,690	8,936	5,114
<b>3</b>	Nokia (including Alcatel-Lucent) (FI)	11,555	9,633	5,314	7,195	3,804
<b>4</b>	QUALCOMM (US)	5,994	4,846	4,629	4,160	1,994
<b>5</b>	ZTE Corporation (CN)	4,692	3,628	3,492	3,117	1,188
<b>6</b>	Samsung Electronics (KR)	4,573	3,541	3,434	3,539	1,239
<b>7</b>	Intel Corporation (US)	3,656	2,895	2,752	2,798	962
<b>8</b>	LG Electronics (KR)	2,578	1,966	1,880	2,129	685
<b>9</b>	China Mobile (CN)	2,567	1,748	1,737	1,437	787
<b>10</b>	CATT (CN)	2,562	2,050	2,026	1,979	554

In many cases, standards contributions are submitted by several companies. In general, there is a main company that is responsible for the contribution and other companies join later to submit it. The first column is a count of all the companies that have been in a group that submitted the standard contribution, while the second column counts contributions for the first contributor only.

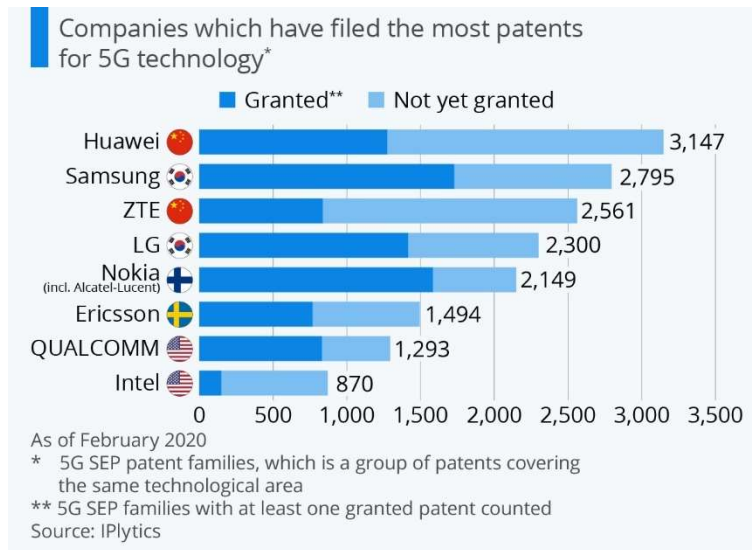
A different way of counting contributions made by multiple companies is to calculate its share. For example, if there are four companies submitting a contribution together, each company will receive a pro rata value of 0.25. The third column represents the counts of proportionate standards contributions (i.e., how many contributions the company made proportionately).

After applying this weighting, Ericsson has submitted more pro rata standards contributions than Huawei for 5G, since Ericsson has made many standard contributions alone.

### 5.1.1 Summary

To sum up the whole 5G race, following graph with the latest data gives a snapshot.

Figure 7: Companies leading the 5G race.



## 5.2 COMPANIES IN 5G INITIATIVES

It is not enough to have only patents. The companies will have to step up in their 5G implementation strategies in real terms because that would ultimately decide which company is going to reap the most benefits out of 5G revolution. According to my analysis while Samsung has already achieved significant number of first initiatives leading the way in the 5G innovations, Huawei is well ahead in term of 5G station setup, thanks to its mammoth domestic market and Ericsson is the only company which has operations in all continents, thanks to its western origination<sup>15</sup>. In this section, I am going to summarize some of the significant achievements of 5 major 5G companies:

<sup>15</sup> 5G Market Research: What are the top companies? - <https://www.greyb.com/companies-working-on-5g-technology/#Samsung-Electronics>

### 5.2.1 Samsung Electronics

Samsung started researching on 5G technology in 2011. Since then, the company has achieved a lot in the next generation of technology and can now be considered as one of the leaders in the 5G domain. Not only in the telecom sector, but Samsung is one of the few companies that is also leading in the 5g chipset market. Following is some of their biggest achievements:

- In May 2013, Samsung had successfully developed the world's first adaptive array transceiver technology<sup>16</sup> operating in the millimeter-wave Ka bands for cellular communications. The new technology sits at the core of the 5G mobile communications system and provides data transmission several hundred times faster than the current 4G networks.
- In Feb 2016, Samsung Electronics and Deutsche Telekom showcased the world's first end-to-end 5G demonstration at Mobile World Congress 2016<sup>17</sup>.
- In March 2016, Samsung demonstrated the World's first mm Wave Multi-cell handover<sup>18</sup>.
- In June 2016, Samsung announced the development of breakthrough 5G-ready antenna and power amplifier technologies to enable smaller, more energy-efficient 5G equipment and devices<sup>19</sup>.
- In November 2016, Samsung Electronics successfully conducted a 5G prototype trial in conjunction with the China Mobile Research Institute (CMRI).<sup>20</sup>
- In February 2017, Samsung and Verizon completed the deployment of 5G systems in five U.S. cities in preparation for beginning customer trials of 5G technology.<sup>21</sup>
- In the same month, Samsung and Deutsche Telekom successfully showcased 5G Guaranteed Latency (GLA).<sup>22</sup>

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<sup>16</sup> <https://news.samsung.com/global/samsung-announces-worlds-first-5g-mmwave-mobile-technology>

<sup>17</sup> <https://www.androidauthority.com/samsung-and-deutsche-telekom-60ghz-5g-mwc-675464/>

<sup>18</sup> <https://news.samsung.com/global/video-samsungs-latest-5g-milestone-multi-cell-handover>

<sup>19</sup> <https://www.fiercewireless.com/tech/samsung-touts-breakthrough-5g-ready-antenna-power-amplifier-at-28-ghz>

<sup>20</sup> <https://www.eiu.com/industry/article/1294801313/china-mobile-conducts-5g-prototype-trial-with-samsung/2016-11-10>

<sup>21</sup> <https://www.telecomlead.com/5g/verizon-deploys-5g-systems-in-5-u-s-cities-for-trials-with-samsung-74650>

<sup>22</sup> <https://www.sammobile.com/2017/02/27/samsung-demonstrates-5g-guaranteed-latency-with-deutsche-telekom-at-mwc-2017/>

- In 2018, Samsung had developed the world's first complete commercial 5G FWA solutions, got selected by Verizon, AT&T, Sprint, and SK telecom to supply the telco with commercial 5G network solutions, successfully completed a 5G field trial, completed a real-time free-viewpoint video streaming test using 5G-supporting devices, started operations in Russia, and some more.<sup>23</sup>
- In 2019, Samsung completed the development of its cutting-edge mm Wave Radio Frequency Integrated Circuits (RFICs) and Digital/Analog Front End (DAFE) ASICs, supporting 28 GHz and 39 GHz bands, announced an agreement to conduct Italy's first 5G Fixed Wireless Access (FWA) trial on the commercial spectrum, unveiled two promising industrial 5G applications – a drone and an industrial robot with CISCO and Orange, announced a collaboration with IBM leveraging IBM's Cloud and AI capabilities and Samsung's mobile devices, announced the successful integration of a cloud-native 5G standalone (SA) Core with Hewlett Packard Enterprise (HPE) and Openet and many more.
- In 2020, Samsung announced a partnership with BMW to showcase new approaches to create future mobility experiences with the world's first commercialized 5G TCU (Telematics Control Unit), announced a commercial agreement with U.S. Cellular for 5G and 4G LTE network solutions, announced an agreement with Spark, New Zealand's largest mobile carrier, for building Spark's 5G networks in 2020, achieved the industry's fastest 5G speeds in a demo by combining 800 MHz of mm Wave spectrum with Multi-User MIMO technology, and many more.

### 5.2.2 Huawei Technologies

Huawei has been pouring money into research on 5G wireless networks and patenting key technologies. The company has hired many experts from abroad as well to decide the technical standards for the next-generation wireless communication technology.

Below listed are some of the major activities of Huawei in the 5G domain.

- As of early 2017, 10% of 1450 patents essential for 5G networks were in Chinese hands in which the majority belong to Huawei and ZTE. Qualcomm possessed 15% of them. However, in the later years, as we have seen in earlier chapters, Huawei made the best of its research budget and currently leading the race.

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<sup>23</sup> <https://www.greyb.com/companies-working-on-5g-technology/#Samsung-Electronics>

- Huawei spent around \$12bn on R&D in 2017 which was threefold of Ericsson spending of \$4.1 bn. In 2018, it planned to spend \$800 million alone in 5G research and development.
- The focus of this company is to involve AI in 5G. In 2018, Huawei and Vodafone made the world's first 5G call, and launched its 5G customer-premises equipment (CPE), the world's first commercial terminal device supporting the 3GPP standard for 5G.
- In 2019, officially completed the third phase of the China 5G Technology R&D (Research and Development) Trial, collaborated with Bell to provide fiber-like mobile home broadband service across Canada, started installing 5G equipment in Thailand, Saudi Arabia, and India.
- In 2020, working with chip supplier STMicroelectronics to develop silicon for its mobile and automotive products, established an alliance with 18 automakers in a bid to build a 5G-enabled automobile ecosphere, revealed that the company apparently built over 200,000 5G base stations in its home countries, and the company chief expects a total of 800,000 to be in place by the year-end covering 340 different cities.

### **5.2.3 Ericsson**

Ericsson claims to be the only vendor that is currently working on all continents to make 5G a global standard for the next generation of wireless technology. Their 5G radio prototypes are the first products designed to enable operators to conduct live field trials in their own networks which helps operators to get a greater understanding of the potential of 5G in their own networks and environments. Given their expertise in the 5G domain, many companies across the globe have collaborated with Ericsson.

- In 2017, the company joined with Celcom Axiata Berhad for first-ever 5G testing in Malaysia, in collaboration with Batelco conducted Bahrain's first 5G trial, with Korea Telecom and Intel conducted a 5G trial connecting a car to a live 5G network right in the center of Seoul, partnered with Indian telecom Bharti Airtel for 5G, showcased the first-ever live 5G demonstration in India, alliance with Australian telecom NBN for kicking off 5G trials in Melbourne, and many more.
- In 2018, Ericsson was selected by Italian operator Wind Tre to virtualize its core network as part of the evolution of its network to 5G Core, Telia, Ericsson and the KTH Royal Institute of Technology announced their partnership to boost the development of 5G in Sweden, partnered with AT&T, Fox Sports, Fox Innovation Lab, and Intel to

enable FOX Sports to broadcast 4K video wirelessly over 5G at the 2018 U.S. Open, showcased the first live demonstration of 5G technology in the Philippines, inked a new deal with Telenor Group, the Norwegian multinational telecommunications company, to transform its core network in Sweden, Denmark, and Norway, and many more.

- In 2019, Ericsson, Huawei, and Nokia agreed to initiate discussions to extend an OSSii (Operation Support System Interoperability Initiative) Memorandum of Understanding (MoU) to cover 5G network technology, signed a sales channel partnership agreement to allow STCS to resell Ericsson hardware, software, post-warranty, and training across networks, digital services, managed services, emerging business & technology business units to end-users – including STC subsidiaries such as VIVA Kuwait and VIVA Bahrain, selected by Etisalat to deploy a 5G radio network in the United Arab Emirates (UAE) to help position the UAE at the forefront of 5G network deployment globally, and many more.
- In 2020, achieved 4.3Gbps – the fastest 5G speed to date, announced that its smart factory in Lewisville, Texas, produced its first 5G base station, announced that it's been selected by Taiwan's largest telecom service provider, Chunghwa Telecom Co. Ltd. to provide the 5G platform to support its future network, agreed to a five-year contract for the deployment of 5G in Hong Kong with SmarTone, one of the leading communication service providers in Hong Kong, selected by Greece's largest mobile communications service provider COSMOTE under a major network modernization deal for its sole 5G Radio Access Network (RAN) vendor, announced that VodafoneZiggo, the leading Dutch communications service provider, is launching 5G with Ericsson Spectrum Sharing and Ericsson 5G Core, announced that Europe's largest 5G research network went live in Aachen Germany that is powered by Ericsson 5G products and solutions, announced the partnership with China Telecom and China Unicom to deploy its Radio System products and solutions, including Ericsson Spectrum Sharing, and secured 91 commercial 5G agreements with unique communication service providers, of which 36 are live networks.

#### **5.2.4 Qualcomm**

Qualcomm, one of the leading 5g chip makers, is also leading in the overall 5G spectrum. While other companies are talking about 5G, Qualcomm is actually building the technologies. Unlike telecom companies, Qualcomm focuses more on building products.

- world's leading mobile network operators including AT&T, Verizon, China Mobile, Deutsche Telekom, NTT DoCoMo, SK Telecom declared to use the Qualcomm Snapdragon X50 5G modem to ascertain the performance of these emerging networks.
- In February 2018, Samsung and Qualcomm announced their intention to expand their decade-long foundry relationship into EUV (extreme ultraviolet) lithography process technology, including the manufacture of future Qualcomm® Snapdragon™ 5G mobile chipsets using Samsung's 7-nanometer (nm) LPP (Low Power Plus) EUV process technology.
- In 2019, announced an expansion of its 5G test networks to include new end-to-end over-the-air (OTA) configurations for both millimeter-wave (mm Wave) and sub-6 GHz bands, announced 2nd generation Qualcomm Connected Car Reference Design, which features a highly advanced suite of connectivity technologies, precise positioning technology, and integrated processing, announced at MWC 19 Barcelona its first 5G customer premise equipment (CPE) reference design for sub-6 GHz and millimeter wave (mm Wave) 5G fixed wireless broadband (FWB) products, announced the PC industry's first commercial 5G PC Platform, the Qualcomm® Snapdragon™ 8cx 5G compute platform, Tata Consultancy Services and Qualcomm announced the launch in Hyderabad of an innovation hub which will be used — with support from Qualcomm Technologies, announced that it is working with Reliance Jio, Flipkart, and Amazon India to build new use cases for 5G, revealed the world's first 5G-supported extended reality (XR) platform along with two new 5G Snapdragon mobile platforms and many more.
- In 2020, Qualcomm showed the world its expertise by unveiling its Snapdragon X60 5G modem for the upcoming 5G smartphones to boost wireless signal speed, announced a complete end-to-end solution with ZeroLight that will utilize the XR2 and 5G, announced that together with Fujitsu, they successfully completed a 5G NR data call using 5G sub-6 GHz carrier aggregation and many more.

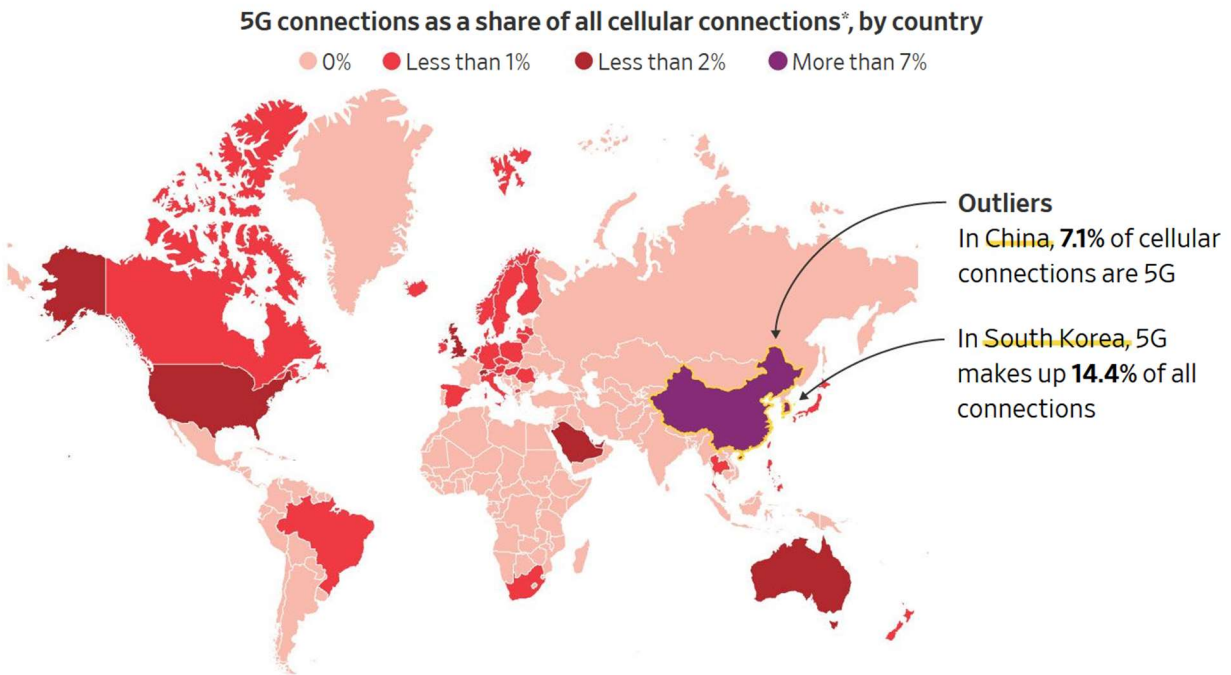
### **5.2.5 Other companies**

I have only described some of the major accomplishments of four companies representing four different countries. There are other companies like Nokia, ZTE, Intel, CISCO and more which have made tremendous achievements. In the next chapter I look into the countries in the 5G race.

## 6 UPDATE ON THE 5G RACE OF COUNTRIES

Though the road to 5G has just started as shown by the following figure, I try to give the latest update on the development of 5G worldwide:

Figure 8: 5G connections as a share of all cellular connections by country.



\*Excluding licensed cellular IoT (Internet of Things) connections

Note: Data as of Sept. 30, 2020

Source: GSMA Intelligence

### 6.1 CHINA

“By most measures, China is no longer just leading the U.S. when it comes to 5G. It is running away with the game.” (Strumpf, 2020)

China has more 5G subscribers than the U.S., not just in total but per capita. It has more 5G smartphones for sale, and at lower prices, and it has more widespread 5G coverage. Connections in China are, on average, faster than in the U.S., too.

China has taken the lead in 5G development through a series of aggressive investment and spectrum-allocation initiatives. In addition to investing \$180B in capital expenditure for 5G deployment over five years, China assigned 200 MHz of mid-band spectrum to its three state



providers and is considering reallocating 500 MHz of C-band spectrum as well.<sup>24</sup> Domestically, China's 5G deployment is being implemented through its major telecommunications companies (China Mobile, China Unicom, and China Telecom). All three are primarily focused on developing a standalone 5G network in China, with plans to deploy pre-commercial application in 2019 and formal commercial application in 2020. China now has ~700,000 5G-operable base stations deployed, which is more than 50 times as many as are deployed in the United States.<sup>25</sup> Globally, China's large manufacturers (Huawei and ZTE) are pushing 5G deployment through commercial sales of 5G-enabling equipment and devices primarily for non-standalone networks, and Huawei has already shipped upwards of 10,000 base stations overseas.

Overseas, China has been developing partnerships with countries and foreign companies to expand its 5G influence. In Europe, Huawei and ZTE are offering their services to build individual countries' 5G networks and have signed multiple 5G contracts despite pressure from U.S. officials demanding that allies block Chinese companies. Additionally, China has invested significant time and resources into its Belt and Road Initiative, including a push for Chinese-built network infrastructure to provide connectivity across the length of the route. Huawei is expected to continue growing that share as more 5G networks are rolled out relying on Chinese telecommunications equipment. These efforts will allow China to promote its preferred standards and specifications for 5G networks and will shape the global 5G product market going forward.

In aggregate, these approaches have given competitive advantage to China in 5G technology and capability. China's 5G strategy should be viewed in the context of the Chinese Communist Party's (CCP) grand strategy. Like artificial intelligence (AI), 5G development is a crucial component of Xi Jinping's "China Dream" vision and "Made in China 2025" roadmap. Social stability and economic growth are the CCP's top priorities because failures in those two areas are seen as direct existential threats to the regime, and 5G has the potential to transition China from a capital- and labor-intensive manufacturing economy to an innovation-led, consumption-driven economy with reduced dependence on foreign investment. In light

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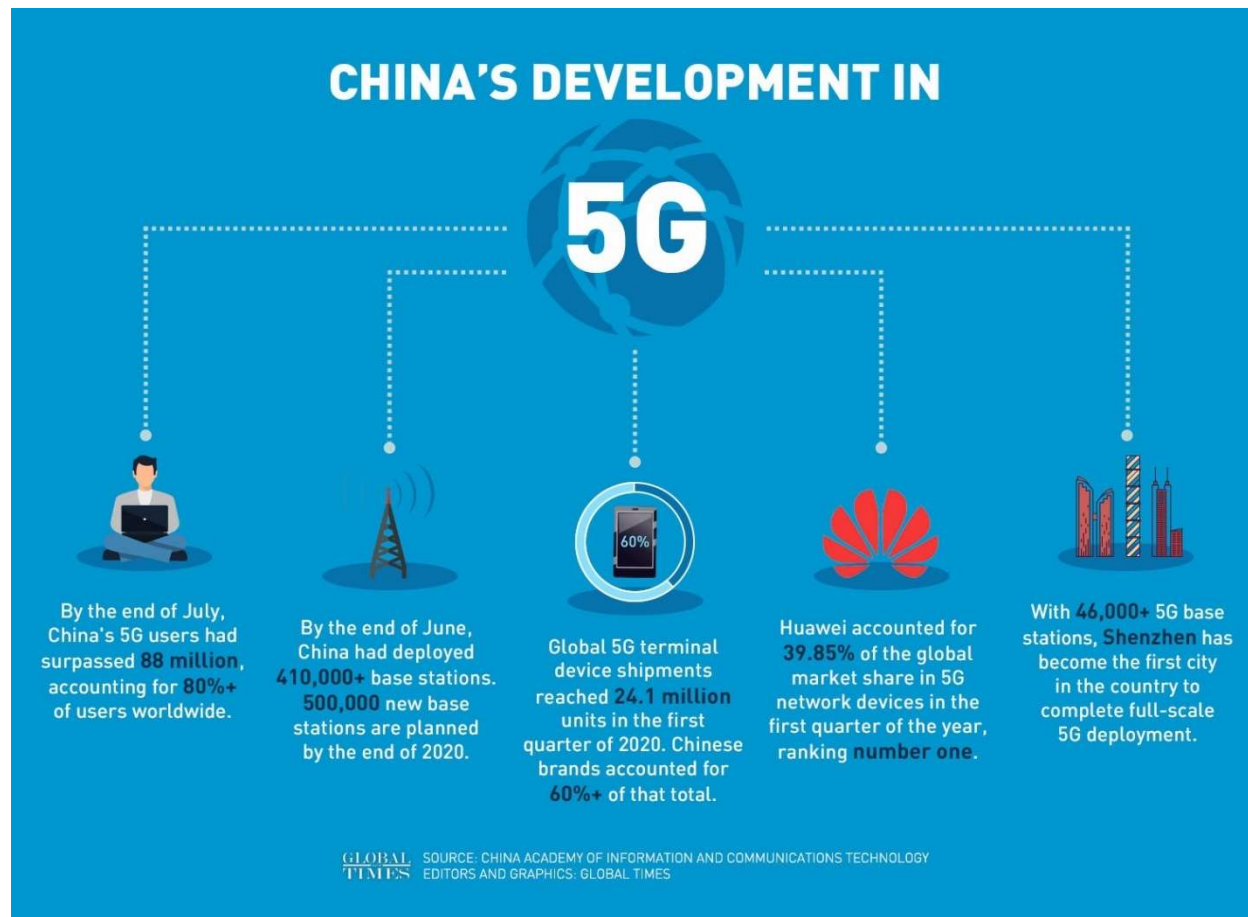
<sup>24</sup> Edison Lee and Timothy Chau, "Telecom Services: The Geopolitics of 5G and IoT," Jefferies, September 14, 2017,

<https://www.jefferies.com/CMSFiles/Jefferies.com/files/Insights/TelecomServ.pdf>.

<sup>25</sup> <https://www.rcrwireless.com/20201023/5g/chinas-5g-infrastructure-push-continues-to-accelerate>

of China's slowing growth and its ongoing trade war with the United States, the CCP likely feels pressured to pursue technological advancement initiatives like 5G more aggressively.

Figure 9: China's development in 5G.



## 6.2 SOUTH KOREA

South Korea is closely following China in 5G maturity due to its early auction of spectrum and its general commitment to wireless technology. The South Korean government has built a clear roadmap including healthy investment to pursue 5G; in 2014, South Korea committed \$1.5B to promote 5G adoption and deployment by 2020, and in 2017, South Korea released its national broadband and spectrum plan (“K-ICT”) to further promote 5G.<sup>26</sup> In line with the K-ICT plan, South Korea's Ministry of Science and ICT (MSIT) has since auctioned over 1,000 MHz of spectrum in the sub-6 and mm Wave ranges to its three largest telecommunications

<sup>26</sup> Lee Kangwook, “South Korean Government to Introduce K-ICT Spectrum Plan,” December 23, 2016, <http://www.ipnomics.net/?p=16629>.

providers (SK Telecom, KT Corp, and LG Uplus). South Korea has closely partnered with AT&T and Verizon to develop 5G mm Wave networks but has spread its risk in pursuing both sub-6 and mm Wave by making its devices functional in both parts of the spectrum (as in the case of its Exynos 5100 5G modem). AT&T is also working with Samsung to release a cell phone with mm Wave and sub-6 capabilities at the end of 2019, but these dual-function devices may have less capability in the United States, given the restricted range of sub-6 spectrum available.

South Korea was able to leverage the 2018 Winter Olympics in PyeongChang to showcase its 5G investment and conduct various network trials. South Korean industry already promotes high-intensity competition for 4G and LTE network technologies, which will fuel further rapid development of 5G. SK Telecom currently leads the field in investment and 5G trials and was also able to acquire the largest amount of spectrum bandwidth in the 2018 MSIT auction, but all three telecoms providers plan to synchronize their launches of 5G cellular service in early 2019 for “Korea 5G Day.” South Korea is well-positioned in the 5G field and will likely continue to be a leader going forward as its major telecom providers take advantage of their newly auctioned spectrum bandwidth.

### **6.3 JAPAN**

Japan is following closely behind China, South Korea, and the United States in 5G capability. Japan has not yet auctioned off key parts of its spectrum bandwidth to commercial providers but has plans to do so in 2019 and is currently developing both mm Wave and sub-6 options (mm Wave is being applied to limited, densely populated geographic areas, while sub-6 is being used to cover the rest of the territory). Similar to South Korea, Japan hopes to use the 2020 Olympics in Tokyo to showcase and test 5G technologies and networks and is driving most of its investment and activity around that 2020 timeline. In 2014, Japan stood up its 5G Mobile Forum (5GMF) to promote 5G research and development, coordinate 5G efforts across organizations, and promote general awareness of 5G.<sup>10</sup> In 2016, Japan’s Ministry of Internal Affairs and Communication (MIC) released a strategy document (“Radio Policy to Realize 5G in 2020”) that mapped out its commitment to and future deployment of 5G.<sup>27</sup>

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<sup>27</sup> Kunko Ogawa, “Radio Policy to Realize 5G in 2020,” Ministry of Internal Affairs and Communication (MIC), June 28, 2016, [https://www.gsma.com/spectrum/wp-content/uploads/2016/08/MIC\\_Spectrum-for-5G-MIC-Kuniko-OGAWA.pdf](https://www.gsma.com/spectrum/wp-content/uploads/2016/08/MIC_Spectrum-for-5G-MIC-Kuniko-OGAWA.pdf).

Japan's three major telecoms providers (NTT DOCOMO, KDDI, and Softbank) are all in the process of testing 5G technologies with the intention of launching in 2020 before the Olympics. All three companies are conducting trials in the sub-6 and mm Wave ranges, and MIC has conducted a "5G System Trial" in Tokyo and rural Japan.

## 6.4 THE USA

The telecommunications industry is organizing the effort to develop and deploy 5G in the United States, with increasing support from the U.S. government. Verizon, AT&T, Sprint, and T-Mobile are all developing their own 5G networks and 5G devices, each with their own strategy and method. Verizon and AT&T are focused on developing high-band mm Wave networks and are in the process of deploying small cells in various test cities for mobile and fixed applications, Sprint is taking a joint approach of mm Wave and mid-band spectrum to build out its network, and T-Mobile is focused on mm Wave and low-band spectrum. While all carriers are looking into sub-6 spectrum options to some extent, they are inherently restricted by smaller amount of bandwidth available in sub-6 relative to the hundreds of GHz available in mm Wave, and this constraint is exacerbated by the fact that the U.S. government owns large portions of the sub-6 spectrum. Carriers are piggy-backing off of existing 4G infrastructure, but those focused on mm Wave will have to build out additional infrastructure to ensure uninterrupted connectivity through a dense network of base stations. There is debate over whether some of the networks deployed have qualified as true 5G, and there is intense competition between these providers to roll out 5G networks within the next few years. 5G development is being overseen by 3GPP (3rd Generation Partnership Project), the standards body that also oversaw the development of 3G UMTS (including HSPA) and 4G LTE standards.

There is the risk that these carriers will not even be able to commit the necessary capex to scale those mmWave networks, given the large number of base stations required. At the end of 2018, Verizon held ~\$120B in debt with ~4% dividend yields, while AT&T held ~\$175B in debt with over 6% dividend yields.<sup>28</sup> T-Mobile holds ~\$25B in debt, and Sprint holds ~\$40B in

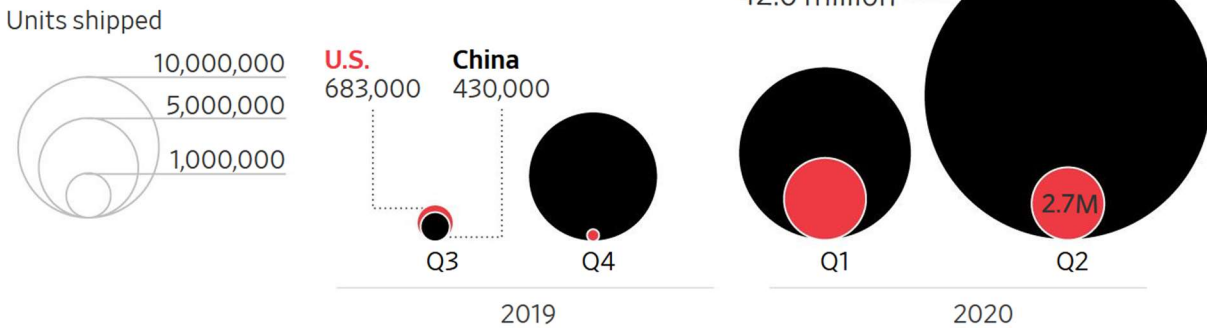
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<sup>28</sup> "Schedule of Outstanding Debt," Verizon, accessed March 20, 2019, <https://www.verizon.com/about/investors/schedule-outstanding-debt>; "Debt Detail as of December 31, 2018," AT&T, accessed March 20, 2019, [https://investors.att.com/~media/Files/A/ATT-IR/financial-reports/debt/2018/4q18/Debt\\_List\\_4Q18.pdf](https://investors.att.com/~media/Files/A/ATT-IR/financial-reports/debt/2018/4q18/Debt_List_4Q18.pdf).

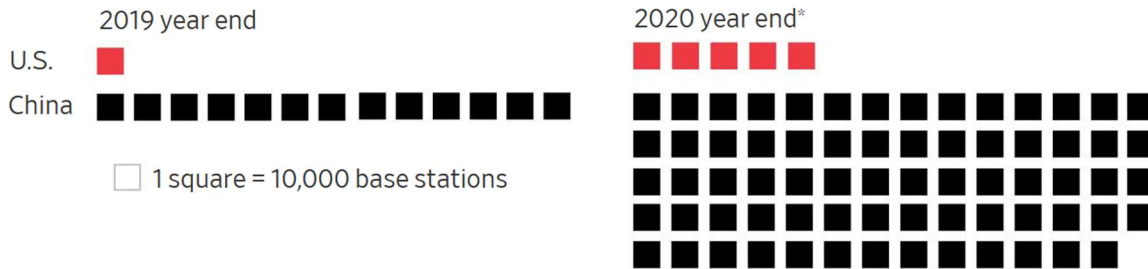


Figure 10: 5G performance of USA compared with China<sup>33</sup>.

**Shipment of 5G smartphones**



**Base stations**



\*Forecasted

Sources: Canalis (shipments); International Business Strategies Inc. (stations)

**6.5 REST OF WORLD (NON-US)**

While China, South Korea, the United States, and Japan lead the field, the rest of the world is playing catch-up on 5G deployment. The United Kingdom, Germany, and France can be considered “second tier” 5G developers, while Singapore, Russia, and Canada make up the “third tier,” and the rest of the world comes after. These countries are beginning to auction off spectrum bandwidth with varying timelines and volume of spectrum made available, but many lack any formal policies or strategies to enable 5G implementation and most anticipate 5G launches outside of the 2020 timeframe (Medin & Louie, 2019).

<sup>33</sup> <https://www.wsj.com/articles/u-s-vs-china-in-5g-the-battle-isnt-even-close-11604959200>

## 7 ANALYSIS: WHY ALL THE HASSLE?

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In this segment of the report, I analyze the reasons why the countries are so aggressive when it comes to 5G. According to my analysis, there are three reasons, such as the following:

*Figure 11: Reasons for 5G race.*



Each of the above perspectives, explains this 5G race on a different note and will help us understand the 5G war in a little bit more comprehensively.

### 7.1 PURE BUSINESS AND GROWTH PERSPECTIVE

This perspective is the most obvious one. With 5G domination, every country is poised to achieve an unprecedented business growth. The economy gets a boost, and the wheels industrial development runs faster. In this perspective, I take on the previous examples of mobile generation domination and the benefits countries got from this and try to forecast the business benefits of 5G for the winning country.

For this segment, I adopt the analysis done by Recon Analytics (2018). Countries that lead the move from one generations to other, historically won big. I try to summarize the benefits of leading each generations below:

#### 7.1.1 2G Era: Led by Europe

The European community and its manufacturers adopted a single digital standard—GSM—and common spectrum bands to establish a broad base of networks and users to serve as the foundation for technological innovation (Recon Analytics, 2018).

- Germany was first in 2G, with France, the UK, Italy, Spain, and other European countries' carriers' 2G networks all up and running with substantial adoption ahead of



other countries and regions. By the mid-1990s, Europe had the most widespread adoption of 2G, with key European countries reaching 80% penetration.

- European consumers and companies, like Nokia and Ericsson, reaped the benefits of technology leadership because they had the most advanced networks supporting the most advanced devices at an earlier date.
- 2G leadership enabled the rise of the European wireless tech industry, ranging from Nokia, Ericsson, Alcatel, and Siemens, which employed hundreds of thousands of people.
- In 1993 Ericsson accounted for 60% of the global market for digital cellular equipment, while Nokia became the largest mobile phone supplier in Europe, and second largest in the world<sup>34</sup>.
- By the end of the decade, Ericsson accounted for 50% of global GPRS (2.5G) sales, as well<sup>35</sup>.
- That year, in 2000, Nokia's exports were 24% of total Finnish goods and service and approximately 80% of the telecommunications equipment the country exported<sup>36</sup>.
- Nokia shares also made up 70% of the market value of the Helsinki stock exchange. At one point, the Helsinki stock exchange removed Nokia—representing more than half of the market capitalization of companies listed at the Helsinki stock exchange—from its index because that index reflected the performance of Nokia more than the Finnish economy as a whole.

### 7.1.2 3G Era: Led by Japan

While European operators spent heavily on 3G wireless licenses, they become hesitant when it was time to invest in actually building 3G networks because they viewed the business case as uncertain. This was partially because Europe had not built an effective ecosphere around the Symbian operating system (Recon Analytics, 2018).

- In 1999, in the late stages of 2G, i-mode was created and provided Japanese carriers with the business cases needed to spur investment in new 3G networks.

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<sup>34</sup> Tuna Baskoy, *The Political Economy of European Union Competition Policy: A Case Study of the Telecommunications Industry* (2008), <https://books.google.com/books?isbn=1135890145>

<sup>35</sup> "Survey-Nordic IT," *Financial Times*, May 11, 2000, in Timothy Bresnahan, Alfonso Gambardella (eds) *Building High-Tech Clusters: Silicon Valley and Beyond* (2004), <https://books.google.com/books?isbn=0521827221>

<sup>36</sup> Source: OECD Economic Surveys: Finland 2002, page 21, Box 1 "Nokia fact sheet" (<https://books.google.com/books?id=5b3LXKJpiEQC&pg=PA21&lpg#v=onepage&q&f=false>)



- i-mode's closed ecosystem made it very straightforward for companies to get paid for their services and consumers to pay for services rendered.
- Consumers that used an i-mode service—ranging from directions to social networks—paid on a per-packet basis and partner companies received 91% of the proceeds. This led to rapid adoption of the i-mode service and a proliferation of services that utilized the carrier's network. i-mode developers were earning \$9 billion a year by 2007 and \$12.8 billion by 2008.
- With this cycle of momentum in the mobile ecosystem, Japan quickly reached 50% 3G penetration in 2007. At the same date, Germany had only 12% and Italy had 25% 3G adoption. In contrast, the US had 3.5% penetration of 3G in 2007—the same year the 2G iPhone was launched.

### 7.1.3 4G Era: Led by the USA

While the US had been slow to roll-out 3G, they corrected their error, as advanced smartphones made a major impact, industry investment grew, and regulators made smart wireless policy decisions. This contributed to a late U.S. rally in 3G that laid the groundwork for the US' 4G leadership, much as i-mode had done for Japan in the 2G to 3G transition (Recon Analytics, 2018).

- The US created a solid foundation and gained 4G leadership—and a host of American companies created an entire ecosphere with consumers benefitting handsomely from it.
- Apple not only grew its market share in Japan—it dominated the market entirely. In 2017, it controlled nearly 70% of the Japanese smartphone market, holding double the share of all the other companies combined.
- In 2009 Japan's domestically developed Linux-based mobile OS had a 39.9% share of the market, while Symbian held more than 50%. At that time, the new entrants, iOS, and Android, held a combined total of 8.1% of the mobile OS market. By 2012, the new entrants' share had risen to 81.6%, while Linux had fallen to 9.1%, and Symbian to 9.2%. By the beginning of 2016 iOS and Android accounted for 99.3% of mobile OS in Japan<sup>37</sup>.

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<sup>37</sup> <http://gs.statcounter.com/os-market-share/mobile/japan/#quarterly-200901-201704>

- In 2011, wireless industry GDP totaled \$195.5 billion. In 2014, when 4G reached 40% penetration in the US, wireless industry GDP was \$332.9 billion. In the space of three years, the GDP contribution of the US wireless industry had grown 70%.
- The US' 4G leadership was responsible for \$43.6 billion of the increase in GDP between 2011 and 2014, as Exhibit 5 shows, contrasting the impact of 4G's immediate availability on actual GDP compared to the GDP projected based on the prior 3G trajectory.
- The impact of the US' 4G lead grew even more in 2016, when the difference between the prior 3G trajectory and 4G's reality amounted to almost \$100 billion in additional annual GDP.
- The \$445.0 billion in realized GDP in 2016 is a product of the advantages provided by accelerated 4G-based network coverage and speed, and the expanded economic activity surrounding, supporting, and being supported by these core networks, including imports and exports.
- In the 3G era, total core wireless (direct, indirect, and support) jobs grew 4% from 2.4 million in 2004 to 2.5 million in 2011. In the period of the 4G launch, from 2011 to 2014, these core wireless jobs grew 84%.

#### **7.1.4 Expected Benefits of 5G**

Now we can take the learning from the earlier generations and try to predict what benefits 5G may bring to the leading country:

##### **7.1.4.1 Trends in the earlier generations**

- In the 3G era, total core wireless (direct, indirect, and support) jobs grew 4% from 2.4 million in 2004 to 2.5 million in 2011. In the period of the 4G launch, from 2011 to 2014, these core wireless jobs grew 84%.
- From 2006 (in the 3G era) through 2016, the cost per MB fell 99.7%, even as data usage grew from 1.677 billion MBs in 2006 to 13.719 trillion MBs in 2016. That means U.S. wireless consumers have seen a dramatic increase in the value they get from wireless service.
- The cost per megabyte has steadily declined. For example, in 2006, it cost \$1.37 per MB. To download a typical 4 MB song, a user would spend \$5.48 using a wireless connection. Songs are bigger now because of higher encoding levels, but, even if we say the song is 10 MB, the cost of downloading that song over a wireless connection

would be significantly cheaper. The implied per-MB cost of a MB of data is an astounding \$0.003614, making that song, even at 10MB, cost about 3.5 cents.

- With the wireless ecosystem increasingly an international one, US 4G leadership has brought billions in revenues to American companies that could have gone elsewhere if the US had not seized 4G leadership. International revenues were significant in 2016 and depended on the 4G leadership that the US has built. International end-user payments to device manufacturers and resellers added up to \$64.9 billion. App and content stores saw \$25 billion in international revenues. And device component suppliers saw revenue of \$35.6 billion from international sources. In total, \$125.5 billion came into American companies that could have gone elsewhere if the US had not seized 4G leadership.
- In 2011, the stores were coming into their own, with \$8.20 billion in revenue. 2014 revenues—the first measurement reflecting the launch of the 4G network era—came in at \$38.90 billion, a delta of \$30.7 billion in three years. In 2016, revenue came in at \$54.1 billion, reflecting both domestic and international revenue.

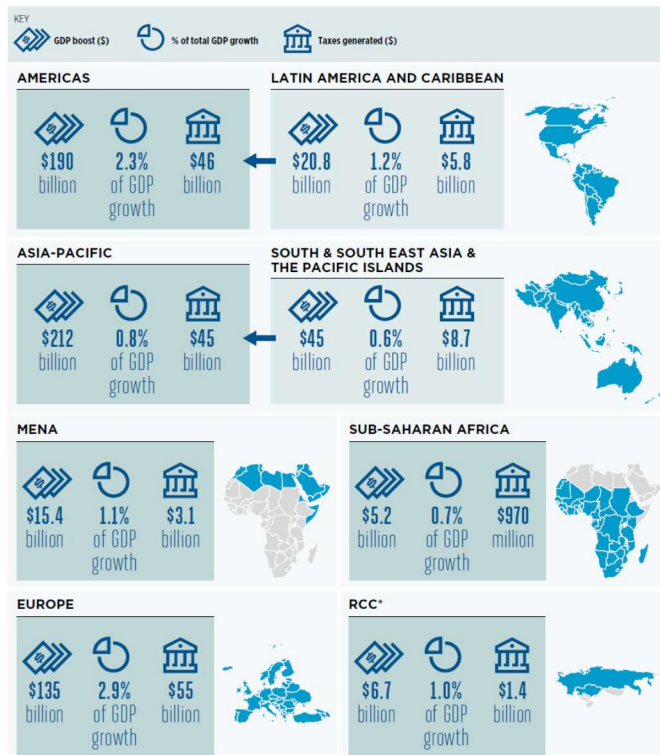
#### **7.1.5 Benefits of Leading 5G**

Following the trend of the earlier generations, 5G is expected to yield the following benefits:

- Early access to robust 5G networks could give the leading country an edge in developing and monetizing services that use them—just as Silicon Valley profited from apps like Instagram, Uber, and YouTube after 4G LTE networks launched.
- Because the US was the first country to make 4G available on a wide scale, American firms were quick to take advantage of it and sell the resulting apps globally. China's manufacturing center, Shenzhen, could tap 5G to connect huge volumes of devices to the cloud and become a leader on the internet of things (IoT) (Sun, 2018).
- The study by GSMA (2018) concludes, under conservative assumptions, that by 2034 mmWave spectrum will underlie an increase of \$565 billion in global GDP and \$152 billion in tax revenue, producing 25% of the value created by 5G (GSMA, 2018).
- There will be a \$2trn annual connectivity boost to global GDP by 2030, the McKinsey Global Institute, the consultancy's think-tank, predicts in health care, manufacturing, transport, and retail alone
- Regional break down of the benefits (GSMA, 2018):

- The Asia-Pacific and Americas regions are expected to generate the greatest share of the total contribution of mmWave 5G to the GDP, \$212 billion and \$190 billion, respectively.
- One fifth (\$45 billion) of the Asia-Pacific total (\$212 billion) is the contribution made by the region after excluding early adopters China, Japan, the Republic of Korea, Australia, and New Zealand.
- In the Americas region, a tenth (\$20.8 billion) of the total (\$190 billion) is contributed by the Latin-American and Caribbean countries.
- Europe has the highest percentage of GDP growth attributable to mmWave 5G than any other region (2.9%).
- The Americas region generates the second highest percentage of GDP growth attributable to mmWave 5G (2.3%).
- Once 5G has taken off in regions such as Sub-Saharan Africa, the annual gain from mmWave 5G will grow much faster from 2026 onwards, closing the gap between the early and late adopters.
- Following is the summary of the benefits:

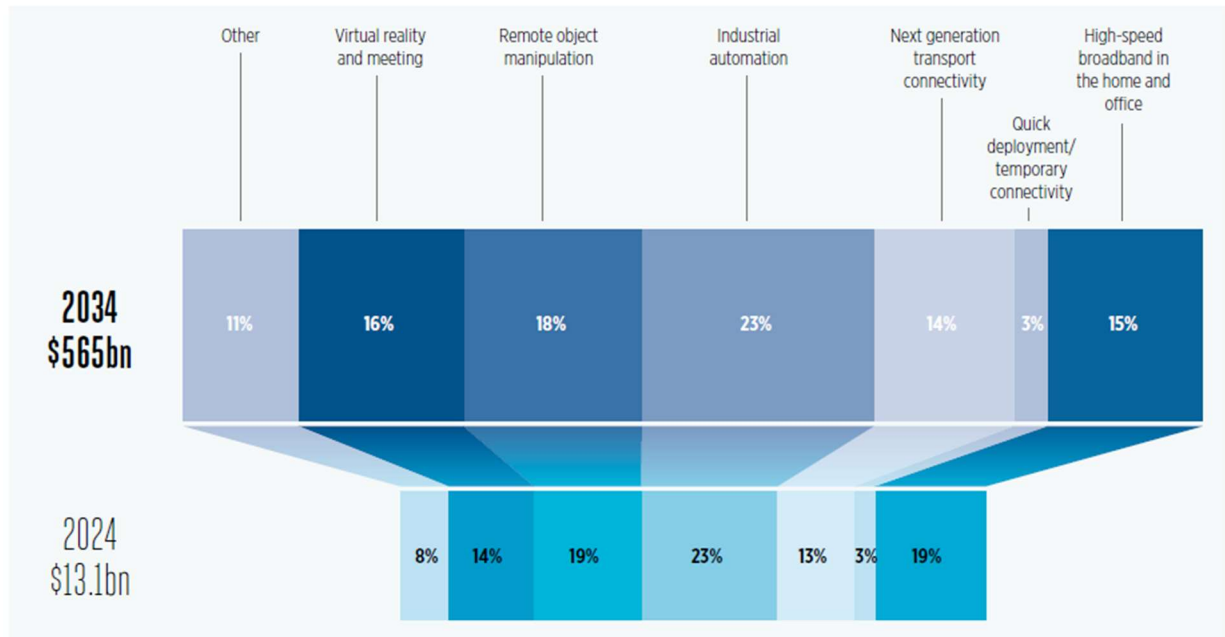
Figure 12: Region wise benefits of 5G.



Source: TMG  
 (\*) Regional Commonwealth in the field of Communications, which includes eleven countries from the former Soviet Union.

- The case wise expected contribution of 5G will be as follows:

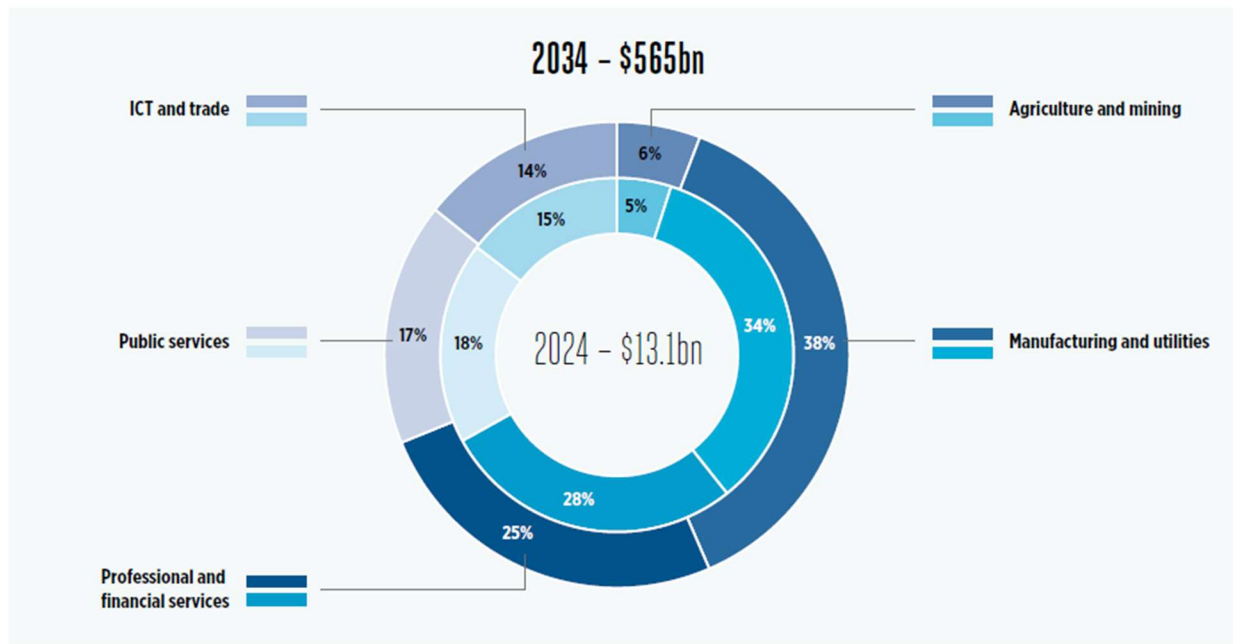
Figure 13: Case wise contribution of 5G.



Source: TMG.

- And by sector:

Figure 14: Sector wise 5G benefits.



Source: TMG.

### 7.1.6 Limitations

Considering the expected benefits, it becomes clear why any country would want to lead the 5G race. The USA and China, having the ambition to lead the world, obviously would fight over this. However, the amount of tension regarding 5G is unprecedented. The USA did not take any aggressive measures against the EU in 2G and against Japan in 3G like it took in case of Huawei, the Chinese company<sup>38</sup>. This perspective does not explain why the USA has the intention not only to accept Ericsson and Nokia, two non-US companies, but also put its “large market and financial muscle” behind them<sup>39</sup>. The earnings of those two companies will not come to US economy, just like the earnings of Huawei. Definitely something else is going on here and there come my next perspective.

## 7.2 THE CULTURAL DOMINION PERSPECTIVE

To understand this perspective, I take help of the recent trade war that happened just before the covid-19 pandemic. Why did the trade war of 2018-19 between US and China happen? The Trump administration justified their initiation of this war by blaming China for its growing negative trade balance, US job loss and alleged currency manipulation by China. But research has found that China is not the liable party for the growing negative trade balance of the USA. Instead, the USA has led its economy to become the destination of the excess savings of other developed and developing countries<sup>40</sup>. Since it became the guardian of the world and its currency became the alternative to gold after 1944 Bretton Woods Conference, the safest destination of every nation’s saving is the USA market. Over the years, the savings of the world replaced the USA savings in USA economy. Therefore, China has little to do with the negative trade balance or budget imbalance of the USA. There is also no evidence that China is responsible for the outsourcing of low-level blue-collar jobs. The developing countries are able to provide labor at a competitive rate and the companies in the pursuit of maximizing their profit take jobs outside of the USA. In fact, research suggests that it is the robots that are killing the jobs of Americans than the workers working in assembling factories of Apple in

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<sup>38</sup> <https://www.economist.com/business/2020/04/08/america-does-not-want-china-to-dominate-5g-mobile-networks>

<sup>39</sup> In February William Barr, the attorney-general, suggested that America put its “large market and financial muscle” behind Ericsson and Nokia, Huawei’s enfeebled European rivals, and the only firms besides Samsung of South Korea allowed to build 5G networks in America (Lucent, America’s last domestic producer, merged with Alcatel of France in 2006; Nokia later bought the pair). <https://www.economist.com/business/2020/04/08/america-does-not-want-china-to-dominate-5g-mobile-networks>

<sup>40</sup> <https://carnegieendowment.org/2019/10/19/why-trade-wars-are-inevitable-pub-80177>

China<sup>4142</sup>. The emergence of robots with Industrial revolution 4.0, we better embrace the job-killing robots than wining about it<sup>43</sup>. There is also evidence that China is not a currency manipulator<sup>4445</sup>. Some might say that the trade war happened for Trump's animosity towards China and his reelection campaign on the basis of his strong stance against China. This argument also weakens when we see Trump's Daughter, Ivanka Trump, has her own clothing brand sweatshops running by abusing workers in China with the help of Chinese officials<sup>4647</sup>. Some politicians claim that it is the negative attitude of WTO towards the USA, that led it to circumvent the WTO and start the trade war. But since the inception of WTO, USA won more trade disputes than any other country<sup>48</sup>. Another research claims that the trade war has little to do with Trump or the USA or China nor "is it even a broader conflict between deficit countries and surplus countries. Rather, it is a conflict between economic sectors."<sup>49</sup> The research defined the trade war as something that "simply represents the most visible part of a much deeper global imbalance." The article logically points out that the United States does not import capital because it has a low savings rate and to put it the other way, it has a low savings rate because it is forced to absorb imported capital. While I agree with the author of the article, I feel the article misses to find out why the trade war was with China (about \$130 billion surplus) rather than other trade surplus countries like Germany (roughly \$280 billion) or Japan (roughly \$180 billion).

At the end of cold war, Francis Fukuyama wrote the book "The End of History and the Last Man" where he argued that with the ascendancy of Western liberal democracy and the dissolution of Soviet Union, all government systems will converge to liberal democracy. He could not predict how China, having a different government system, further from any liberal democracy, might grow to be the largest economy within just two decades of his publication.

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<sup>41</sup> <https://www.techrepublic.com/article/robots-will-kill-36m-american-jobs-by-2030/>

<sup>42</sup> <https://www.usatoday.com/story/money/2017/11/29/automation-could-kill-73-million-u-s-jobs-2030/899878001/>

<sup>43</sup> <https://www.industryweek.com/technology-and-iiot/article/21963290/its-time-to-embrace-the-jobkilling-robots>

<sup>44</sup> <https://www.cfr.org/in-brief/china-manipulating-its-currency>

<sup>45</sup> <https://www.piiie.com/experts/peterson-perspectives/trade-talks-episode-95-china-currency-manipulator>

<sup>46</sup> <https://www.chicagotribune.com/nation-world/ct-apple-ivanka-trump-ethics-collide-in-china-20180125-story.html>

<sup>47</sup> [https://www.washingtonpost.com/graphics/2017/politics/ivanka-trump-overseas/.](https://www.washingtonpost.com/graphics/2017/politics/ivanka-trump-overseas/)

<sup>48</sup> <https://www.piiie.com/research/piie-charts/united-states-wins-more-wto-cases-china-us-china-trade-disputes>

<sup>49</sup> <https://carnegieendowment.org/2019/10/19/why-trade-wars-are-inevitable-pub-80177>

This was rightly predicted by, my first political scientist, Samuel P. Huntington in his book “The Clash of Civilizations and the Remaking of World Order”. He indicated fundamental differences among various cultures of the world. Focusing on the USA and China, he emphasized on five key differences between the westerners and the Confucian societies<sup>50</sup>.

1. First, while the westerners believe in liberty, equality, democracy and individualism, the Confucians values the ethos that reflects “the values of authority, hierarchy, the subordination of individual rights and interests, the importance of consensus, the avoidance of confrontation, ‘saving face’ and in general the supremacy of state over society and of society over the individual.”
2. Second, unlike the westerners, Chinese identifies themselves in racial terms. To be more specific they identify their dissents with “the ‘mirror test’: go look in the mirror” to find their race, blood, and culture.
3. Third, China’s view of external affairs is the extension of its internal orders: ‘harmony through hierarchy’ with China’s leader at the top.
4. Fourth, China has a ‘visceral mistrust of any external affairs in its internal affairs’. Learning from the history and the century of humiliation, China firmly believes that every westerner is trying to “divide China territorially, subvert it politically, contain is strategically and frustrate it economically.”
5. Finally, unlike the western belief, “forget the past, ignore the future and focus maximizing immediate gains” Chinese tend to think “the evolution of their society in terms of centuries and millennia and to give priority to maximizing long-term gains”.

Though these five bipolar characteristics of the world’s two major powers does not give any direct indication to the 5G War we are talking about, it shades light why the overtaking by an archrival in terms of global supremacy may sting United States more than what Britain felt when it got overtaken by the USA- having similar cultural, religious, and political beliefs- at the beginning of twentieth century. When Hillary Clinton stated for most American that “I don’t want my grandchildren to live in a world dominated by the Chinese”, it became clear that any mean (including a trade war) seems worthwhile to prevent China from getting the world supremacy<sup>51</sup>.

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<sup>50</sup> Chapter 9, “The Clash of Civilizations and the Remaking of World Order” by Samuel P. Huntington

<sup>51</sup> Chapter- Clash of Civilizations, “Destined for War: Can America and China Escape Thucydides’s Trap” by Graham Allison.



The political scientist Graham Allison talked about a clash between the US and China in a 2015 article in the Atlantic<sup>52</sup>. In that article, he mentioned the USA as the ruling power which is still considered to be the world leader when other countries want to follow. But in recent times China in efforts to increase its influence over other countries has expanded its geoeconomic initiatives. With a vast economic power and determination to be the number one superpower within next few decades, China is rising above the ruling power. China is also very agile in flexing geoeconomic muscles against any country to achieve its geopolitical goals. In this crossroad, the ruling power feels threatened and can react with instigating initiatives.

### **7.2.1 Summary**

On the basis of the above analysis on the cultural bipolarism of the USA and China, my findings are as follows:

1. The cultural difference makes it difficult for the USA to trust China with a supreme like the 5G. Although Huawei asserts itself free from any Chinese government pressure, the Chinese state history and its bases of state capitalism put doubt that in case of any emergency, China will not take over Huawei and weaponize its technological powers.
2. It is already proven that whoever controls the networks, control the information flow. The Chinese government, which is not as transparent as the western world would like to, bears the burden of proving that they would not use the information against any other country's national securities<sup>53</sup>.
3. Nobody found any smoking gun yet, regarding the claim of Huawei's espionage on behalf of Chinese government but there are laws in China that require Huawei to submit to requests from Beijing<sup>54</sup> and evidence of Huawei's suspicious activities. All of these build on the cultural differences between US and China.

### **7.2.2 Limitations**

Although this perspective gives a new way of looking into the 5G war. This perspective along with the pure business perspective almost comprehensively explains "why all the hassle". We understand on the basis of the business opportunity along with the cultural difference why USA would not want China to have the 5G dominance. However, we still need some

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<sup>52</sup> <https://www.theatlantic.com/international/archive/2015/09/united-states-china-war-thucydides-trap/406756/>

<sup>53</sup> In 5G Race with China, U.S. Pushes Allies to Fight Huawei.

<https://www.nytimes.com/2019/01/26/us/politics/huawei-china-us-5g-technology.html>

<sup>54</sup> <https://www.nytimes.com/2019/01/26/us/politics/huawei-china-us-5g-technology.html>

explanation why USA is so active is impeding Huawei's progress and in turn impede Chinese progress and this leads to my third perspective, power leverage perspective.

### **7.3 THE POWER LEVERAGE PERSPECTIVE**

World hegemony changes and it is not a new concept. USA took the leadership of the world fairly recently when compared with UK's centuries of leadership. In the last century, the development of the world was unprecedented, and the credit of this development can largely be attributed to the adoption of western ideals and American financial model. After the Bretton woods, when USA got the leverage over the financial world in the form of dollars, it led many economies out of poverty and a rare stability for a comparatively long period of time. With every hegemon change the world enjoyed the benefits. But will be true for China if it gets the Power Leverage in the 5G form? The answer is, according to my analysis, no. Followings are some of the evidences behind my opinion:

- Richard Nixon's visit in 1972 began the process of bringing China into the post-war global system. U.S. policymakers believed that positive reinforcement in the form of diplomatic respect, earnest attempts at cooperation, and avoidance of topics such as human rights would somehow encourage an evolution of China's socioeconomic and political system. The benefits of following a liberal course, which some called the "Washington consensus," were thought to be such that even authoritarian Chinese leaders would grant more power to the middle class, if only to keep it supportive of their rule and further open up their society, since development ultimately would depend on cultural changes that ensured a fertile field for capitalist-style modes of organization. The West's leaders believed that they could change China. China, however, has refused to follow Washington's script. While it has eagerly taken advantage of its access to the global economy and the prestige of sitting at the leading diplomatic tables, it has resolutely pursued its own interests at the expense of other nations. Washington and other liberal capitals also misjudged Beijing's determination to maintain and even expand its authoritarian practices and mercantilist policies. It is well on its way to becoming an all-pervasive technological surveillance state (Auslin, 2018).
- The practice of state superiority along with denying of basic human rights to Chinese citizens gives us indication of how a world led by government with Chinese ideals will look like. In addition to the mass detentions, the authorities have intensified the use of informers and expanded police surveillance, even installing cameras in some people's

homes. Human rights activists and experts say the campaign has traumatized Uighur society, leaving behind fractured communities and families. China has categorically denied reports of abuses in Xinjiang and even on the face of video evidence described the facilities in question as mild corrective institutions that provide job training<sup>55</sup>. This sort of lying and human rights suppression is against the basic human values.

- The belt and road initiative led by China, although in the short run is bringing jobs and growth, it is fostering a new form of diplomacy which is called “Debt Trap Diplomacy”. The concern is that with the aim being to grow its global influence China may force strategic concessions from countries in receipt of BRI of AIIB (Asian Infrastructure Investment Bank)<sup>56</sup>. The ASEAN (Association of Southeast Asian Nations) have grown increasingly concerned regarding Chinese motives and fear that the BRI is paving the way for increased Chinese aggression regarding territorial disputes<sup>57</sup>. In a recent ISEAS-Yusof Ishak Institute survey in ASEAN countries, 70 percent of respondents said that their government should remain vigilant in negotiations with China over BRI projects<sup>58</sup>. Jones (2019: 5)<sup>59</sup> writes that during BRI negotiations China has ‘put almost all of the risk on the recipient country...and is using political power in order to drive down the risk of non-repayment.’
- The geopolitical power handling in the last few years is really apprehensive. China is a trade surplus country, and this gives it power over other trade dependent countries. There are times China can use this power to achieve its geopolitical interest and get out of any external pressure. But the way China has flexed its geopolitical muscle was not a leaderlike attitude. For example, after incompetently letting the coronavirus loose on the world, Beijing slapped tariffs on Australian barley this week in an unmistakable show of muscle after Australian Prime Minister Scott Morrison said last month that he wanted an

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<sup>55</sup> <https://www.nytimes.com/2018/09/08/world/asia/china-ughur-muslim-detention-camp.html>

<sup>56</sup> Kuo, L. and Kommenda, N. (2020) *What is China's Belt and Road Initiative?*, Available at: <https://www.theguardian.com/cities/ng-interactive/2018/jul/30/what-china-belt-road-initiative-silk-road-explainer>

<sup>57</sup> Hong, Y. (2017) Motivation behind China's ‘One Belt, One Road’ Initiatives and Establishment of the Asian Infrastructure Investment Bank, *Journal of Contemporary China*, 26 (105), 353–368

<sup>58</sup> ISEAS-Yusof Ishak Institute (2019) ‘State of Southeast Asia: 2019 Survey’, Available at: [https://www.iseas.edu.sg/images/pdf/ASEANFocus%20FINAL\\_Jan19.pdf](https://www.iseas.edu.sg/images/pdf/ASEANFocus%20FINAL_Jan19.pdf)

<sup>59</sup> Jones, B. (2019) *China's Belt and Road: The New Geopolitics of Global Infrastructure Development*, Washington: Brookings Institute.

independent inquiry into the COVID-19 outbreak<sup>60</sup>. Not only they slapped this tariff but also, they have made humiliating remarks about Australia. The editor-in-chief of the state-run Global Times newspaper then described Australia as “chewing gum stuck on the sole of China’s shoes” (an attack that is particularly aggressive in Asia), adding: “sometimes you have to find a stone to rub it off.” But when Canberra pushes forward with the call, Beijing suspended imports from Australia’s top meat processing facilities and imposed the tariffs on barley — measures that could cost the country upward of \$500 million annually<sup>61</sup>. Some other such examples are:

- China restricted its auto import from Japan to influence Japan’s national security policies.
- It stopped Philippines’ banana to enter its territory when Manila opposes its policies in the south china seas.
- It showed more favorable behavior to Taiwanese companies which adhere to China than those who do not.
- It influences South Korea’s decision to let the USA to deploy the Terminal High-Altitude Area Defense (THAAD) missile defense system by promising trade and business deals.
- It established Asian Infrastructure Investment Bank to rival the Washington based “The World Bank”.
- It used its economic assistance to African countries to influence them to vote in favor Chinese proposals.
- It stopped importing of Norwegian Salmon to punish Norway for awarding a Chinese dissident, Liu Xiaobo, the Nobel prize.

On the basis of the above evidences, it can easily be predicted that if China gets some other leverage like the 5G, the Chinese muscle flexing will be pervasive and surely that will not be in favor of its partner. We can already see Chinese aggression in fostering Huawei’s business. Such as:

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<sup>60</sup> <https://www.politico.eu/article/china-flexes-trade-muscles-coronavirus-crisis/>

<sup>61</sup> When Canberra pressed forward with its calls for an inquiry, Beijing [suspended imports](#) from Australia’s top meat processing facilities and [imposed the tariffs](#) on barley — measures that could cost the country upward of [\\$500 million annually](#). <https://www.politico.eu/article/china-flexes-trade-muscles-coronavirus-crisis/>

- When Germany debated Huawei, China's ambassador there threatened "consequences" if Germany excluded the telecoms giant from its market.<sup>62</sup>
- In response to US's steps against Huawei, China is opening an antitrust case against google<sup>63</sup>.
- Beijing is considering retaliating against the Chinese operations of two major European telecommunication-equipment manufacturers, Nokia, and Ericsson, should European Union members follow the lead of the U.S. and U.K. in barring China's Huawei Technologies Co. from 5G networks.<sup>64</sup>

## 8 LEARNING FOR THE AUDIENCE COUNTRIES

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5G race is for the countries which has the technical capabilities and have the intention to lead the world. No matter who wins the race, all the competing countries will have some shared benefits. But what about the other countries who are not part of this race but follow the competing countries? What is their role in this race and what should they do to, on one hand, make the best use of this competition and on the other hand do not get in between the power clash of the competing countries?

Countries like Japan, South Korea, Finland, and Sweden have their own companies to let their 5G infrastructures handled. Countries like the USA, Germany and UK have their own capabilities to check whether by giving the 5G infrastructures to a foreign company whether they are sacrificing their sovereignty or not. Therefore, these countries are not vulnerable to the threats of 5G. The focus of my analysis will be the countries which have none these.

According to my analysis, there are three strategies for the audience countries to follow:

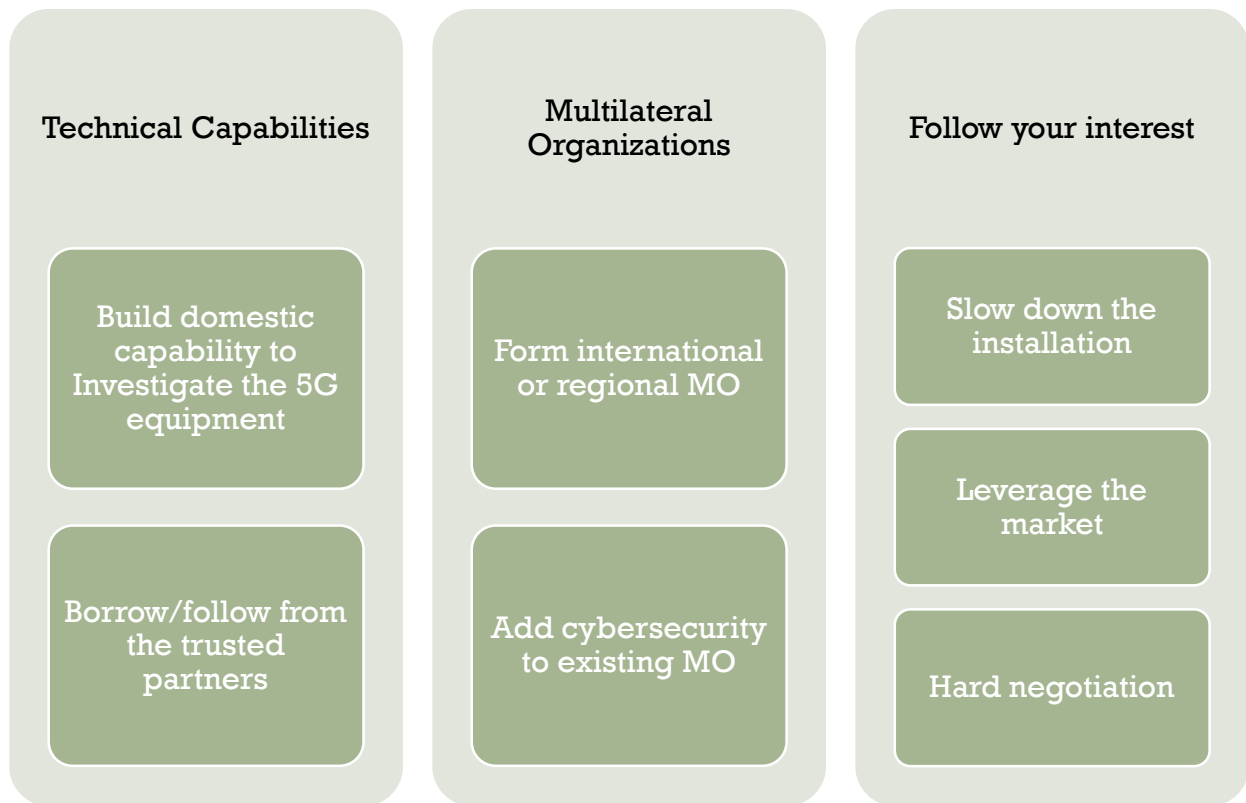
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<sup>62</sup> <https://www.straitstimes.com/world/europe/china-threatens-germany-with-retaliation-if-huawei-5g-is-banned>

<sup>63</sup> <https://www.cnet.com/news/china-reportedly-readying-antitrust-probe-into-google-after-huawei-prompt/>

<sup>64</sup> <https://www.wsj.com/articles/china-may-retaliate-against-nokia-and-ericsson-if-eu-countries-move-to-ban-huawei>

Figure 15: Strategies for the audience countries.



## 8.1 TECHNICAL CAPABILITIES

The world is currently seen through a technological vista. Countries that have invested in the technology are getting the growth more than the others. The fourth industrial revolution is completely based on technology. To run the technology, the connectivity matters the most. On this background, the audience countries can adopt the following strategies:

### 8.1.1 Build domestic capability to Investigate the 5G equipment

The best option for any country is to have a domestic capability to investigate the 5G equipment. Taking the example of UK, they have independently reviewed the Huawei technologies through its National Cyber Security Centre (NCSC) and took the decision to ban Huawei. Though US was pressuring, UK always did its own review and took its own decision<sup>65</sup>. England could do it because it has its own technological capabilities. All the audience countries can take strategies to have their own investigation capacity. Not only for this reason, taking such strategies will help every country to achieve technological independence and

<sup>65</sup> <https://www.bbc.com/news/newsbeat-47041341>

protect national sovereignty from cyber espionage. Such capabilities will open new opportunities in the technological arena and the country will be able to reap the benefits of 5G evolutions. Therefore, it is high time the countries focused on building their own technological capabilities.

### **8.1.2 Borrow or follow your trusted partners**

Building technological capabilities takes time. In the meantime, if the country wants to go for the 5G infrastructure installation, it can borrow the technological expertise from its trusted partners, or it can directly follow the verdict of the trusted partners. For example, Australia and New Zealand have joined their US counterparts in their belief that Huawei poses serious security threat to the national security and banned Huawei from doing business in their territory<sup>66</sup>.

## **8.2 MULTILATERAL ORGANIZATIONS (MO)**

The conflicts in the international arena are not new. Countries have fought among them for securing their interest number of times for number of reasons. The most conflicted area was and still is the international Trade. Then the countries came together in 1948 with GATT and then in 1995 with WTO to find mutual multilateral solutions. Overall, these organizations have been tremendously successful. On this background, the audience countries can adopt the following strategies:

### **8.2.1 Form International or Regional MO**

The audience countries should not have any standalone practice. Instead of separately investigating the 5G companies, the countries should come together and have a unified approach. They can establish an organization, such as the WTO (World Trade Organizations) for checking the technologies and their espionage capabilities. Pooling and sharing knowledge, capabilities and capital would allow the organization to develop a credible and competitive 5G hub.

In addition, the harmonization of standards and legislation at the international level is fundamental to ensure the establishment of an efficient and competitive ecosystem, ready for

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<sup>66</sup> Washington has banned US firms from doing business with Huawei (for example, designing and producing chips) and wants its allies to ban it from their 5G networks. Australia and New Zealand have joined the US.: <https://www.bbc.com/news/newsbeat-47041341>

the deployment of this new technology at the lowest cost possible (Mariani & Bertolini, 2019). If internationally it is not possible, regionally it should be done.

### **8.2.2 Adding to Existing MOs**

Either new regional organizations can be established with the representation of member countries or in the existing regional organizations like SAARC, ASEAN, GCC and others, a separate independent unit for investigating the 5G technologies can be set up. These kinds of collectives will not only allow the member countries to have allow cost investigation but also will give them a high negotiation power. 5G is a critical infrastructure for any country in the world. Decisions regarding 5G involve national sovereignty. Therefore, this should a good reason come together and spur collections actions through negotiations. Powerful countries in each region, should take the leadership role in this regard.

## **8.3 FOLLOW YOUR INTEREST**

According to the analysis done by GSMA Intelligence (2019), it is clear that 4G and 5G is based on data transfer. Unlike the earlier generations, 4G is a fully packet-switched network optimised for data services. 5G builds on this packetswitching capability. Considering this finding, following strategeis the audience countries can adopt:

### **8.3.1 Slow down the installation**

In terms of the speed, the 5G is not significantly higher than 4G LTE. Most of the developing countries are still working on their 4G LTE installation. Considering the 4G LTE speed and capabilities of reaping the benefits of 5G, the audience countries can choose to slow down the installation until “the coast is clear”. Currently the 5G market is heated with geopolitical interests and converting to 5G may put the countries against a world superpower. According to Webb (2019), the cost of falling behind other countries in terms of technology will not be great. Current mobile data speeds are more than adequate for all foreseeable uses. Data growth is slowing and may plateau around 2027, with only about two times the growth occurring during the 5G era. With 5G predicated predominantly on higher speeds and also on its ability to deliver substantially enhanced data capabilities, this suggests that 5G may not be targeting the right areas (Webb, 2019). This is especially true for the countries which do not have the capability of reaping 5G benefits like the IoT.



### **8.3.2 Leverage the Market**

The other way of looking into this 5G race is that this makes the audience countries a huge market and companies from everywhere trying to get that market under their portfolio. The companies are desperate to grab market share because this generates a potential future. This presents a lucrative opportunity for the audience countries to use this market as leverage to gain geopolitical interests. The cost when compared with the expected benefits of 5G installation does not vary significantly across the vendors like Huawei or Ericsson. Therefore, if there is any such opportunity, the audience countries should make the best of this opportunity. For example, hypothetically, Australia can negotiate its recent embargos with China using Huawei or India can resolve border conflicts with China leveraging its huge market.

### **8.3.3 Hard Negotiation**

At last, if none of the above strategies are not applicable, the audience countries can have a hard bargain because unlike the previous mobile generations, multiple companies of multiple origins are providing the 5G installation service. Since the number of market players this time is high, the competition is high. The countries are no longer the price takers. Unlike the 3G to 4G, the cost of switching from one company to the other will not be higher. Therefore, the audience countries can negotiate to get a good price in the contract.

## 9 CONCLUSION

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The world is at a crossroads. The world's hegemony is on the verge of a turnaround. Changes are coming in our life from every perspective. 5G, at this crossroads, comes as the medium of change. The move to 5G from the existing generation of technology comes with boundless opportunity. However, this technological miracle poses some serious threats too. The leader in the 5G transformation will have the growth and the power to rule the world by setting technological standards. The 5G leader in the technological world can be assumed to hold the same power as the dollar holder has in the financial world. That is why all the powerful countries are chasing control over it. If they cannot have power, they are preventing some other country with different ideals from getting it. In the midst of this clash, the countries that do not have any equivalent power are facing a dilemma. In this paper, I have tried to analyze the politics of 5G and come up with some strategies for those countries. Basically, I suggested three strategies such as building your own technical capabilities to investigate the 5G technologies of a foreign country or following your trusted partner, forming multilateral organizations, and following your own interest. The point I want to focus on is that building consensus among ourselves is a must to protect our national sovereignty, embrace this new technology and reap the benefits that 5G promises.

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